Lepidoptera of North America
13. Flower Visitation by Colorado Butterflies (40,615 Records) with a Review of the Literature on Pollination of Colorado Plants and Butterfly Attraction (Lepidoptera: Hesperioidea and Papilionoidea)

Contributions of the C. P. Gillette Museum of Arthropod Diversity
Colorado State University

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13. Flower Visitation by Colorado Butterflies (40,615 Records) with a Review of the Literature on Pollination of Colorado Plants and Butterfly Attraction (Lepidoptera: Hesperioidea and Papilionoidea)

by

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**Abstract.** I present 40,615 of my records of visits of adult butterflies (LEPIDOPTERA: Papilionoidea, Hesperioidea) to flowers and other food/water sources. Part I arranges the records by butterfly species to determine the flowers/foods most often visited by each butterfly species. Most butterflies visit a wide range of colors and types of flowers, with fewer visits to red at least in part because of a shortage of red flowers in the Colorado flora (subtropical/tropical butterflies evidently visit red more often, as demonstrated by hundreds of literature records for *Phoebis sennae*). But some butterflies show very different restricted preferences. Butterflies often visit numerous flowers that lack a “landing platform”, as their legs are capable of landing on any type of flower, so a landing platform is not necessary. Most popular flowers have a clustered inflorescence, though some do not. All Colorado butterflies prefer flowers that are in floral displays of clusters or closely joined together; none prefer solitary flowers. Short-proboscsis butterflies are limited to smaller flowers. Lycaenidae mostly visit yellow and white flowers, probably in part because of a greater frequency of yellow and white colors among flowers that are small enough for their short proboscis. Long-proboscsis butterflies can recycle abdominal fluid to dissolve dung for food, and they visit red flowers more often. Butterfly flight height partly determines which flowers can be visited. Apocynaceae (*Apocynum* and *Asclepias*) flowers sometimes kill butterflies by catching their proboscis. Females frequently sip mud, so it is a myth that butterflies visit mud only to get sodium; many visit mud to rehydrate. Part II arranges the records by flower species, and includes flower species that are common but not visited, to determine which flowers are attractive to butterflies and which are not. Although butterflies in general are not very particular in their flower choice (especially regarding flower color and ultraviolet pattern and size and shape), most of the pretty flowers in nature are seldom or never visited by butterflies, which seems to mean that floral scent is important in both attracting and repelling butterflies to flowers. The most popular plant family for butterflies is Asteraceae, in which most genera are popular. Other very popular flowers are *Asclepias, Apocynum, Verbena, Monarda, Buddleja, Eriogonum, Sedum lanceolatum, Erysimum, Jamesia,* some legumes including *Medicago sativa, Lythrum, Cnidoscolus, Ceanothus, Aesculus,* many Lamiaeaceae, *Penstemon,* and *Lobelia siphilitica.* Popular “butterfly flowers” merely must have white or visibly-bright colors, diurnal flowering, adequate but not strong floral scent, sufficient sugar concentration, and adequate access for the proboscis; nothing else seems necessary. Butterflies that visit sap and rotting fruit mostly belong to groups within Nymphalidae that display this behavior worldwide, while dung and carrion feeding occur in all the major taxa of butterflies. The chemical compounds attracting butterflies to flowers are reviewed and discussed, and specific chemicals attracting them to sap, rotting fruit, carrion, dung, etc. are successfully pinpointed from the literature. Known pollinators are listed for the Colorado plants that are popular and not popular with butterflies. Very few if any Colorado plants seem to be primarily pollinated by butterflies (most are pollinated by bees), and evidently no plants would become extinct if butterflies were not available to pollinate them. Thus Colorado butterflies are generally only occasional pollinators of flowers. Much more work needs to be done on the floral scents that attract butterflies.

**Key words:** flower visitation records of butterflies, flower preferences of butterflies, attractiveness of flower species to butterflies, foods of butterfly adults, butterfly pollination, pollination of Colorado plants, Lepidoptera, Colorado, Rocky Mountains, Great Plains.
Introduction

This paper attempts to determine the food preferences of adult butterflies, including which flower species are popular with butterflies and which are not, based on 40,615 records of the foods visited by adult butterflies recorded in my notebooks, which list all the butterflies I observed or caught from 1959 to 2013, mostly in central Colorado (especially Jefferson County) but frequently in south-central Colorado and sometimes in nearly all other western states west of the Mississippi (especially California, Minnesota, and Arizona), and infrequently in Alberta and British Columbia Canada, and some states in the eastern U.S., and Mexico.

Methods. I have studied butterflies continuously from 1959 to 2013. In 1959 my mother made a little net for me using a coat hanger and a net bag made from opaque red cotton cloth. I couldn’t see inside it, so the cloth was quickly replaced with cheesecloth, and soon a handle was fashioned from a golf club handle. One of my first butterflies was a large *Papilio cresphontes* collected on manure that I kept in a jar on dry grass. Then I made a little collection of butterflies stored in crude cardboard boxes using ceiling-tile as a pinning bottom. I would often accompany my father in nature while he mapped geologic strata and collected fossils for the U.S. Geologic Survey. During those 55 years I recorded in notebooks the species that I saw or collected. My expertise rapidly expanded, and I received a B.S. in zoology from the University of Colorado in 1968 and a Ph.D. in entomology from the University of California at Berkeley in 1972 with a thesis on mate-locating and dispersal of butterflies, and gained expertise in plant identification from several college courses but mostly through self-teaching using floras and flower-picture books.

I spent many thousands of days in the field studying butterflies, mostly in Colorado, accumulating roughly 100,000 records of mate-locating behavior of butterflies (Scott 1973e, 1974d, 1983, 2010), more than 4,000 records of larval hostplants (Scott 1986b, 1992, 2006), in addition to the current 40,614 records of the flowers/foods visited by butterflies. Recording merely flower visits of butterflies was never the primary purpose of any field trip. I recorded the flower visits I saw to be complete in recording interesting behaviors and other phenomena related to butterflies. Trips were made to study mate-locating behavior, and to locate hostplants. Some collecting of butterflies was generally undertaken at the same time, for scientific purposes (taxonomy or rearing etc.) and for exchange with other lepidopterists to build up a more-complete collection. Trips were made to maximize my exposure to as many butterfly species as possible while minimizing the expense.

Each record of adult food visitation in my notebooks contains the locality and date, the name of the butterfly, and the name of the flower species or type of food if not a flower. Each flower record is based on a butterfly visiting that flower apparently to feed (obviously, butterflies visit flowers for only one reason, to feed on their nectar). I often saw the proboscis actually placed into the flower, but most records involved the butterfly just visiting the flower in a way that looked like flower-feeding without my necessarily getting close enough to see the proboscis actually inserted into the flower. Visits that were very brief are listed as such if the butterfly did not seem to like that flower (for example “2 sec.” in the records below means that the butterfly spent only two seconds on the flower). Records of feeding on other foods (sap, honeydew, dung, carrion, mud, etc.) were also recorded and usually involved seeing the proboscis. In the early decades, I recorded merely the butterfly species and flower species and date, and did not record more than one visit to that flower if there was more than one. (In those decades I recorded few visits to flowers anyway because I could not identify the flowers very well then.) Later, the number of visits to that flower species at that locality on that day was also recorded.

Identification of the flowers and their nomenclatural problems. There are more than two thousand species of higher plants in Colorado alone, and plants may have more morphological variation than butterflies, in shape and color, creating difficulty identifying them. I recorded very few visitations when I was young (in the 1950s and most of the 1960s), and gradually gained expertise in plant identification, and finally became an “expert” botanist, so now there are not very many dozen botanists in Colorado who are better at identifying plants. I gathered a collection of several thousand pressed plants for lab identification using
microscope and numerous purchased floras. In the early decades I relied on many botanists to help identify pressed plants, including Farrel Branson, Beecher Crampton, James A. Erdman, Charles Feddema, James Harding, L. R. Heckard, John R. Keith, June McGaskill, James L. Reveal, Hansford T. Shacklette, John Strother, and William A. Weber. (Recently I reidentified some plant specimens that were misidentified by those persons.) William Weber kindly identified plants for me without payment for many years, until I listed collection numbers such as “lot #35” etc. on grasses used as oviposition sites by Hesperia females and he wrongly assumed that those lot numbers meant that I was doing paid consulting work, so he charged me a fee, forcing me thereafter to better learn the plants and identify them myself. To identify a flower, you should try to match it in picture books such as Rickett et al. (1973), and then use the floras to either confirm that identification or identify it as one particular species among many that resemble that picture. Or more laboriously use the floras to identify flowers that lack pictures in available books. Those floras unfortunately use keys, which can cause huge mistakes in identification (just one mistake in a dozen couplets can lead to a grossly wrong identification), and many of the floras/plant books lack good descriptions that could be checked to correct those mistakes. (Tables of character states versus taxa are vastly superior to enable confident identification of plants and animals, because you can go quickly to the distinctive traits on the table, you can identify a specimen with a table even if your specimen lacks one or more character traits, the table doubles as a description of the taxon [and is better than traditional descriptions that often miss some traits], and tables are needed to enter taxonomic data into the handheld computer devices such as ipads that will be the primary identification devices of the future. Taxonomists should prepare tables, not keys.) This takes time especially when you find a flower that you have not identified before, so if you lack the time during a busy summer season you must collect and press a specimen of the flower species to save for later identification to get a confident identification. Having a sorted collection of pressed flowers helps identify those species identified previously, though you must always remember that botanists—like entomologists—split to the limit of resolution, so they name more and more taxa as microscopes and DNA machines improve, so there may be many flower species that look like yours, and the floras must be consulted for confident identification.

Plant nomenclature is in flux. Splitting is rampant in botanical names especially genera, and in Colorado the problem is severe, because there is no good scientific flora for Colorado. The only complete flora for Colorado (Harrington 1964) still has good useful descriptions of morphology of each species, but has just one perfunctory line about its distribution in Colorado and has nothing else about the plants, and is out of date at 50 years old. The only recent books (Weber and Wittmann 1996a, 1996b, 2012a, 2012b) are mere keys to the species in Colorado, with little or no additional information about the plants (tables of taxa versus character traits are absent), but sometimes the taxonomic decisions therein are better than those in other books such as the published volumes of the incomplete series Flora of North America. I have not studied the botanical literature to determine whether Weber’s highly-split names should be used, rather than the more traditional names in the Great Plains Flora (McGregor et al. 1986, a nice regular flora with actual descriptions and ranges etc.). Should the split names be used, even though most of them appear to be mindless splitting?, or should the traditional names that are widely known be used? Should floras made in faraway lands be used or should we trust the greater expertise of local botanists? Most plants have not been studied biologically or genetically, so the species/subspecies/form status of many are in dispute (for instance Aster ericoides has been frequently split into two to four species that clearly appear to be just variable weak varieties to me, and the altitudinal forms of Heterotheca are considered to be three species or just one by different botanists, the canescent leaf-underside Cirsium incanum was treated as a species but earlier and recently as a variety of glabrous Cirsium arvense, etc.). A particularly annoying occurrence in botanical nomenclature is that when botanical writers change the genus name of a plant (either due to splitting or due to a valid phylogenetic reason) they frequently change the species name as well at the same time. There are dozens of these changes (Cryptantha jamesii became Oreocarya suffruticosa, Padus Malus became Malus pumila or Padus sylvestris then Pyrus malus, Rorippa nasturtium-aquaticum became Nasturtium officinale, Matricaria matricarioides became Lepidotheca suaveolens, Acer negundo became Negundo aceroides, Sida hederacea became Malvella leprosa, Potentilla frutcosa became Pentaphylloides floribunda then Dasiphora fruticafloribunda,
Rhamnus frangula became Frangula alnus, Quamoclit pennata became Ipomoea quamoclit, Haplopappus spinulosus became Machaeranthera pinnatifida, Aster arenosus became Leucelene ericoides, Brachyactis ciliata became Aster brachyactis, Lycopersicon esculentum became Solanum lycopersicum, etc. etc.) The names of numerous time-honored families such as Compositae and Leguminosae and Cruciferae etc. were changed, and now all end in –aceae. Botanists have shifted name changes into high gear. I mostly use the traditional generic names here because those have been used in the regular floras and the genus category is largely arbitrary, and list the split genus name as a subgenus, unless there seems to be some good phylogenetic reason to use the newer names found in Weber’s books. Some of the highly-split names are additionally annoying because various newer floras such as Weber’s and the California flora (Hickman ed., 1993) arrange the families and genera alphabetically (those botanists see how plant taxa are shuffling about as a result of DNA research and evidently give up and leave the names alphabetized the way they were in their computer), so that finding a genus in the book using only the older name is difficult, as the species placed in the former genus now are spread among multiple different split genera that are scattered in many different alphabetical places in the book, making them difficult to find so one must search through indexes or look at every genus listed in the book to try to reconstruct what happened to the names. Hopefully a real flora will be published soon for the southern Rocky Mountains area. I brought up to date old plant names listed in my notebooks to make them consistent throughout this paper. I had to correct names listed for some flowers in my older notebooks due to newer botanical knowledge of their correct names and improved identifications of the plants. I mainly used the names in Weber and Wittman’s books as they are more up-to-date than the USDA Plants web site and Kartesz checklist etc., and they discuss changes made in the volumes of Flora of North America that have been published so far.

Due to the gradual increase of my botanical expertise, plus lack of time to carefully identify every plant, problems occur with the quality of some flower identifications in my notebooks, especially the older ones. The ~ and ? symbols in the records listed below are used for uncertain identifications: ~ means that the visited flower is the named species or another similar species; the ? symbol means the identification is not certain. Some flowers are listed only by genus, because the species could not be determined. Some flowers are just identified as “mustard”, or “yellow sunflower”; there are a hundred species that at first were recorded merely as “yellow sunflower” (similar to Helianthus in the Asteraceae), because many of those require some time and expertise to identify to species. Nearly all of my “Cirsium vulgare” records up to 1988 were really Carduus nutans, so I changed those to “Cirsium vulgare (probably Cardius nutans)” here. Identifying the species of Solidago and Erysimum and Senecio and many others is often difficult, so these are frequently not identified to species. Many plants from Arizona were not properly identified fully because I lack the knowledge and floras to properly identify those (I used the library copy of the Kearney and Peebles flora sometimes) and I failed to collect specimens for later identification.

Computerizing the records took about a year (about 700 hours) to produce a computer file with 16,792 entries/paragraphs of records. Many of these records consisted of multiple visits to a flower species or other adult foods, so there are 40,614 total records (see Appendix A for the method used to determine this number) of adult visitation to food sources, usually flowers. Correcting typos, making the butterfly and plant nomenclature consistent, and compressing the alphabetized file (for instance compressing 37 records of a butterfly species on one flower species to one line containing 37x) took several more months. Flower colors were added, using the colors recorded in the notebooks plus (usually) the colors reported in floras, usually Harrington (1964) because of that book’s excellent technical botanical descriptions of each plant including corolla/bract color. The basic chronological file of original records was maintained and updated, and half a dozen different files were then made from it in the process of alphabetizing and editing and compressing, and two of those files form the core of what is published here (the first being a compressed file of butterfly species and the flowers/foods they visit and the number of visits/records for each, the second being a compressed file of the flowers/foods visited by butterflies and the butterfly species that visit that flower/food and the number of visits/records for each).
The first file of butterfly species and flowers/foods visited was organized into one paragraph per butterfly species, with the flowers/foods listed for each butterfly. Then the butterflies were sorted by systematic relationship (determined from Scott 1986a, 2008) instead of alphabetically. This information forms Part I below, where conclusions are made about the adult food preference of each butterfly species. Relevant literature is cited at the end of this paper.

A compressed version of the original data file in Microsoft Word was then alphabetized by flower species visited, to determine the butterfly species that visit each flower species, and to determine the popularity of those flowers/foods for butterflies in general (the tedious method of making this computer file is detailed in Appendix B). This information forms Part II below, which discusses the popularity of the flowers to butterflies and also lists flowers in Colorado that are NOT visited by butterflies to contrast them with the popular flowers. Part II makes inferences from the data and from the literature regarding whether butterflies pollinate the various flower species, and also gives the pollinators of all those Colorado plants—popular and unpopular—based on published cited literature. Relevant plant papers and floras used in Part II are cited at the end of this paper.

The conclusions made in this paper about which flowers and flower types are preferred and which are shunned by the butterfly species, and which kinds of butterflies visit the common flower species and may pollinate them, should be of interest to both entomologists and botanists, especially because this paper is based on a large number of records, which should make the conclusions much more confident than the frequently-erroneous claims made in the usual “butterfly gardening” type of publication that reports this information for butterflies. The large number of records presented should be helpful to scientists involved in studies on the pollination of plants, and will supply reliable information to “butterfly gardening” enthusiasts and lepidopterists. And the raw records presented should be of use to later researchers who research the ultraviolet reflection patterns and the floral scents of the flowers in an attempt to better determine the causes of butterfly attraction to flowers.

**Part I. The Flowers and Foods Visited by Each Butterfly Species**

**User’s Guide to the Adult Feeding Records.** Under each butterfly species, the flower species visited is listed. If no number is listed after the flower, only one visit or record was recorded in my notebooks. Numbers such as 1x mean one visit/record, 7x means 7 visits/records, etc. In my older notebooks, the flowers visited were listed for each locality/day but I did not record the number of visits per locality/day (whether one visit or twenty five visits or whatever), so the recorded number is a minimum estimate of what was seen in the field. After the flower visitation records, visits to rotten fruit, aphid honeydew, sap, dung, carrion, mud, etc. are listed. “Mud” here means any kind of moist or wet sand-dirt-soil. The symbol ~ beside a plant means it was either that species or something similar. The ? symbol means the identification was questionable.

Before presenting the detailed list of flowers etc. visited by each butterfly species, I now discuss the records along with relevant literature, in order to arrive at some conclusions about the butterflies’ preferences for various flower species.

Most butterflies visit a great variety of flowers. The common butterfly species generally have long lists of many dozen species of many kinds of flowers that they visit. The butterfly species with few flowers listed below are generally butterflies that are limited in range or season so had fewer opportunities to study, or they are species that occur far from my usual travels. C. Robertson (1929) published a 33-year study of 15,172 insect flower visitors in central Illinois, including Lepidoptera and bees and other insects, and Tooker et al. (2002) computerized his Lepidoptera records. Those records also show that the commonest butterflies produced long lists of visited flowers.

Different flowers grow in different habitats, so a butterfly species that occupies many habitats will visit numerous kinds of flowers.

Many of the lower-altitude butterfly species have several generations per year (versus just one in the higher mountains), and those species must usually visit different flowers during each generation, because
Most flowers have short blooming periods, although some such as *Medicago sativa* bloom all summer and may be visited by several generations of butterflies. Thus multi-generation butterfly species are expected to be less specialized in their choice of flowers. Opler and Krizek (1984) note that flower visitation is lower in spring generations and higher in later generations. This is evidently due to higher temperatures later creating a greater need for fluids to avoid desiccation, and spring temperatures may be lower so the butterflies fly less.

Most butterflies visit most colors of flowers, but some butterflies prefer only some colors. Butterflies can see all the colors humans can, plus ultraviolet (see Part II, below), so the colors that butterflies see are somewhat different than what humans see. I make almost no observations concerning their ultraviolet preferences below because the ultraviolet-reflection pattern is not known for most Colorado flowers (Scott 1986a shows uv patterns of some flowers and many butterflies, and others are discussed below in Part II). So I will discuss here only the colors I can see:

A major conclusion is that many or most butterflies seem to show no preference for different colors, and they visit all colors from white to reddish (visits to red are comparatively few) to pink to orange to yellow to blue to violet and purple, everything except rare visits to green (some flowers such as *Euphorbia* etc. are greenish). But many show distinct preferences. The following are the strongest preferences observed: *Hesperia leonardus* shows a striking preference for *Liatris* flowers (the reason I--Scott [1986]--named it the Blazing Star Skipper), but will visit others and often visits *Carduus* etc. *Piruna* visits many flowers but greatly prefers pink *Geranium*. *Polistes sonora* greatly prefers *Cirsium scariosum* var. *acaulescens* flowers that grow at ground level in wet meadows. *Notamblyscirtes simius* visits many flowers but oddly frequents yellow *Opuntia* and burrows down into the stamens to get nectar until only their wingtips are visible!

Other butterflies show distinct preferences that are less striking. Most butterflies seldom visit red flowers, so it is tempting to conclude that they don’t like them. The deficit of visits to red flowers seems clear from the records, and is contrary to statements in some plant books that red is the typical color of butterfly flowers (such as Judd et al. 2008, who list “Bright; often red”) (butterfly pollinated flowers are often pink though, see below), although Willmer’s (2011) table 5.4 and p. 118 and fig 5.12 individually give different preferences but taken together they include all colors. One wonders if butterflies seldom visit red because most butterflies see red less well than other colors. However there are enough records of butterflies visiting red flowers and enough physiological studies (see Part II below) to be sure that most butterflies can see at least the light spectrum wavelengths that humans perceive as red. And Hesperidae with long proboscis frequently visit red *Hedysarum* while Papilionoidea with short proboscis do not, so few visits to red flowers may be mainly caused by the usually-longer corollas on red flowers, which are frequently adapted for hummingbird pollination. But the main reason for the red deficit may be a real shortage of red flowers in the flora of Colorado. There just aren’t very many red flowers, perhaps because hummingbirds are not quite as common as elsewhere, so there are fewer opportunities for butterflies to visit red flowers that aren’t there. Therefore, much of the red deficit may be due to simple lack of opportunity; Colorado butterflies may have visited more red flowers if more were available. A similar phenomenon may involve Lycaenidae, which apparently prefer yellow and white flowers; the reason could be their usual small size and the small size of their proboscis, because small flowers and short flowers and open flowers (the flowers a short proboscis can successfully suck nectar from) evidently have yellow and white flowers more often than longer flowers, and thus the short-proboscsis lycaenids more often fit into the categories of “generalist pollinators” which have short mouthparts so must visit more accessible flowers with shorter tubes or smaller flowers or open flowers that can be easily imbibed, flowers such as Asteraceae which are mostly yellow, etc. Anyway the lycaenid “preference” for yellow and white may be an artifact of the usual colors of the flowers that are small enough for them to access (including the great abundance of yellow and white Asteraceae flowers); or maybe they have evolved some genetic preference for those. Opler and Krizek (1984) found that proboscis length of butterflies is proportional to the corolla length of their flowers, and proboscis length of butterflies (mode about 1 cm) is about twice the tube length of flowers visitied (mode about 0.5 cm). Opler and Krizek (1984, Table 11) also noted that few butterflies except Hesperidae visited red/orange flowers in eastern United States.
Here is a summary of the distinct preferences for flowers—especially flower colors—displayed by the butterfly species that seem to be detectable in the detailed records listed below (ultraviolet colors were not considered here): Some *Erynnis* visit all colors, but seven species (*icelus, brizo, martialis, pacuvius, persius, afranius, telemachus*) prefer white and yellow flowers. *Anatrytone logan* prefers purple flowers. *Poanes hobomok* visits all colors and seems to visit pink and red flowers more than most butterflies. *Parnassius* prefer yellow and white flowers. *Papilio multicaudata* visits all colors except it seems to shun yellow. *Nathalis* prefers yellow. *Colias* species prefer yellow and blue/purple. *Euchloe* prefer yellow and white. *Pieris* and *Pontia* visit all colors except pure red. *Libythea carinenta* prefers white and yellow flowers. *Clylopsis* never visits flowers. *Coenonympha tullia* prefers yellow. *Cercyonis pega* visits all colors whereas *C. meadii* and *C. oetus* prefer white and yellow; *Cercyonis pega* also often visits sap. *Erebia* prefer yellow and white flowers, and *E. callias* adds a huge attraction for mud. *Neominois* and *Oeneis* seldom visit flowers but when they do they prefer yellow and white flowers. *Anaea* never visits flowers, and visits sap. *Argynnis* (Speyeria) species often visit all colors, except *A. aphrodite* prefers rose-purple *Monarda*, and the A. callippe-group (including callippe, atlantis, zeren, coronis) more often visit yellow-white flowers and seldom visit red. *Boloria* most often visit yellow and white flowers. *Asterocampa* prefer sap, but also visit mostly whitish and yellow flowers. *Agailis milberti* and *Polygonia* prefer yellow and white, while *Nymphalis* prefer white and yellow; all those plus *Vanessa* seldom visit red, and *Polygonia* and *Nymphalis* and *Vanessa atalanta* often visit sap. *Euphydryas* prefer yellow and white. *Poladryas* prefers yellow flowers, and does not! visit mud. *Chlosyne* prefer yellow and white, except *C. whiteneyi* also often visits blue flowers. *Phyciodes mylitta-pallida* prefer yellow and white, while other *Phyciodes* visit all colors but seldom red. lycaenids in general prefer yellow and white flowers (as Scott and Scott 1978 noted), in part because their proboscis is small and evidently a larger proportion of small or short or open flowers tend to be white or yellow: *Apodemia* prefers white and yellow flowers. *Lycaena cupreus* prefers yellow flowers, while other *Lycaena* prefer yellow and white flowers, except *L. florus* and *L. dione* also often visit blush ones; all *Lycaena* rarely visit red. *Hypaurotis* never visits flowers and often visits sap and raindrops. *Satyrium sylvinus* visits all colors of flowers except perhaps pure red, but most hairstreaks prefer yellow/white flowers. The mostly-tropical *Strymon melinus* visits all colors including red, and likewise the mostly-tropical Polyommatini=”Polyommatinae” (Leptotes, Brephidium, Hemiarusus) visit all colors, while most temperate zone Polyommatini prefer yellow/white colors. *Celastrina* prefer white flowers. *Eriogonum*-feeding *Euphilotes* prefer white and yellow flowers. *Glaucopsyche lygdamus* visits most colors except perhaps red. *Plebejus* prefer yellow and white flowers, except *P. melissa* and *P. saepiolus* also often visit blush ones; all seldom visit red. Butterflies that often visit sap also tend to often visit rotten fruit. (My summaries of the preferences for colors were merely based on casual inspection of the records, and true preferences for colors would obviously require detailed experiments presenting all colors plus ultraviolet simultaneously to test butterfly preference, so these “preferences” are biased by whatever color flowers were available to the butterfly at the time.)

Bergerot et al. (2010) found that butterflies with longer proboscis length were more specialized in flower visitation than butterflies with shorter length (although there was great variation for both groups in their graph), but the present records suggest that if anything the reverse is true in the Rocky Mountains fauna. Small-proboscis Lycaenidae seem to have about the same number or fewer number of flowers visited as long-proboscis Hesperidae. Evidently a butterfly with long proboscis can visit long and short flowers, whereas a butterfly with short proboscis is limited to short ones.

A better understanding of the flowers visited by butterflies would include data on the lengths of the butterfly proboscis, the minimum lengths of a tiny straw placed into the flower to just reach the nectar, the color of the flowers in ultraviolet as well as light visible to humans, the size of the flower and the degree of clustering of the flower (the size of the inflorescence floral display), the height of the flower, the flower scents, sugar concentration in the flower nectar, plus the habitat, altitude, amount of forest and shade, etc. A full analysis like that would be a huge undertaking.

Tiple et al. (2009) attempted to measure some of those things in India, where they observed 27,570 nectar visits of about 50 butterfly species on many nectar plants over several years. They measured the
flower length, the proboscis length (which varied from 4 mm in *Pseudozizeeria* to 38 mm in a *Papilio*), body length and weight and wingspan, and calculated a “wing load” index (weight divided by wing area) and a “proboscis index”. The measurements of proboscis length and other body measurements were highly correlated so the study of those traits provided little insight. They found of course that small-proboscs butterflies (such as most Lycaenidae) visited shorter flowers, and long-proboscs ones visited short and long flowers. Most of their conclusions involved peculiarities of visitation by various taxa, like the ones I reported above, although they mostly discussed differences between the butterfly families. They also found that Lycaenidae prefer shorter flowers, Papilionidae longer ones, because of their great difference in proboscis length. The butterfly taxa that prefer sap are similar worldwide. They concluded that Papilionidae preferred sparse flowers, Pieridae moderately-sparse flowers, while Hesperiidae and Nymphalidae preferred dense massing (clumping) of flower inflorescences. This is definitely not the case in Colorado, where all the families visit mostly massed flowers: the Colorado flowers are either packed tightly together in massed inflorescences such as Asteraceae, or there are numerous flowers crowded on the inflorescence, or the plant has numerous flowers. Evidently the Papilionidae in India often visited large single flowers on trees, whereas nearly all the trees in Colorado are wind-pollinated except some cultivated trees. They reported that Pieridae and Lycaenidae preferred flowers of herbs while Hesperiidae and Nymphalidae preferred flowers of shrubs. In Colorado, the majority of flowers are herbs.

Actually, all the flower-feeding butterflies in Colorado mostly visit flowers that are clustered, either with many small flowers on an inflorescence, or joined into Asteraceae flowers, etc. Most Colorado flowers that butterflies often visit are in clusters of many flowers. Chilean butterflies also preferred larger floral displays (Arroyo et al. 2007). There is not a single butterfly species in Colorado that mostly visits solitary flowers. Evidently Colorado butterflies prefer a big display of flowers clustered near or together.

Stefanescu and Traveset (2009) compiled another large data set, of 29,305 recorded visits to 214 flower species by 100 butterfly species over 12 years in northeastern Spain. They found that butterflies with long flight periods and those of open areas visited more generalized flowers, which of course happens because they encounter more kinds of flowers in different seasons and habitats. Their woodland habitats tended to have butterflies that are more specialized in flower visits than open-habitat butterflies that visit more varieties of flowers. But an examination of this possible trend in Colorado produces only ambiguity: In Colorado, forest butterflies have a limited repertoire of flowers because *Picea engelmannii* and *Pinus contorta* forests grow thick (due to wrongful fire suppression), and *Picea* branches cover the ground and choke out most life (like the dog-hair-thick forests covering much of Switzerland, and the taiga worldwide), resulting in an impoverished flora and fauna, and the thick forests are mostly at higher altitude so the fauna flies later and it is often too cold in the forest shade for butterflies to fly and feed. After those forests burn, butterflies become common. The deepest-forest butterfly in Colorado is *Oeneis jutta*, but it only occurs in more-open forest with enough sunlight reaching the forest floor to permit growth of *Carex geyeri* sedges, and it rarely visits flowers, and both of my records are to very different flowers. The most woodland-habitat *Amblyscirtes* (*A. vialis*) feeds on many types of flowers and on few Asteraceae, but the semi-woodland *Colias scudderii* and the open-moist-woodland *Pieris marginalis mcdunnoughii* and *Boloria titania* and *Lycaena florus* feed mostly on Asteraceae (but so does the open-weedy-habitat *Lycaena helloides*), while the slightly-more forest-habitat *Argynnis* (*Speyeria*) *hesperis* and the more meadow-habitat *Argynnis* (*Speyeria*) *atlantis* both feed on many Asteraceae. The forest lycaenid *Callophrys spinetorum* rarely feeds on Asteraceae, but most (non-forest) *Callophrys* and *Strymon* seem to feed on Asteraceae less than usual, for unexplained reasons as the remaining Lycaenidae often feed on Asteraceae. Colorado butterflies occur at different altitudes and times and habitats and contact different flowers, and making generalizations about flower visitation is very difficult, as the butterflies already visit such a wide variety of flowers to begin with.

Corbet (2000) also attempted to determine which butterflies preferred which kinds of flowers, and calculated “wing loading” (wing area divided by body weight). She suggested that butterflies with high wing loading visited clustered or nectar-rich flowers, while butterflies with low wing loading visited solitary and less nectar-rich flowers. And she claimed that *Vanessa* and relatives with long proboscis and higher wing loading often visited deeper flowers such as *Buddleja*, while lycaenids with smaller wing
loading visited short flowered Asteraceae etc. These trends are not evident in Colorado. Of course Lycaenidae have smaller proboscis so they can’t visit long flowers, but other than that, ALL Colorado butterfly families mostly visit clustered flowers, and nearly all—including Vanessa and relatives—often visit Asteraceae flowers. My records are many, and they represent all seasons of the year, all habitats at all altitudes from desert and plains and riparian habitats and fens to mountain forests and meadows and alpine tundra and rockslide, over a huge area. The butterflies in this area feed on so many different flowers, of so many kinds and shapes and colors, that it is very difficult to find simplistic trends. And I have not measured nectar concentration so I can offer no conclusions about it, other than the studies reported in Part II below that seem to indicate that butterflies often visit flowers with high sugar concentration as well as those with low concentration and the glucose/hexose ratio also matters little. I conclude that there are not many valid conclusions.

(By the way, wing loading in butterflies depends mainly on the mate-locating method of the species rather than floral visitation, as males that rait “perch to await females” have bigger stronger bodies with more jet-plane-shaped wings, while males that fleek “patrol to seek females” have smaller weaker bodies and more rounded wings for long-range cruising, and females tend to have larger more rounded wings for slow and steady oviposition [Scott 1974d; see Scott 2010 for discussion of raiting, fleaiting, and fleeking etc.]. Additionally, butterflies with strong thoraxes compared to the area of wings (such as Hesperiiidae) generally fly more precisely than other butterflies, so their energy expenditure in flight ends up no higher than the smaller-bodied butterflies because they get to their destination faster. And butterflies with a jagged erratic flight such as Theclini (which have a bigger thorax) or a hopping flight such as Satyrinae evidently use that flight as an aerial predator-avoidance strategy, so analyzing such species’ life strategies merely using wing-loading energetics is bound to be misleading.)

**Special flight patterns for seeking nourishment.** Scott (1973b) found that various butterflies have a special flight pattern that they use to seek flowers and mud, when those are scarce on hillsides and ridgetops. They fly downward to a gulch, then fly down-valley until flowers or mud are found. In semi-dry conditions, this flight pattern seems to maximize their chance of finding flowers and mud in the moister conditions that occur lower down in gulches where ground water tends to come to the surface of the ground and accumulate. lycaenids including *Callophrys johnsoni*, *Callophrys augustinus*, *Atlides halesus*, *Erora laeta quaderna*, and *Satyrium saeptium* (also MacNeill 1967), and the nymphalids *Oeneis uhleri* and *Euphydryas bernadetta* were all observed in this down-valley flight. After feeding, the adults then depart for hillsides, or to hilltops where most of these species go to mate. California *Euphydryas editha* at one colony commute downhill to feed on flowers then return to the colony (Gilbert & Singer 1973).

In the tropics, Heliconius butterflies often “trap line” between flowers (Gilbert, 1972), and repeat the same flight pattern each day. *Hesperia leonardus* adults do seem to trap line by flying rapidly between *Liatris* flowers, but I do not know whether they have any memory of the location of those flowers or just fly rapidly and sooner or later encounter them.

**Flowers killing butterflies.** Rarely, flowers kill visiting butterflies. The killers are nearly always *Apocynum* and *Asclepias* in the family Apocynaceae. 13 *Euphydryas anicia capella* and one *Phyciodes pulchella camillus* were caught and most were found dead, after their proboscis became stuck in the stamen column slits of *Apocynum androsaemifolium*. One *Pieris rapae*, one *Polites mystic*, and one *Polites themistocles* were caught by their proboscis getting stuck between the corona and petals of the strange flowers of *Asclepias speciosa*. One *Vanessa cardui* died after its proboscis was found wrapped around the peduncle of *Anemone canadensis*.

Other foods may also kill butterflies. Strangely, three *Chlosyne gorgone* were found dead next to dog dung, probably because something the dog ate (or a de-worming chemical given to the dog by a veterinarian?) passed through the dog’s intestines unchanged and was toxic to the butterflies.

Part II below discusses other aspects of butterfly attraction to flowers, including the popularity of the various flower species to butterflies, the colors of flowers and ultraviolet patterns, butterfly vision, floral scents, the attractive components of flower nectar, and pollination of the flower species by butterflies.

The visitation records and preferences of butterflies for their adult foods follow.
The Adult Butterflies and their Foods

HESPERIIDAE, EUDAMINAE

Epargyreus clarus (Cramer) visits flowers of all colors: Apocynum androsaemifolium pinkish-white 5x; Apocynum cannabinum whitish 47x; Asclepias syriaca pink 2x; Carduus nutans rose-purple; “Cirsium vulgare” probably Carduus nutans rose-purple; Cirsium arvense purple 12x; Dipsacus fullonum var. sylvestris white to lilac 5x; Epilobium (Chamerion) danielsi=angustifolium red-purple; Geranium caespitosum pink 2x; Gilia pinnatifida white; Glycyrhiza lepidota yellowish-white 16x (one got proboscis caught ½ sec); Hesperis matronalis var. alba white; Iris missouriensis pale blue; Jamesia americana white; Lupinus argenteus blue 3x; Lythrum salicaria purple 6x; Medicago sativa violet 97x; Monarda fistulosa rose-purple 22x; Penstemon secundiflorus purple; Phaseolus vulgaris bush bean whitish; Philadelphus lemoinei white; Rudbeckia laciniata ampla yellow; Symphoricarpos rotundifolius pink; Symphoricarpos occidentalis pink; Tamarix chinensis=ramossissima rosy-white; Thalictrum dasycarpum whitish; Tilia americana yellowish-cream 2x; Tradescantia occidentalis blue unpopular flower only 1 sec.; Trifolium pratense red-purple 27x; white flowering plant; Zinnia elegans (pink 1x, yellow with orange center 30 min. 1x); dung of bird landed on in shade; mud 9x (one was in recycling position with proboscis below abdomen). An internet photo (Citizendum Encyclopedia, under “pollinator”) shows E. clarus supposedly pollinating a Cephalanthus occidentalis white flower because the anthers extend and contact the butterfly body, but the stigmas are way below because of the long legs. Venables and Barrows (1985) saw visits on 23 mostly-garden flowers, and found pollen on adults, but concluded they are mostly nectar thieves.

Chioides zilpa (Butler): Pinguina tree.

Aguna asander (Hewitson): Asclepias pollinia on leg (William McGuire specimen).

Zestusa dorus (W. Edwards): mud 26x.

Codatractus arizonensis (Skinner) visits white or pink flowers at least: Acacia angustissima white-flowered thornless; Baccharis 3x whitish; Cnidoscolus angustidens white; Polygonum ?pensylvanicum pink some; mud.

Codatractus valeriana Ploetz=mysie (Dyar) probably visits flowers of all colors, and often visits mud:

Cnidoscolus angustidens white with ragged leaves and points from leaves; Lamiaceae small blue;

Polygonum ?pensylvanicum pink; Valeriana ~white/rose; mud.

Urbanus dorantes (Stoll): blue legume.

Autochton cellus (Boisduval and LeConte): Baccharis whitish 2x.

Achalarus casica (Herrick-Schaeffer): mud 4x.

Thorybes drusiis (W. Edwards): mud.

Thorybes pylades (Scudder) visits flowers of all colors, and often visits mud: Aesculus californica whitish 1x; Apocynum androsaemifolium pinkish-white 2x; Astragalus shortianus purple; Barbarea orthoceras yellow; Cirsium ?rose-purple 3x; Eriogonum umbellatum yellow 2x; Hedysarum boreale? red legumes; Jamesia americana white; Lathyrus leucanthus white; Lathyrus polymorphus incanus purple and pink 2x; ~Lathyrus eucosmus pink pea; Lathyrus or Vicia ?blue-purple-pink; pea flower; Lamiaceae white; Oxytropis lambertii reddish-purple; ~Pedicularis? blue elephant flower; Penstemon virens blue; Symphoricarpos albus pink; Symphoricarpos occidentalis pink; Vicia americana purple; white flowering shrub; mud 15x.

Thorybes mexicana (Herrick-Schaeffer) evidently visits flowers of all colors even red, and often visits mud:

Delphinium ~ramosum blue; Erigeron? ursinus blue; Gentianella acuta “amarella” blue 2x; Hedysarum boreale? red legumes; Oxytropis sericea white; Sedum lanceolatum yellow; Symphoricarpos albus pink; Taraxacum officinale yellow 2x; Trifolium repens whitish 2x; mud 5x.

Cogia hippalus (W. Edwards): Cnidoscolus angustidens white with ragged leaves and points from leaves 2x; Polygonum ?pensylvanicum pink several; mud wet sand.

Cogia caicus (Herrick-Schaeffer): mud 2x.
HESPERIIDAE, PYRGINAE

Pyrrothrix araxes arizonae (Godman and Salvin) is the only butterfly known to land on water puddles by spreading the wings flat on the water and floating motionless on the water surface while they imbibe (to depart they flap the wings and zoom away) (Scott 1989). They may often visit all colors: Baccharis whitish ~47x; Lamiaceae white; Oxytropis lambertii reddish-purple 5x; Polygonum ?pensylvanicum pink 4x; ~Senecio spartioides yellow; sunflower yellow very-large-leaf; white Lamiaceae 2x; Zinnia ~elegans many ?pink; mud: water puddle 2x (wings spread on water while imbibing).

Staphylus ceos (W. Edwards): Baccharis whitish; pea flower blue-red; Polygonum ?pensylvanicum pink 2x; Valeriana ~white/rose.

Pholisora catullus (Fabricius) evidently visits all colors of flowers, and mud: Arctium minus rose-purple; Astragalus gracilis var. parviflorus purple 2x; Geranium caespitosum pink; Helianthus pumilus yellow; Heterotheca villosa yellow 2x; Lactuca serriola yellow; Lupinus argenteus blue; Medicago sativa violet 3x; Sphaeralcea coccinea orange 3x; Trifolium fragiferum pink; mud 3x.

Pholisora mejicanus (Reakirt) visits blue-purple flowers and probably all colors, and mud: Cirsium arvense purple; Cleome (Peritoma) serralata pinkish (briefly on); Lappula redowskii light-blue; Verbena bracteata blue 7x; mud.

Hesperopsis alpheus (W. Edwards): Erigeron pumilus white 10x; Medicago sativa violet (Maurice Howard) and other flowers (Scott and Scott 1978); Psoralea? thin blue legume.

Hesperopsis libya lena (W. Edwards): Centaurea repens blue 4x; Medicago sativa some (Michael S. Fisher).

Most Erynnis seem to prefer white/yellow flowers, except for E. funeralis, horatius, and tristis.

Erynnis icelus (Scudder and Burgess) seems to prefer white flowers: Antennaria parvifolia whitish; Cerastium strictum ~arvense~ white 2x; Erigeron pumilus white; Prunus virginiana white 3x; Senecio fendleri yellow; mud 9x.

Erynnis brizo burgessi (Skinner) seems to prefer white and yellow flowers: Arctostaphylos uva-ursi whitish; Astragalus drummondii white; Astragalus parryi white 11x; Cerastium strictum ~arvense~ white; Erysimum ~asperum~ yellow; Erysimum caputatum orange-yellow; Lesquerella montana yellow 5x; purple legumes; Senecio canus yellow 2x; Senecio fendleri yellow Xcanus yellow; white flowers; mud 12x.

Erynnis martialis (Scudder) prefers white and yellow flowers, sometimes blue/purple: Apocynum androsaemifolium pinkish-white 9x; Astragalus agrestis purple; Astragalus flexuosus purple 6x; Ceanothus fendleri white 13x; Cerastium strictum ~arvense~ white 3x; Eriogonum umbellatum yellow; Erysimum caputatum (orange 1x, yellow 2x); Heterotheca villosa yellow 2x; Jamesia americana white; Lathyrus leucanthus white 3x; Lesquerella montana yellow 4x; Mertensia lanceolata blue 8x; Penstemon virens blue; Potentilla fissa yellow 2x; Sedum lanceolatum yellow 7x; Senecio canus yellow 5x; Senecio fendleri yellow; Taraxacum officinale yellow; mud 10x.

Erynnis pacuvius (Lintner) most often visits white and yellow, but also visits purple, bluish, pink, even red flowers: Antennaria parvifolia whitish; Apocynum androsaemifolium pinkish-white 4x; Arctostaphylos uva-ursi whitish; Astragalus crassicarpus white; Astragalus agrestis purple; Astragalus flexuosus purple 3x; Ceanothus fendleri white 9x; Cerastium strictum ~arvense~ white; Erysimum ~capitatum~ yellow; Geranium caespitosum pink; Hedysarum boreale? red legumes; Heterotheca villosa yellow; Jamesia americana white; Lesquerella montana yellow 4x; Mertensia lanceolata blue; Sedum lanceolatum yellow; Senecio canus yellow 11x; Senecio fendleri yellow 6x; Symphoricarpos albus pink; Taraxacum officinale yellow; Thlaspi arvensis white; white flowering plant; mud 19x.

Erynnis funeralis (Scudder and Burgess) visits bluish and yellow and pink flowers etc.: blue legume; Erigeron ursinus blue-purplish; Heterotheca pumila yellow; ~Lathyrus eucosmus pink pea; Medicago sativa violet; tiny yellow-flowered plant like long-leaf Artemisia dracunculus; Zinnia grandiflora 5-10 cm roadside yellow-with-orange-center sunflowers; mud 6x.

Erynnis baptisiae (W. Forbes): Trifolium pratense red-purple.

Erynnis afrantius (Lintner) prefers yellow/white flowers, but also visits all other colors: Allium textile white; Apocynum cannabinum whitish; Campanula ~rotundifolia~ blue; Cirsium arvense purple 7x (+ var.
incanum 2x); Clematis ligusticifolia white; Convulvulus arvensis whitish; Grindelia squarrosa yellow; Heterotheca villosa yellow 4x; Hymenoxys (Tetraneuris) acaulis yellow 3x; Lathyrus polymorphus incanus purple and pink; Lesquerella montana yellow 2x; Lupinus argenteus blue; Marrubium vulgare cream; Medicago sativa violet 41x; Melilotus alba white 2x; Monarda fistulosa rose-purple; Oxytropis lambertii reddish-purple 4x; Penstemon glaber deep blue or bluish-purple; Psoralea tenuiflora blue-purple 2x; Senecio fendleri yellow 2x (plus one ½ sec.); Solidago altissima “canadensis” yellow; Symphoricarpos albus pink 2x; Taraxacum officinale yellow; Thermopsis divaricarpa yellow; Thlaspi arvense white; Verbena stricta purplish-blue 2x; white flowering plant; mud 23x.

Erynnis persius (Scudder) prefers white and yellow, but also visits all other colors; Allium textile white to light-rose 3x; Antennaria parvifolia whitish; Apocynum androsaemifolium pinkish-white 7x; Arctostaphylos uva-ursi whitish; Astragalus aggregis purple 3x; Astragalus flexuosus purple 14x; Astragalus laxmannii “adsurgens” usually whitish 3x; Barbarea orthoceras yellow 4x; Berberis (Mahonia) repens yellow; Berteroa incana white; Cerastium strictum “arvensce” white 5x; Claytonia rosea pinkish-white; Comandra umbellata white; Cryptantha virgata white; Erigeron pumilus bluish-white 8x; Eriogonum umbellatum yellow 3x; Erysimum capitatum orange; Harbournia trachypleura yellow; Heterotheca villosa yellow 3x; Jamesia americana white 4x; Lathyrus leucanthus white pea; Lesquerella montana yellow 16x; Lupinus argenteus blue; Mertensia lanceolata blue; Oxytropis lambertii reddish-purple 3x; Penstemon angustifolius blue; Penstemon virens blue; Phacelia heterophylla ~pinkish 3x; Physaria vitalifera yellow; Potentilla fissa yellow 2x; Pseudostellaria “Stellaria” jamesiana white; Pulsatilla patens multifida purple-white; Ranunculus ?glaberrimus yellow; Ribes cerea pinkish-white; Sedum lanceolatum yellow 13x; Senecio canus yellow 16x; Senecio fendleri yellow 22x; Senecio integerrimus yellow 5x; Thermopsis divaricarpa yellow 12x and female tried to feed on flower twice; Thlaspi arvense white 4x; Thlaspi (Noccaea) fendleri “montanum” white; Townsendia grandiflora bluish-white 6x; Viola nuttallii yellow (1x and one 2 sec.); mud 64x incl. visit by female.

Erynnis telemachus Burns prefers white and yellow flowers, sometimes blue and orange; Allium violet; Antennaria parvifolia whitish; Apocynum androsaemifolium pinkish-white; Astragalus parryi white 3x; Barbarea orthoceras yellow 10x; Berberis (Mahonia) repens yellow 3x; Cerastium strictum “arvensce” white 3x; Claytonia rosea pinkish-white; Delphinium ~geyeri blue; Erysimum capitatum orange 2x; Lesquerella montana yellow 5x; Linum lewisii blue; Mertensia lanceolata blue 3x; Pseudostellaria “Stellaria” jamesiana white; Ribes cerea pinkish-white 2x; Senecio canus yellow 4x; Senecio fendleri yellow 2x; Taraxacum officinale yellow 4x; Thermopsis divaricarpa yellow 5x (2 were seen inserting proboscis between sepals and corolla); Viola canadensis scopulorum white 2x; white flowering plant; yellow flower; juices from expanding Quercus gambelii leaf buds 4x; wet rotting wood many; dung; mud 22x.

Erynnis propertius propertius (Scudder and Burgess): Calyptridium umbellatum white; mud 2x.
Erynnis propertius meridianus E. Bell: white-flowered shrub similar to Almeliacheir.

Erynnis horatius (Scudder and Burgess) visits all colors, even red: Allium cernuum pinkish-white; Apocynum androsaemifolium pinkish-white; Arctostaphylos uva-ursi rose-purple; Carduus nutans rose-purple; Erysimum ~asperum yellow; Geranium caespitosum red; Hedysarum boreale? red legumes; Liatris punctata purplish; Melilotus alba white 4x; Melilotus officinalis yellow; Symphoricarpos albus pink; Trifolium ?white or pink; mud 3x.

Erynnis tristis (Boisduval) evidently often visits purple-violet and pink as well as white and yellow flowers. Ssp. tristis: Eriogonum grande orange (photo); Medicago sativa violet many; Lamiaceae. Ssp. tatus: Asteraceae yellow; Oxytropis lambertii reddish-purple; Polygonum ?pensylvanicum pink; Raphanus sativus bluish-white; Verbena purple (for ?tristis); mud 10x.

Systasea zampa (W. Edwards) =evansi (E. Bell): blue legume 2x; mud.

Pyrgus centaurea loki Evans visits yellow flowers, sometimes bluish or pink or whitish flowers and mud: Arnica cordifolia yellow 7x; Arnica mollis yellow 2x; Barbarea orthoceras yellow 2x; Erigeron simplex usually blue 2x; Erigeron urisinus blue 18x; Fragaria virginiana glauca white 2x; Hymenoxys grandiflora yellow; Kalmia polifolia pink 3x; Mertensia? blue; Polygonum bistortoides whitish 2x; Sedum rhodanthum pink 2x; Senecio crassulus yellow 5x; Senecio dimorphophyllus yellow 6x; ~Senecio
freemontii var. bitoides yellow sunflower with leaf blade round and wavy-margined; Senecio integrerrimus yellow 2x; Senecio werneriaefolius yellow; Taraxacum officinale yellow 9x; Trollius laxus yellow; Viola labradorica violet-purple; catkin (male) of Salix arctica pinkish; mud 2x.

Pyrgus ruralis (Boisduval): mud.

Pyrgus xanthus W. Edwards probably visits all colors of flowers also, and mud: Antennaria parvifolia whitish 2x; Antennaria rosea rosy-whitish; ?Eriogonum ursinum blue “Aster”; Potentilla subviscosa yellow often; Taraxacum officinale yellow often; manure (Scott 1975b); mud 5x.

Pyrgus scriptura (Boisduval) probably visits all colors of flowers, and manure and mud: Heterotheca villosa yellow 4x; Heliotropium curassavicium “white-blue low scorpioid Borage”; Oxytropis lambertiii purple-violent; Verbena bracteata bluish-purple; manure; mud 4x.

Pyrgus communis (Grote) visits all colors of flowers (seldom red), often visits mud, and rarely visits compost and dung. It ignores many large flowers in favor of smaller ones: Achillea millefolium “lanulosa” white (+ one on cultivated var. ½ sec.); Agastache rugosa red 2x; Allium textile white to light-rose 2x; Antirrhinum majus many colors 2 sec.; Apenia cordifolia purple-pink; Aster ascendens usually bluish; Aster ericoides white 11x + var. falcatus 2x; Aster lanceolatus hesperius bluish-white; Aster porteri white 4x; Asteraceae yellow; Asteraceae shrub yellow; Astragalus flexuosus purple 2x; blue legume; Centaurea cyanus blue; Centaurea diffusa white 8x; Centaurea maculosa lavender 15x; Chrysanthemum Xsuperbium white; Chrysanthenum morifolium purple 1 sec.; Chrysanthemum nauseosus yellow 23x; Cichorium endivia blue; Cirsium arvense purple 3x; Convolvulus arvensis whitish 3x; Coreopsis verticillata var. “Moonbeam” yellow; Coronilla varia pink; Cosmos bipinnatus white with yellow center; Cryptantha jamesii white; Cucumis sativus yellow; Echinacea purpurea purple; Eriogonum divergens blue; Eriogonum umbellatum yellow 4x; Gaillardia pulchella reddish with yellow apex; Gazania longisca hybrid whitish with ultraviolet middle; Gomphrena globosa purple; Grindelia squarrosa yellow 9x; Gutierrezia sarothrae yellow 4x; Helianthus petiolaris yellow ½ sec.; Heterotheca canescens yellow 5x; Heterotheca villosa yellow 12x; Hymenopappus filifolius yellow 1x; Hymenoxys (Tetraneuris) acaulis yellow; Lappula redowskii light-blue 9x; Liatris punctata purplish 10x; Linum lewisii blue; Lobelia ~siphilitica (1/2 m tall like Verbena) violet-blue 4x; Lobularia maritima “blue Alyssum”; yellow-flowered low bush; Machaeranthera canescens deep blue/purple 3x; Machaeranthera pattersoni purple/violet 7x; Machaeranthera annua=phyllocephala yellow 3x; Machaeranthera pinnatifida=Haploppappus spinulosus yellow 3x; Machaeranthera tanacetifolia blue-purple; Malva neglecta pinkish-white 3x; Medicago sativa violet 80x; Melilotus officinalis yellow 2x; Nepeta cataria white; Nepeta Xfaassenii violet 8x; Oxytropis lambertiip purple 3x; Penstemon strictus blue; Perovskia atriplicifolia blue 3x; Phyla=Lippia cuneifolia white 2x; Psoralea tenuiflora blue-purple; Rosippa simua yellow 2x; Rubus “Darrow Blackberry” white; Rudbeckia hirta yellow 4x; Rudbeckia laciniata ampla yellow; Sedum lanceolatum yellow 2x; Senecio fendleri yellow 2x; Senecio canus yellow; Senecio spartioideus yellow 3x; Senecio tridenticulatus yellow; Sidalcea malvaeflora purple; Sisymbrium altissimum yellow; Sphaeralcea coccinea orange 3x; Tagetes ~erecta orangish large petal y marigold; Tagetes patula 8x (2 orange-yellow, rest orangish/orange); Tagetes tenuiflora yellow 2x; Taraxacum officinale yellow 11x (+ one only ½ sec.); Thelesperma filifolium yellow; Trifolium fragiferum pink 5x; Trifolium repens whitish 46x; Verbena (near-venosa) “Purpletop” purple; Verbena bracteata bluish-purple; Verbena bracteata pink; Verbena hastata purplish-blue; Verbesina encelioides golden-orange; Veronica ~americana prostrate bluish ½ sec.; Viguiera (Heliomeris) multiflora yellow 2x; Viola nutallii yellow; Viola tricolor var. tricolor purple 2x; Zinnia elegans 7x (incl. yellow 3x, orange 2x); dung of human; compost (male fed repeatedly on fresh compost spread in garden); mud 32x.

Pyrgus (communis?) albescens Ploetz; Raphanus sativus bluish-white.

Pyrgus philetas W. Edwards: Polygonum ?pensylvanicum pink some; yellow sunflower with dissected leaves; yellow violet-like leaf; mud 30x.

Carcharodus flocciferus Zeller (Europe): Ranunculus yellow buttercup.

Heliopetes domicella (Erichson): mud.
Heliopetes ericetorum (Boisduval): ~Eriogonum compositum whitish “dense Eriogonum vaguely like effusum” 3x; white flowering plant many; mud 5x.

HESPERIIDAE, HETEROPTERINAES
Carterocephalus “palaemon” skada (W. Edwards) Cal.: Calyptridium umbellatum white.

Piruna pirus (W. Edwards) makes more than half its visits to Geranium caespitosum pink, which it may occasionally pollinate, many to Apocynum, and the rest of its visits are to many flowers of all colors, and mud: Achillea millefolium “lanulosa” white; Apocynum androsaemifolium pinkish-white 77x; Apocynum cannabinum whitish 50x; Arctium minus rose-purple; Arnica mollis yellow; Asclepias speciosa pink 2x; Aster laevis var. geyeri blue; Astragalus flexuosus purple 5x; Ceanothus fendleri white 3x; Cirsium arvense purple 39x + var. incanum 2x; Cryptantha ~thrysiflora white; Geranium caespitosum pink 404x incl. Janet Chu. Geranium is the favorite: when feeding on Geranium both sexes land on petals with head toward anthers/stigmas and put proboscics next to stamen column then put proboscis down into holes (by stamens) and the top of bend of proboscis often touches anther and the labial palp tip sometimes touches anther, and an antenna often touches (near base) anther/stigma (they may pollinate Geranium if pollen is found on their head, as they suck nectar as adults land on petals and fit under the stamens and probably contact them sometimes, but would they contact the 4 stigmas which rise in a column surrounded by the arching stamens?; pollination is evidently infrequent because they seldom touch the stigmas); Grindelia squarrosoa yellow; Hackelia floribunda 1m tall plant with tiny blue flowers; Helianthus pumilus yellow; Heterotheca villosa yellow 2x; Jamesia americana white; Lathyrus eucosmus rose-purple; Medicago sativa violet 161x; Melilotus alba white; Monarda fistulosa rose-purple 3x; Nasturtium officinale white; Rudbeckia laciniata ampla yellow 2x; Solidago ~alissima ~canadensis yellow 4x; Trifolium pratense red-purple; fluids ejected from abdomen as Paul A. Opler states they suck up fluids [evidently to feed on ~bird dung]; mud 16x.

Piruna polingii (W. Barnes): Geranium purplish 6x.

Piruna aea mexicana H. Freeman: mud 14x.

HESPERIIDAE, HESPERIINAE
Megathymus yuccae (Boisduval and LeConte): mud.
Agathymus species feed only on mud.
Agathymus neumoegeni neumoegeni (W. Edwards): mud 17x.

Agathymus arynxa arynxa (Dyar) : mud 7x; A. arynxa baueri mud 18x; A. arynxa fremani mud 3x incl. visit by female.
Agathymus evansi (H. Freeman): mud ~10x.

Agathymus remingtioni estelleae Stallings and Turner: mud.

Anceyoxypha numitor (Fabricius) visits all colors of flowers. Alisma subcordatum whitish; Anemone canadensis white 2x; Asclepias incarnata pink; Asclepias syriaca pink; Cirsium arvense purple 5x; Cirsium vulgare rose-purple; Erigeron philadelphicus white 2x; Helianthus divaricatus [not tuberosus?] yellow; Helianthus tuberosus yellow 6x; Heliopsis helianthoides yellow; Lobelia siphilitica violet-blue; Lotus corniculatus yellow 5x for a long time; Lythrum alatum purple; Medicago lupulina yellow 3x; Medicago sativa violet 133x; Oxalis stricta yellow; Phlox pilosa pink 3x (and male 2 sec and 2 sec); Potentilla norvegica yellow 12x; Taraxacum officinale yellow 8x (and seed head very briefly); Trifolium pratense red-purple 6x (and one 5 sec.); Trifolium repens whitish; Verbena hastata purplish-blue 13x; Viola americana purple 7x; Viola tricolor var. tricolor purple; mud 3x.


Oarisma powesheik (Parker): Echinacea angustifolia purple 9x; “Cirsium vulgare” surely Carduus nutans rose-purple.

Oarisma garita (Reakirt) visits all colors of flowers, all the way from red to blue: Achillea millefolium “lanulosa” white; Allium textile white (another did not land after inspecting two white flowers); Apocynum androsaemifolium pinkish-white 10x; Arnica mollis yellow; Asclepias speciosa pink; Aster ascendens usually bluish; Aster glaucodes white to violet; Astragalus agrestis purple violet 2x;
Astragalus bisulcatus purple 12x; Astragalus flexuosus purple 27x; Calochortus gunnisonii white; Campanula rotundifolia blue; Carduus nutans rose-purple 2x; Ceanothus fendleri white 5x; Cerastium strictum “arvense” white 5x; Cirsium arvense purple 7x (and var. incanum 2x); Cirsium ochrocentrum rose-purple; Cleome (Peritoma) serrulata pink; Convolvulus arvensis whitish 2x; Coreopsis tinctoria yellow (sunflower with Achillea leaves); Crepis acuminata yellow; Crepis occidentalis yellow; Erigeron ~glabellus blue hairy; Erigeron divergens white 2x; Erigeron pumilus blush-white 11x; Erigeron speciosus blue 3x; Erigeron urinus blue-purplish 5x; Eriogonum subalpinum [pinkish]-cream 14x; Eriogonum umbellatum yellow 2x; Gaussia aristata yellow with red-purple base 4x incl. Janet Chu; Geranium caespitosum pink 13x (one seen placing proboscis on base of column); Hedysarum boreale? red legumes; Heterotheca villosa yellow 7x; Lappula redowskii bluish-white; Linum lewisii blue 2x; Lapinus argenteus blue 1x and one only ½ sec.; Medicago sativa violet 7x; Melilotus officinalis yellow; Oxytropis lambertii reddish-purple 5x (one sucking each flower of inflor.); Penstemon ~confertus procerus small-flowered blue; Penstemon virens blue 2x and another only ½ sec; Potentilla concinna yellow 2x; Potentilla fissa yelow (this flower is nearly shunned by most butterflies); Potentilla pulcherrima yellow; Potentilla hippianaXpulcherrima yellow; Potentilla ?hippiana yellow; Rosa ~woodsi -pink; Rudbeckia hirta yellow 3x; Sedum lanceolatum yellow 18x; Senecio canus yellow; Senecio fendleri yellow 4x; Senecio triangularis yellow; Senecio? yellow; Sisymbrium altissimum yellow; Symphoricarpos albus pink; Tetradyenia canescens yellow; Townsendia ~hookeri white; Trifolium hybridum pinkish-white 2x; Vicia americana purple 2x; mud.

Oarisma edwardsi (W. Barnes) visits all colors of flowers from red to blue: Apocynum androsaemifolium pinkish-white; Asclepias speciosa pink 2x; Aster laevis blue big; Astragalus ?bluish [whitish?]; Linum [lewisii] blue (Scott and Scott 1978); Ceanothus fendleri white 2x; Geranium caespitosum pink 3x; Hedysarum boreale? red legumes; Lesquerella ?montana yellow; Melilotus alba white; Melilotus officinalis yellow; Oxytropis lambertii reddish-purple 2x; Penstemon ?virens pink or yellow; Symphoricarpos albus pink.

Copaeodes aurantiaca (Hewitson) visits flowers of all colors: Baccharis whitish; blue legume; Cnidoscolus angustidens white; Lantana ~camara yellow-red; Polygonum ?pensylvanicum pink several; Raphanus sativus bluish-white 3x; sunflower yellow; Valeriana white-pinkish; Zinnia ?pink or yellow; mud 3x.

Adopaeooides prittwitzi (Ploetz): Lotus greenei low 3 cm plant with flowers yellow but basal part orange-brown; Nasturtium officinale white many; Ranunculus yellow flower without usual yellow petals. Thymelicus lineola (Ochsenheimer) probably visits flowers of all colors but often visits purple: Cirsium arvense purple 150x; Medicago sativa violet; Trifolium hybridum pinkish-white 2x; Trifolium pratense red-purple 2x. Pivnick and McNeil (1985) noted that T. lineola prefers Trifolium pratense red-purple, Medicago sativa violet, and Vicia cracca bluish-purple.

Amblyscirtes feed on flowers rather seldom it appears, of all colors evidently, based on the few records I have of them, more often on blue-purplish than yellow-white ones.

Amblyscirtes exoteria (Herrick-Schaeffer): Lamiaceae white.

Amblyscirtes aenus W. Edwards: Apocynum androasemifolium pinkish-white; Cirsium ochrocentrum rose-purple 2x; Erysimum asperum yellow; Geranium caespitosum pink; Medicago sativa violet; Penstemon blue; red-purple legume 3x; bird dung recycling by sucking drops coming from anus; mud 4x.


Amblyscirtes oslari (Skinner): Apocynum androasemifolium pinkish-white; Cirsium arvense purple; Cirsium probably; Hedysarum boreale? red legumes; Lathyrus eucosmus white; Lathyrus polymorphus incanus purple and pink; Monarda fistulososa rose-purple; Oxytropis lambertii purple 9x; Penstemon secundiflorus purple 4x; Symphoricarpos albus pink; mud 7x.

Amblyscirtes eos (W. Edwards): Asclepias speciosa pink; Astragalus sp. ?bluish; Heterotheca canescens yellow; Liatris punctata purplish 6x; ? Lobelia siphilitica [perhaps Salvia azurea?] blue 2x; mud (wet sand).

Amblyscirtes elissa Godman: Baccharis whitish.

Amblyscirtes nysa W. Edwards: Cleome lutea yellow; Lantana ~camara yellow-red; ~Lathyrus eucosmus pink pea; Senna hirsuta var. leptocarpa yellow; mud 2x.
**Amblyscirtes vialis** (W. Edwards) prefers purplish flowers, but also visits yellow and whitish ones etc.: *Apocynum androsaemifolium* pinkish-white 3x; *Astragalus flexuosus* purple 13x; *Geranium caespitosum* pink; *Heterotheca villosa* yellow; *Jamesia americana* white; *Lathyris eucosmus* rose/purple; *Medicago sativa* violet; *Mertensia lanceolata* blue 2x; *Oxytropis lambertii* reddish-purple; *Penstemon secundiflorus* purple 5x; *Rubus idaeus* melanolasius white 2x; *Scutellaria brittonii* deep-violet-blue; *Tamarix chinensis=ramosissima* whitish 2x; *Thermopsis divaricarpa* yellow 5x; *Trifolium pratense* red-purple 2x; *Verbena stricta* purplish-blue 4x; *Oxytropis lambertii* reddish-purple; mud 13x.

**Amblyscirtes phylace** (W. Edwards) often visits *Oxytropis lambertii*; *Astragalus agrestis* purple; *Barbarea orthoceras* yellow; *Campanula rotundifolia* blue; *Ceanothus fendleri* white; *Geranium caespitosum* pink 2x; *Linum lewisii* blue; *Oxytropis lambertii* reddish-purple ~20x; *Phaseolus heterophyllus* flower with two orange hoods and yellow center with vine stem and tri-part leaves; mud 3x.

**Lerodea eufala** (W. Edwards) apparently visits all colors of flowers: *Aster ?chilensis* bluish; blue legume; Asteraceae yellow; *Eriogonum lafitolium* whitish 3x; *Heterotheca canescens* yellow 12x; *Lantana ~camara* yellow-red; *Liathis punctata* purplish 2x; ?*Lobelia siphilitica* [perhaps *Salvia azurea*?] blue Lamieacea; *Medicago sativa* violet 3x; *Polygonum pensylvanicum* pink ~5x; purple flower many; small white-flowered vine; sunflower big yellow; *Verbena purplish-blue*.

**Lerodea arabus** (W. Edwards): blue legume.

**Lerema accius** (J. Smith): *Zinnia ~elegans* and small *Zinnia ?pink* 4x.

**Hylephila phyleus** (Drury) seems to visit flowers of all colors: Asteraceae yellow 2x; *Baccharis salicifolia* whitish 2x; blue legume; *Eriogonum lafitolium* whitish 2x; *Gomphrena globosa* bright purplish-crimson; *Lantana ~camara* yellow-red; *Medicago sativa* violet; sunflower big yellow; *Trifolium repens* whitish 3x; *Verbena purplish-blue*; *Verbena hastata* purple 5x; *Zinnia ~elegans* ?pink 9x.

**Hesperia** species visit a wide variety of flowers including red-purplish and blue-purplish ones. They often visit *Cirsium* and red. *Hesperia leonardus* usually visits only *Liathis punctata*.

**Hesperia uncas** W. Edwards visits all colors of flowers, esp. yellow and white: *Agoseris glauca* yellow 2x; *Arabis divaricarpa* blue 2x; *Asclepias speciosa* pink 2x; *Aster ericoides* white 2x incl. var. ericoides; Asteraceae yellow; *Astragalus drummondii* white 3x; *Astragalus kentrophyta* yellowish-white; blue asters; *Carduus nutans* rose-purple 17x; *Chrysanthamum nauseosus* yellow 8x; *Cirrus arvense* purple 5x; *Cirsium canescens* whitish 2x; *Cirsium ochrocentrum* (rose-purple 1x, lavender-white 1x); *Cirsium scariosus* var. aculeascens whitish; *Cirsium undulatum* rose-purple; *Cirsium vulgare* rose-purple; *Cryptantha jamesii* white 4x; *Erigeron pumilus* white 3x; *Erysimum asperum* yellow 4x; *Grindelia squarrosa* yellow 4x; *Helianthus*? yellow 2x; *Heterotheca villosa* yellow 6x; *Hymenopappus filifolius* yellow 4x; *Liathis punctata* purplish 5x; *Lupinus argenteus* blue; *Medicago sativa* violet 2x; *Monarda fistulosa* rose-purple; *Opunica macrorhiza* yellow; *Opunica polyantha* yellow 8x; *Oxytropis lambertii* blue-purple; *Oxytropis deflexa* var. *sericea* whitish; *Oxytropis sericea* whitish 2x; *Penstemon albidus* white with violet guide lines; *Penstemon secundiflorus* purple; *Potentilla pensylvanica* yellow; *Senecio fendleri* yellow; *Senecio tridentaculatus* yellow; *Thalassia* type-yellow; *Tamarix chinesis=ramosissima* rosy-white; *Taraxacum officinale* yellow 2x; *Thelesperma filifolium* yellow; *Verbena encelioides* golden-orange; mud 3x incl. female.

**Hesperia uncas tomiichi** M. Fisher: *Asclepias halli* whitish 5x; *Calochortus nuttallii* violet-rose; *Eriogonum lonchophyllum* white 22x; *Lepidium eastwoodiae* white ½ sec.; *Lygodesmia juncea* pink 1 sec.

**Hesperia juba** (Scudder) visits white, yellow, occasionally orange and purplish-violet etc. flowers, especially *Chrysanthamum nauseosus* especially in late summer, and frequents mud: *Allium textile* white to light-rose; *Aster porteri* white; *Barbarea orthoceras* yellow 2x; *Chrysanthamum nauseosus* yellow 161x; *Erigeron pumilus* bluish-white 5x; ~*Eriogonum compositum* whitish “dense *Eriogonum* vaguely like *efusum*”; *Eriogonum umbellatum* yellow; *Erysimum capitatum* usually orange; *Harbouria trachypleura* yellow; *Heterotheca villosa* yellow 3x; *Liathis punctata* purplish 2x; *Medicago sativa* violet; *Physocarpus monogynus* white; *Senecio canus* yellow 2x; mud 19x.

**Hesperia comma** (Linnaeus) (the following includes ssp. *ochracea*, *idafo*, *idafoXsusanae*, *idafoXassinioboia*, *oroporta*) visits purplish-bluish and yellow and white flowers, even pink and rose-
Hesperia comma colorado (Scudder) visits yellow, white, and blue-purple flowers (few red flowers grow at its high altitude): Arnica mollen yellow; Aster ~ascendens blue 2x; Erigeron melanoccephalus white or pinkish; Erigeron ursinus blue-purple yellow-colored violet; Erigeron rigonum yellow-purple 3x; Haplopappus (Oreochrysum) parriy yellow; ~Haplopappus (Pyrocoma) lanceolata tall yellow aster; Asteraceae; Haplopappus (Teneus) pygmaeus yellow; Heterotheca canescens pinkish 1x; Heterotheca villosa yellow 15x; Hymenoxys grandiflora yellow; Potentilla prob. pulcherrima yellow; Sedum lanceolatum yellow 2x; Solidago simplex var. nana=decumbens yellow.

Hesperia comma harpalus (W. Edwards); Calyptridium umbellatum white many.

Hesperia woodgatei (R. Williams): aster blue; white bushy flower.

Hesperia ottoe W. Edwards prefers purplish flowers, and sometimes visits all other colors: Asclepias pumila whitish; Asclepia speciosa pink 2x; Carduus nutans rose-purple 167x; Cirsium arvense purple 2x; Cirsium ochrocentrum rose-purple; Cirsium undulatum rose-purple 3x; Cleome (Peritoma) serrulata pinkish Janet Chu; Echinacea angustiflora purple 6x; Heterotheca canescens yellow; Lobelia siphilitica violet-blue Lamiaeae 3x; Monarda fistulosa rose-purple 22x; Solidago ~altissima “~canadensis” yellow; Trifolium pratense red-purple; mud 5x.

Hesperia leonardus pawnee Dodge visits yellow, white, and occasionally orange and blue-purple flowers and often visits mud, but usually feeds just on Liatris punctata purplish in Colo., Neb., and Minn.: Aster ericoides white 2x; Aster porteri white 2x; Aster blue several (Paul A. Opler); Carduus nutans rose-purple 6x (incl. Paul A. Opler); Chrysothamnus nauseosus yellow 59x; Cirsium (Paul A. Opler); Eriogonum effusum white perching?; Eriogonum umbelatum yellow; Grindelia squarrosa yellow 4x; Gutierrezia sarothrae yellow 5x; Helianthus annuus yellow 2x (incl. Paul A. Opler); Helianthus petiolaris yellow 2x; Heterotheca villosa yellow 4x (incl. Paul A. Opler); Liatris punctata purplish 256x (mainly uses this flower, Scott and Scott 1978); Lycium barbarum halimofolium violet 3 sec; Senecio spatioides yellow 3x; Solidago missouriensis yellow; Tagetes ~erecta orange; Verbesina encelioides golden-orange ~30x; mud 23x. H. leonardus pawnee and the next H leonardus montana surely pollinate Liatris punctata because they swiftly “trap line” between the flowers, and the stamens and stigmas extend outward enough to provide pollination opportunities.

Hesperia leonardus montana (Skinner) visits purplish, pinkish, bluish, and white flowers, but nearly always visits just Liatris punctata: Aster lanceolatus hesperius bluish-white 2x; Aster porteri white 3x; Carduus nutans rose-purple 86x; Cirsium pink; Cirsium white; Dalea purpurea pink-purple; Erigeron speciosus blue? “pink Asters”; Geranium caespitosum pink; Heterotheca villosa yellow 11x; Liatris punctata purplish 595x; Machaeranthera pateroni purple/violet blue 13x.
Hesperia leonardus leonardus T. Harris is the only H. leonardus ssp. that is often found on flowers other than Liatris, commonly on high flowers (Scott and Stanford 1981): It is still abundant on Liatris punctata purplish in Mich., N.J. and Iowa (Steve Spomer and Tim Warwick). It sometimes feeds on other flowers: Aster, Cirsium, Clematis, Eupatorium purpureum pink-purplish [and including “bonehead” meaning Boneset], Liatris other species purplish, Solidago yellow, Vernonlia angustifolia purple.

Hesperia pahaska Leuellers visits purplish and all other colors of flowers (Scott 1973a studied this species): Asclepias asperula occidentalis purple 1x; Asclepias hallii purple 5x; Asteraceae yellow; Astragalus drummondii white 20x; Astragalus miser var. oblongifolius [not bisulcatus] pale-violet 3x; Baccharis whitish; Carduus nutans rose-purple 3x; Cirsium prob. rose-purple; Cirsium arvense purple 17x; Cirsium canescens whitish; Cirsium ochrocentrum rose-purple 4x; Cirsium undulatum (rose-purple 1x, lavender 2x); Cirsium vulgare rose-purple 16x; Cleome (Peritoma) serrulata pink 3x; Cryptantha jamesii white 13x; Descurainia sophia yellow 1x; Erigeron canus blue-white 2x; Erigeron pumilus white 4x; Eriogonum flavum yellow-cream; Eriogonum umbellatum yellow; Erysimum asperum yellow 10x; Hedysarum boreale? red legumes; Heterotheca villosa yellow 1x; Hymenopsappus filifolius yellow 2x; Jamesia americana white; Leucelyne ericoides=‘Aster arenosus white 1x; Linaria genistifolia dalmatica yellow and redder at apex; Machaeranthera bigelovii purple/violet 2x; Melilotus officinalis yellow 2x; Mirabilis multiflora purplish 1x; Monarda fistulosa rose-purple 4x; Opuntia polyacantha yellow 46x; Oxytropis lamberti purple 20x; Penstemon secundiflorus purple 80x; Penstemon virgatus asagayi lavender-purple 7x; Polygonum ?pensylvanicum pink 2x; Sedum lanceolatum yellow 3x; Senecio fendleri yellow; Symphoricarpus albus pink; Thermopsis montana yellow; Trifolium white to pink; Zinnia ~elegans ?pink small 9x; mud 3x.

Hesperia viridis (W. Edwards) visits all colors of flowers except perhaps pure red: Achillea millefolium “lamulosa” white; Asclepias speciosa pink 2x (one has pollinia on leg); Astragalus ?bisulcatus large tall pinkish-purple; Carduus nutans rose-purple 7x; Ceanothus fendleri white 2x; Cirsium ?purple 3x; Cirsium arvense purple 22x; Cirsium ochrocentrum rose-purple several; Cirsium undulatum rose-purple; Clematis ligusticifolia white some; Cleome (Peritoma) serrulata pinkish; Conium maculatum white; Cryptantha jamesii white; Erigeron pumilus usually white; Eriogonum leptophyllum whitish; Eriogonum umbellatum yellow; Gaillardia aristata yellow with red-purple base; Helianthus pumilus yellow 4x; Heterotheca villosa yellow 9x; Liatris punctata purplish; Marrubium vulgare cream; Medicago sativa violet 5x; Melilotus alba white some; Monarda fistulosa rose-purple 11x; Opuntia macrorhiza yellow; Opuntia phaeacantha yellow 2x; Opuntia polyacantha yellow; Oxytropis lamberti reddish-purple; Penstemon secundiflorus purple 2x; Pericome caudata yellow; Senecio-type several yellow; Solidago altissima “canadenis” yellow; mud 5x.


Hesperia dacotae (Skinner) visits at least purplish flowers: Carduus nutans rose-purple 41x; Cirsium undulatum rose-purple; Echinacea angustifolia purple 12x.

Hesperia lindseyi (W. Holland): Aesculus californica whitish 12x; Asclepias speciosa pink 3x; Brodiaea ~bluish; Eriodyctyon californicum white to lavender several; lily yellow; Lamiaceae several; mud.


Hesperia nevada (Scudder) visits all colors of flowers (except perhaps red) including blue-purple: Arnica rose; Asclepias halli white; Astragalus agrestis purple 33x; Astragalus drummondii white; Astragalus hallii white; Astragalus laxmannii “adsurgens” usually whitish 2x; blue flower; Cryptantha virgata white; Erigeron pumilus bluish-white 5x; Eriogonum lonchophyllum white; Eriogonum subalpinum [pinkish] cream 3x; Erysimum capitatum usually orange 52x; Geranium caespitosum pink; Harbouria trachypleura yellow; Oxytropis lamberti purple 20x; Oxytropis sericea white 2x; Penstemon strictus blue; Penstemon virens blue; Penstemon cyathophorus pink-blue; Sedum lanceolatum yellow 8x; Senecio canus yellow (another left after ¼ sec.); mud 13x.

Polites (Yvretta) carus (W. Edwards): Polygonum ?pensylvanicum pink; mud many.

Polites (Yvretta) rhesus (W. Edwards) visits white, yellow, and blue-purplish-violet flowers, and prefers Astragalus drummondii, Erysimum asperum, and Oxytropis lamberti where those are present: Allium textile white to light-rose 2x; Astragalus drummondii white 3x (preferred, Scott and Scott 1978);
Polites peckius surllano
Polites draco
Polites sabuleti sabuleti

Primrose pink rupestris following flowers are center 1x angustifolia 3x; Chamaedrys
Tagetes erecta Zinnia pinkish (cm flower) white
Centranthus gracilis flowers: Lambertii missouriensis Harbouria trachypleura fendleri agrestis mud:
Encelium gymnospermoides Solanum missouriensis yellow 4x; Solidago (Euthamia) occidentalis yellow 19x; sunflower big yellow; Taraxacum officinale yellow; Trifolium fragiferum pink; Verbesina enceloioides golden-orange; mud 2x.

Polites draco (W. Edwards) visits yellow and white and less-often bluish-purple flowers, and often visits mud: Achillea millefolium “lanulosa” white; Aletes ~acaulis (?lanulosa) yellow; Arnica parvifolia ½ sec.; Arnica mollis yellow; Arnica rydbergii yellow; Astilbe foliacea var. apricus purple 2x; Astra glas agrestis purple 11x; Astragalus drummondii white several; Astragalus flexuosus purple 3x; Ceanothus fendleri white; Erigeron eliator pink-purple; Erigeron pulimus bluish-white 9x; Erigeron urinus blue-purplish 5x; Eriogonum subalpinum (pichkis)-cream 4x; Erysimum capitatum (yellow 1x, orange 3x); Harbouria trachypleura yellow; Heterotheca pumila yellow 2x; Hymenoxys grandiflora yellow; Iris missouriensis pale blue turned down and turned and put proboscis between petal bases; Oxytropis lambertii reddish-purple 4x; Penstemon virens blue 2x; Sedum lanceolatum yellow; Senecio canus yellow; Senecio crassulosa yellow 2x; Taraxacum officinale yellow 5x; mud 8x.

Polites peckius surllano Scott visits all colors including red and pink, but usually visits purplish-blue-violet flowers: Achillea millefolium “lanulosa” white; Aster ericoides white; Astor ~fendleri white; Astragalus gracilis var. parviflorus purple; Buddleja davidii purple/ violet 27x; Carduus nutans rose-purple 2x; Centranthus ruber red 4x; Ceratostigma plumbaginoides violet; ~Chrysanthemum parthenium small (2.5 cm flower) white-with-orange-center Asteraceae 2x; Cirsium arvense purple 11x; Cirsium discolor pinkish-purple 2x; Cirsium vulgar rose-purple; Echinacea purpurea purple 7x; Erigeron philadelphicus white; Gomphrena globosa purple or bright purplish/crimson 13x (prefers Gomphrena over Salvia); Hesperis matronalis pink; Lavandula angustifolia flower yellow 3x; Liatris punctata purplish 59x; Lobelia ~siphilitica violet-blue; Lupinus argenteus blue; Lycnis coronaria red 12x; Malva sylvestris pink; Medicago sativa violet 16x3; Nepeta Xfaassenii violet 2x; Rudbeckia hirta yellow (not popular, rarely visits) 2x; Salvia farinacea (purple-blue 40x, violet-blue 26x, white 1x) (not as popular as Verbena and Zinnia); Salvia nemorosa “East Friesland” blue 8x; Scabiosa columbaria blue-lilac 9x; Solidago missouriensis yellow rested didn’t feed; Sonchus uliginosus yellow; Symphoricarpus ~occidentalis pink; Tagetes erecta yellow-orange 4x; Tagetes patula orange 2x; Taraxacum officinale yellow 2x; Teucrium chamaedrys=Germander red 4x; Thermopsis divaricarpa yellow; Trifolium pratense red-purple; Trifolium repens whitish; Verbena bipinnatifida (pink to purple 2x, purple 2x); Verbena hastata purple 3x; Verbena rigida purple; Verbena stricta purplish-blue; Vicia cracca dark-blue hanging-flower; Zinnia angustifolia red (not popular); Zinnia elegans 25x (crimson 1x, orange 4x, pink 7x, yellow with orange center 1x, red and orange 2x, white 1x). In addition, watching urban park flowers I learned that the following flowers are not popular and are mostly not visited: Achillea millefolium cultivated var. rosy to white (unpopular flower, 2x rested on it but did not feed, and none visited it other times); Agastache rupestris red none; Campanula carpatica blue none; Campanula ~rapunculoides none; Caryopteris clandonensis none several days; Diascia ~rigescens pink none; Erigeron speciosus blue none; Evening primrose pink none; Fallugia white flowers none; Gaillardia pulchella reddish with yellow apex none;
**Polites peckii peckii** (W. Kirby): *Rudbeckia hirta* yellow AZ; *Erigeron ~ursinus* blue (Gunnison Co. CO).

**Polites themistotheles** (Latreille) visits all colors of flowers, blue-purple-violet and yellow and whitish and pink and even orange and red, and sometimes visits mud: *Apocynum androsaemifolium* pinkish-white 3x; *Asclepias speciosa* pink 2x (one caught between corona and petals by proboscis, another had pollinia on leg); *Asclepias verticillata* whitish; *Aster laevis* var. *geyeri* blue; *Aster lanceolatus hesperius* bluish-white 10x; *Astragalus agrestis* purple 5x; *Astragalus flexuosus* purple; *Astragalus laxmannii* “adsurgens” usually whitish 3x; *Bidens cernua* yellowish; *Buddleja davidii* (pink-purple 1x, purple 1x); *Carduus nutans* rose-purple 20x; *Centaurea cyanus* ~blue 3x; *Centaurea dealbata* purple; *Centranthus ruber* red 6x; *Chrysanthemum Xsuperbum* white 3x; *Cirsium arvense* purple 6x; *Convolvulus arvensis* whitish 7x (+ another only 1 sec.); ? *Coreopsis* orange; *Delphinium ajacis* violet briefly; *Echinacea angustifolia* purple 2x; *Echinacea purpurea* purple 3x; *Erigeron pumilus* usually white; *Gomphrena globosa* (purple 26x, bright purplish-crimson 9x); *Hedysarum boreale*? red legumes many; *Jamesia americana* white; *Liatris punctata* purplish 9x; *Lobelia ~siphilitica* violet-blue 2x; *Lupinus argenteus* blue 3x; *Lychnis coronaria* red (not popular); *Medicago sativa* violet 92x; *Monarda fistulosa* rose-purple 2x; *Oxypotis lambertii* reddish-purple 2x; *Phacelia heterophylla* ~pinkish; *Rudbeckia hirta* yellow 5x (not very popular); *Salvia farinacea* (purple 25x, purple-blue 15x, violet 4x, white 4x) (preferred over *Gomphrena*, but not as popular as *Verbena* and *Zinnia*); *Salvia officinalis* blue 5x; *Sedum lanceolatum* yellow; *Symphoricarpos albus* pink many; *Tagetes patula* yellow-orange 11x; *Taraxacum officinale* yellow 13x; *Trifolium pratense* red-purple 3x; *Verbena bipinnatifida* (purple 14x, pink 1x, rosy 4x, rosy-white 1x, white 9x); *Veronica ~americana* blue or nearly white only 1/3 sec; *Vicia americana* blue; *Zinnia elegans* 121x (1 of these on crimson flowers, 3 on violet-red, 1 on rosy, 6 on rose-white, 57 on pink, 15 on orange, 15 on yellow, 1 on yellow-around-pink, 14 on white); mud 2x. In addition, the following urban park flower-garden flowers were found to be unpopular: *Achillea millefolium* rosy to white none; *Agastache rugipetala* red none; *Campanula carpatica* blue none; *Dicentra ~rigescens* pink none; *Evening primrose*? pink none; *Gilia scarlet none; Perovskia atriplicifolia* blue none; *Petunia* red and white flowers none; *Physostegia virginiana* rosy-cream none; *Platycodon grandiflorum* blue none; *Salvia ~like Gilia*?; *Zinnia angustifolia* red none.

**Polites orogenes rhena** (W. Edwards) visits all colors of flowers (even pink and red), especially purplish-blue-violet (especially *Monarda*), and often visits mud: *Achillea millefolium* “lanulosa” white; *Apocynum androsaemifolium* pinkish-white 3x; *Asclepias speciosa* pink (leg had two pollinia); *Asclepias syriaca* pink 3x (one leg had pollinia); *Carduus nutans* rose-purple 21x; *Cirsium ochrocentrum* rose-purple violet 5x; *Cirsium undulatum* rose-purple; *Cirsium prob. rose-purple; *Clematis ligusticifolia* white; *Echinacea angustifolia* purple; *Geranium caespitosum* pink 2x; *Hedysarum boreale*? abundant on red legumes; *Helianthus pulchella* yellow 6x; *Heterotheca villosa* yellow 3x; *Medicago sativa* violet 11x; *Monarda fistulosa* rose-purple 118x; *Oxypotis lambertii* reddish-purple; *Penstemon secundiflorus* purple 2x; *Ratibida columnifera* purple; *Solidago ~alissima* “~canadensis” yellow few; *Symphoricarpos albus* pink many; *Verbena stricta* purplish-blue 12x; sap of *Salix amygdaloides*; mud 5x.

**Polites mystic** (W. Edwards) visits all colors of flowers (including red), especially purplish-blue-violet (especially *Monarda*), and mud: *Apocynum androsaemifolium* pinkish-white 5x; *Apocynum cannabinum* whitish 52x; *Asclepias speciosa* pink 16x (two of these had pollinia on leg; a female was caught between corona and petals by her proboscis); *Asclepias tuberosa* orange; *Convolvulus (Calystegia) sepium* angulata white in flower tube; *Carduus nutans* rose-purple 9x; *Cirsium arvense* purple 8x + var. *incanum* 2x; *Cirsium ochrocentrum* rose-purple 3x; *Cirsium undulatum* rose-purple; *Cirsium scariosum* ~coloradense (for *P. mystic*?) whitish; *Clematis ligusticifolia* white; *Cryptantha virgata* white 2x; *Ericogonum umbellatum* yellow; *Gaillardia aristata* yellow with red-purple base; *Gaillardia pulchella* reddish with yellow apex long pink center and pink petals 6x; *Geranium caespitosum* pink 3x (but another ignored it); *Hackelia floribunda* blue; *Heterotheca villosa* yellow; *Lupinus argenteus* blue; *Medicago sativa* violet 12x; *Mentha arvensis* pink; *Monarda fistulosa* rose-purple 40x; *Oxypotis
lambertii reddish-purple 3x; Penstemon secundiflorus purple 3x; Penstemon virens blue; Taraxacum officinale yellow; Trifolium pratense red-purple 13x; mud 4x.

Polites sonora (Scudder). Ssp. utahensis (Skinner) greatly prefers the whitish Cirsium scariosum var. acaulescens which sprawls its flowers at GROUND level with NO stem! Otherwise it visits blue and purple and yellow and whitish flowers, plus manure and mud: ~Aster ascendens blue 2x; Astragalus drummondii white; Berteroa incana white; Cirsium prob. rose-purple; Cirsium arvense purple ~8x; Cirsium ~scariosum ~whitish-blue; Cirsium scariosum (=coloradense=drummondii) var. acaulescens whitish 71x (the favorite flower); Erigeron ~ursinus blue 4x; Erigeron ursinus blue-purplish 5x; Melilotus officinalis yellow; Rudbeckia hirta yellow; Taraxacum officinale yellow; cow manure; mud 2x.

Ssp. sonora visited: Calytridium umbellatum white some; purple Lamiaceae.

Polites vibex (Geyer): Monarda fistulosa rose-purple 2x.

Wallengrenia egeremet (Scudder) Cirsium arvense purple; Helianthus petiolaris yellow; Lamiaceae flower blue (1/2 m tall like Verbena) 2x; ?Lobelia siphilitica.

Pompeius verna (W. Edwards): Asclepias incarnata pink.

Atalopedes campestris (Boisduval) visits all colors of flowers except perhaps pure red. Asclepias incarnata pink; Asclepias speciosa pink 2x; Asclepias syriaca pink; Asclepias sp. pink; Aster ?chilensis bluish; Aster red; Aster ericoides white var. ericoides white 3x; Aster novi-belgii purple; Bidens cernua yellowish 2x; Caryopteris clandonensis “Longwood Blue” blue; Chrysanthemum Xsuperbum white; white sunflower (Chrysanthemum? Gerbera?); Chrysothamnus nauseosus yellow ~9x; Cirsium arvense purple 3x; Cirsium discolor pinkish-violet 3x; Cirsium vulgarum rose-purple; Coreopsis annual ~yellow; Cosmos bipinnatus orange; Echinacea purpurea purple 2x; Gaillardia aristata yellow with red-purple base 2x; Heterotheca canescens yellow ~17x; Liatris punctata purplish 4x; Lobelia siphilitica dark blue; ?Lobelia siphilitica (perhaps Salvia azurea?) blue Lamiaceae; Medicago sativa violet 25x; Nepeta cataria white; Penstemon blue cultivated; Polygonum pensylvanicum pink; Solidago yellow; big sunflower yellow; sunflower yellow; Tagetes ~eectra yellow-orange 25x; Tagetes patula (orangish 4x, yellow 3x); Teucrium chamaedrys red-purple 7x; Trifolium pratense red-purple 2x; Trifolium repens whitish 3x; Verbena hastata purple 15x; Verbena Xhybrida “Imagination” purple 18x; ?Verbena tall 1m blue flower; Zinnia elegans 19x (and also pink 10x, yellow 3x, yellow around pink, small hybrid white 5x); mud 2x. Venables and Barrows (1985) saw visits on 27 mostly-garden flowers, and found pollen on adults but concluded they are mostly nectar thieves.

Atrystone arogos (Boisduval and LeConte) visits flowers of all colors, mostly purplish (and blue to pink) ones, but often yellow: Apocynum androsaemifolium pinkish-white 3x; Asclepias pumila (white 4x, whitish-green); Asclepias speciosa pink ~22x; Asclepias syriaca pink 2x; Carduus nutans rose-purple 11x; “Cirsium vulgarum” probably Carduus nutans rose-purple 62x; Cirsium arvense purple ~129x; Cirsium ochrocentrum rose-purple; Cirsium vulgare rose-purple 3x; Dalea purpurea cylindrical pink/rose-purple legume 2x; Echinacea angustifolia purple 7x; Eriogonum flavum yellow; ~Eupatorium purpureum pink-purplish 1 m “Liatris” with wide leaves; Gaillardia aristata yellow with red-purple base; Geranium caespiotum pink; Grindelia squarrosa yellow 2x; Helianthus pumilus yellow 11x; ?Heliopsis helianthoidea yellow serrate sunflower; Heterotheca villosa yellow 9x; Liatris punctata purplish 15x; Lobelia siphilitica violet-blue Lamiaceae 2x; Medicago sativa violet ~38x; Monarda fistulosa rose-purple 32x; “Penstemon” ~albidus white; Ratibida columnifera yellow 2x; Rudbeckia hirta yellow; Solidago altissima “canadensis” yellow 56x; Solidago ~missouriensis yellow; Solidago yellow 2x; sunflower yellow 2x Janet Chu; mud 7x.

Poanes taxiles (W. Edwards) visits all colors including red, especially purplish (especially Monarda), and mud: Apocynum androsaemifolium pinkish-white 6x; Apocynum cannabinum whitish 2x; Asclepias incarnata pink 2x; Asclepias speciosa pink 2x; Astragalus bisulcatus purple; Campanula rapunculoides blue; Carduus nutans rose-purple 8x; Ceanothus fendleri white 2x; Centranthus ruber red; Ceratostigma plumbaginoides violet 2x; Cirsium arvense purple 18x + var. incanum 1x; Cirsium canescens whitish narrow leaves white; Cirsium ochrocentrum rose-purple 3x; Cirsium undulatum rose-purple; Cirsium vulgare rose-purple 2x; Convolvulus (Calystegia) sepium angulata white 4 cm flowers 9x (5x crawled inside 5 cm corolla tube, and female crawled completely into flower and extended proboscis to feed);
Poanes melane

Poanes hobomok

Carduus nutans

Asteraceae shrub yellow 4x; Aster lanceolatus hesperius foliaceus because of the late white to lavender; Senecio reddish ~capitatum mud:

reddish flowers more than most butterflies visit reddish (salicaria orange)

Echium vulgare whitish to pink Tooker et al. (2002), berry).

Symphoricarpos albus pollinia on leg; midpoint of abdomen sucks it up); mud 12x in purple 2x; bird dung (abdomen dips down to put a drop onto dung, proboscis back under body nearly to midpoin of abdomen sucks it up); mud 12x incl. female.

Poanes hobomok (T. Harris) visited red and pink flowers in my few records: Asclepias syriaca pink and pollinia on leg; Hedysarum boreale? abundant on red legumes; Lathyrus eucosmus red-purple pea; Symphoricarpos albus pink many; Rubus idaeus melanolasius fed on green raspberry (old flower-young berry). To confirm this color preference I added flowers recorded by Allen (1997), Gochnfeld and Burger (1997), Iftner et al. (1992), Marrone (2002), Nielsen (1999), Opler and Krizek (1984), Royer (2003), Tooker et al. (2002), and internet photos: Allium schoenoprasum lavender; Apocynum androsaemifolium whitish to pink; Apocynum whitish to pink; Arabis? lavender; Asclepias including A. syriaca pink; Asclepias purpurascens purple; Asclepias pink; Aster lavender/yellow disc; Aster white with yellow disc; Centaurea ~montana blue; Chrysanthemum leucanthemum white; Chrysanthemum Xsuperbum white; Echium vulgare pink or sometimes white; Fragaria virginiana pink; Geranium maculatum rosypurple (some white); Glechoma hederacea purplush-blue; Hesperis matronalis pink 2x; Hieracium aurantiacum orange-red; Iris versicolor blue-violet (some white); Lamium amplexicaule pink; Ledum groenlandicum white; Ligustrum white; Lonicera yellow? (some white, red, or purple); ?Lythrum salicaria purplush; Nepeta Xfaassenii violet; Phlox pilosa roseate to pink or violet; Rubus white (rarely reddish); Rubus blackberry white (rarely reddish) common; Sonchus oleraceus yellow; Syringa vulgaris lilac-purple; Taraxacum officinale yellow; Tradescantia virginica purple; Trifolium pratense pink; Verbena pinkish; Vicia ~cracca lavender; mud; bird dung frequently. So Poanes hobomok sometimes visits all colors, often white and blue/purple, but may prefer red and pink; at least it seems to visit red flowers more than most butterflies.

Poanes viator (W. Edwards): Asclepias incarnata pink 51x; Asclepias syriaca pink/incarnata pink and pollinia on leg; Asclepias syriaca pink and 1 pollinia on leg.

Poanes melane (W. Edwards): Aesculus californica whitish 2x; Cirsiun canescens whitish.

Stenga morrisoni (W. Edwards) probably visits all colors of flowers, except perhaps pure red, and often visits mud: Arctostaphylos uva-ursi whitish; Astragalus miser var. oblongifolius pale-violet; Erysimum ~capitatum yellow; Lesquerella montana yellow 2x; Opuntia polyacantha yellow 3x; Oxytropis lambertii reddish-purple 14x; Penstemon secundiflorus purple 11x; Senecio canus yellow; Senecio fendleri yellow; Senecio integerrimus yellow; Taraxacum officinale yellow; mud 14x.

Ochloides agricola (Boisduval): Aesculus californica whitish 6x; Brodiaea bluish; Eriodictyon californicium white to lavender; Lamiaeae.

Ochloides sylvanoides (Boisduval) visits all colors of flowers except pure red. Most flowers are Asteraceae because of the late-summer flight period. Achillea millefolium “lanulosa” white 2x; Arctium minus rose-purple 23x; Asclepias speciosa pink; Aster ascendens blue 4x; Aster blue; Aster ericoides white 2x; Aster foliaceus purple 15x; Aster glaucodes white to violet; Aster laevis var. geyeri blue 68x incl. Janet Chu; Aster lanceolatus hesperius bluish-white 53x; Aster novae-angliae purple 9x; Aster porteri white 64x; Asteraceae shrub yellow 4x; Astragalus laxmannii “adsurgens” whitish; Berteroa incana white 3x; Carduus nutans rose-purple 70x; Centaurea ?bluish; Centaurea diffusa (lavender 7x, white 19x);
Centaurea maculosa; Centaurea repens blue; Cerastium strictum “arvense”? Stellaria media white; Chrysanthemum leucanthemum white 2x; Chrysanthemum Xsuperbum white; Chrysanthemum nauseosus yellow 36x; Cichorium intybus blue; Cirsi um prob. rose-purple; Cirsi um arvense purple 21x + var. incanum 18x; Cirsi um centaurea yellowish-white 2x; Cirsi um vulgare rose-purple 6x; Dipsacus fullonum var. sylvestris violet-pink 8x incl. Anne U. White; Epilobium (Chamerion) danielisi=angustifolium red-purple 3x; Erigeron speciosus blue 13x; Eriogonum flavum yellow; Eriogonum latifolium 2x; Geranium caespitosum pink 8x; Grindelia squarrosa yellow 29x; Helianthus pumilus yellow; Heterotheca villosa yellow 54x; Liatris punc tata purplish 22x; Linaria genistifolia dalmatica yellow but red at apex probed several times but did not succeed and flew; Lythrum salicaria purple 8x; Machaeranthera canescens deep blue/purple; Machaeranthera pat tersoni purple/violet 12x (+2x for “M. pat tersoni/canescens”); Medicago sativa purple 89x; Mentha arvensis pink; Monarda fistulosa rose-purple 6x [this flower blooms mostly earlier]; Nepeta cataria white; Polygonum pensylvanicum pink several; Rudbeckia laciniata ampla yellow 5x; Solidago ~altissima “~canadensis” yellow 20x; Solidago missouriensis yellow; Sonchus uliginosus yellow; sunflower yellow; Tagetes patula orange-yellow; Trifolium pratense red-purple 7x; Verbena hastata purplish-blue 7x; Viguiera (Heliomeris) multiflora yellow 20x; Solidago missouriensis yellow; Sonchus uliginosus pink 3x; Solidago yellow.

Ochlodes yuma yuma (W. Edwards) visits all colors except perhaps pure red: Arctium minus rose-purple; Asclepias sp. purple; Aster ?chilensis bluish several; blue asters; Chrysanthemum nauseosus yellow 5x; Cirsi um sp. purple; Grindelia yellow; Helianthus yellow; Lamiaceae blue (all Scott, Shields, and Ellis 1976); Asclepias subverticillata cream; Cir si um arvense purple; Cirsi um vulgare rose-purple; Eriogonum latifolium 2x; Melilotus officinalis yellow; Polygonum pensylvanicum pink 3x; Solidago yellow.

Ochlodes yuma anasazi S. Cary and Stanford: Cirsi um vulgare rose-purple 54x; Pericome caudata yellow 12x.

Paratrytone snowi (W. Edwards) visits all colors of flowers, more often purplish ones (this species was studied by Scott 1973a): Achillea millefolium “lanulosa” white; Allium geyeri pink 1x; Apocynum androsaemifolium pinkish-white; Artemisia frigida pale greenish 4x; Astragalus hallii purple 60x; Astragalus miser? white; Astragalus purpureus; Astragalus red-purple 2x; Cirsi um canescens whitish 2x; Cirsi um ochrocentrum rose-purple violet 2x; Cirsi um undulatum rose-purple lavender 3x; Cryptantha jame sii white 1x; Eriogonum jamesii cream 4x; Geranium caespitosum pink 4x; Hymenoxys richardsonii [not Hymenopappus filfolius] yellow 4x; Ipomopsis aggregata collina [not Gilia texana] red 1x; Linum lewisi blue 2x; Lupinus argentius blue 8x; Monarda fistulosa rose-purple 40x; Lamiaceae ?Monarda ~rose-purple; Oenothera hookeri yellow 2x; Oxytropis deflexa var. sericea white; Oxytropis lambertii purple 82x; Penstemon blue; Penstemon caespitosus blue 2x; Penstemon griffini blue 7x; Penstemon large purple 2x; Penstemon virgatus asagraysi [not secundiflorus] lavender-purple 96x; Phacelia heterophylla ~pinkish; Potentilla yellow 1x; Pol ygonum pratense red-purple; Urtica dioica gracilis gray-green 1x; mud 3x. Ipomopsis sancti-spiritus is claimed to be pollinated by this in New Mex. (Cary et al. 2011).

Anatrytone logan (W. Edwards) prefers purple flowers, sometimes yellow etc. A. logan logan: Asclepias syriaca pink 2 pollinia on legs of 2 adults; Cirsi um undulatum rose-purple 3x; Echinacea angustifolia purple; Medicago sativa violet; Verbena stricta purplish-blue; Vicia cracca bluish-purple. A. logan lagus: Carduus nutans rose-purple 3x; Cirsi um arvense purple 2x; Cirsi um ochrocentrum rose-purple; Cirsi um vulgare rose-purple; Heterotheca villosa yellow; Medicago sativa violet; Monarda fistulosa rose-purple 23x; sunflower yellow (rattling=perching?); mud 4x.

Eu phyes conspicua (W. Edwards) often visits Asclepias: Asclepias incarnata pink 3x; Eupatoria perfoliata white 2x.

Eu phyes dion (W. Edwards) also often visits Asclepias: Asclepias incarnata pink 6x; Asclepias syriaca pink 4x; Sonchus arvensis [oleraceus?] yellow.

Eu phyes bimacula (Grote and Robinson) often visits Asclepias: Asclepias incarnata pink; Asclepias speciosa pink 13x (3 had pollinia on leg); Asclepias syriaca pink 9x (one had pollinia on leg); Cirsi um arvense purple 3x; Melilotus officinalis yellow.
Euphyes vestris (Boisduval) visits all colors of flowers even reddish, especially Monarda, often visits mud, and recycles dung: Agastache urticifolia pinkish; Anemone canadensis white; Apocynum androsaemifolium pinkish-white 30x; Asclepias incarnata pink; Asclepias speciosa pink 10x; Asclepias syriaca pink 13x; Astragalus drummondii white; Astragalus flexuosus purple 2x; Astragalus laxmannii “adsurgens” cream; Calylophus serrulata (Onagraceae) yellow bush 20 cm tall ~10 flowers; Carduus nutans rose-purple 8x; Ceanothus fendleri white 9x; Cirsium arvense purple 4x; white bird droppings 3x (2 of them observed sucking it on leaf after diluting it with drop from abdomen) 3x; Erigeron divergens rose-purple to white; Erigeron speciosus blue; Eriogonum umbellatum yellow 2x; Euphorbia esula yellow-green; Galium ~triflorum whithish; Gaura reddish; Geranium caespitosum pink 15x; Grindelia squarrossa yellow; Hedysarum boreale? red legumes; Heterotheca villosa yellow 8x; Jannesia americana white; Lathyrus ~polymorphus incanus blue/purple; Lathyrus eucosmus red-purple pea; Lupinus argenteus white (unpopular flower, probing flower ½ sec. then left); Marrubium vulgare cream; Medicago sativa violet 11x; Melilotus albus white; Monarda fistulosula rose-purple 106x incl. Anne U. White; Penstemon viens blue; Phacelia heterophylla 3x (usually purplish but one white); Rudbeckia laciniata ampla yellow; Solidago altissima “canadensis” yellow 4x; Symphoricarpus albus pink; Symphoricarpus occidentalis pink; Trifolium pratense red-purple 2x; Verbena stricta purplish-blue 13x; Veronica ~catenata pale-blue or white; mud 8x.

Notamblyscirtes simius (W. Edwards) visits flowers of all colors (Scott 1973d studied this species): Astragalus ?bisulcatus white 5x; Astragalus miser var. oblongifolius pale-orange [not A. bisulcatus] 7x; Astragalus missouriensis blue; Cirsium arvense purple 1x; Cirsium ?purple probably; Cryptantha jamesii white 15x; Erigeron pumilus white 13x; Erysimum asperum yellow 1x; Hymenopappus filifolius yellow 1x; Lygodesmia juncea pink 1x; Machea ranthera pinnatifida=Haplopappus spinulosus yellow; Opuntia macrohiza yellow ~26x; Opuntia polyantha yellow (adults crawl into and almost disappear among the stamens) 77x (Opuntia polyantha purple had no visits); Oxytropis deflexa var. sericea white; Oxytropis lambertii red-blue 3x; Penstemon secundiflorus purple 95x; Taraxacum officinale yellow 1x. Atrytonopsis hianna hianna (Scudder) evidently visits flowers of all colors: Allium textile white to light-rose 4x; Erysimum asperum yellow 7x; Penstemon blue; Penstemon secundiflorus purple; Rubus delicous white; Scutellaria brtonii deep-violet-blue; Thermopsis divaricarpa yellow; mud 2x. Atrytonopsis hianna deva (W. Edwards): Cirsium ~arizonica big reddish; Cirsium ?purple 3x. Atrytonopsis vierecki (Skinner): asters white; Cirsium ~undulatum blue several; Cirsium ?purple 2x; Verbena bluish.


PAPILIONIDAE, PARNASSIINAE

Parnassius clodus Ménétriés visits white and yellow flowers at least: Achillea millefolium “lanulosa” white; Calytridium umbellatum white 12x; clover; Lamiaceae 3x; Senecio yellow. Parnassius phoebe smintheus E. Doubleday prefers yellow and white flowers, sometimes orange, and seldom visits blue-purple ones. It sometimes visits mud (Scott 1973c studied this species). It evidently pollinates some yellow Asteraceae such as Senecio. Achillea millefolium “lanulosa” white 1x; Agoseris aurantiaca orange; Agoseris glauca yellow 3x (one male caught by foreleg in slit of flower the petal or stamen wound around his leg); Antennaria parvifolia whitish; Apocynum androsaemifolium pinkish-white; Arenaria (Eremogone) fendleri white 2x; Arnica mollis yellow 5x; Astereaceae yellow; Astragalus laxmannii “adsurgens” usually whitish 2x; Ceanothus fendleri white; Cynocephalum nauseosum yellow.
1x; Cirsium canescens whitish 2x; Erigeron ~simplex blue 2x; Erigeron pumilus bluish-white 24x; Erigeron sp. white 7x; Erigeron ?ursinus blue; Eriogonum flavum yellow-cream; Eriogonum subalpinum cream; Eriogonum umbellatum yellow 4x; Erysimum capitatum orangish-yellow 3x; Gaillardia aristata yellow with red-purple base 4x; Geum (Acomastylis) rossii turbinatum yellow; Gutierrezia sarothrae yellow (not Chrysothamnus viscidiflorus); Harbouria trachypleura yellow 11x; Helianthus? yellow sunflower; Heterotheca villosa yellow 4x; Hymenoxys grandiflora yellow 2x; Jamesia americana white; Lesquerella montana yellow 2x; Monarda fistulosa rose-purple; Physocarpus monogynus white; Polygonum bistortoides (photo Dodson and Dunnire 2007); Potentilla ?hippiana? yellow 1x; Potentilla fissa yellow; Potentilla gracilis yellow 2x; Rudbeckia laciniata ampla yellow; Scutellaria brittonii deep-violet-blue; Sedum lanceolatum yellow 117x; Senecio canus yellow 30x; Senecio fendleri yellow 43x (a male has much pollen from it, a female covered with its pollen, so they must pollinate it); Senecio sp. yellow [most probably S. fendleri or S. canus] 97x (one pollinating it covered with yellow pollen); Senecio fremontii var. blitoides yellow; Senecio integerrimus yellow; Senecio werneriaceolius yellow 2x spatulate leaf; Taraxacum officinale yellow 7x; Haplopappus (Tonestus) pygmaeus yellow; Tragopogon dubius major yellow-lemur; sap of Salix amygdaloides visited by females; mud 5x.

**PAPILIONIDAE, PAPILIONINAE, TROIDINI**

Battus philenor hirsuta (Skinner); Aesculus californica whitish; Brodiaea pulchella bluish 2x.

Battus philenor philenor (Linnaeus); Baccharis whitish; Cleome lutea yellow 2x; Liatris punctata purplish 4x; ~Lobelia siphilitica “blue flowers like Penstemon”; Oxytropis lambertii reddish-purple; Zinnia ~elegans ~pink several.

**PAPILIONIDAE, PAPILIONINAE, PAPILIONINI**

*Papilio machaon* ssp. bairdii W. Edwards and ssp. brucei W. Edwards (brucei is also a form within ssp. bairdii) visits most colors of flowers (esp. purplish), and often visits mud: Asclepias speciosa pink (f. bairdii 25x, f. brucei 4x); Carduus nutans rose-purple (f. bairdii and f. brucei) 2x+; Castilleja integra crimson [briefly?] Cirsium ?purple 2x; Cirsium arvense purple; Cirsium vulgare rose-purple (f. bairdii 21x, f. brucei 20x); (ssp. brucei) Cirsium ~centaurea whiteyish-white small head; (ssp. brucei) Cirsium vulgare rose-purple 4x; Cleome (Peritoma) serrulata 4x (+ pinkish 4x [incl. for form hollandi and f. brucei], whitish 1x); (ssp. brucei) Liatris punctata purplish; Medicago sativa violet 90x; (ssp. brucei) Verbena stricta purplish-blue; mud ~3x and (ssp. brucei) ~2x.

*Papilio zelicaon* Lucas (and its black form nitra) visits all colors of flowers, even red: Apocynum androsaemifolium pinkish-white 2x + 1x for form nitra; Astragalus laxmannii “adsurgens” white; Brassica nigra yellow 2x; Brassicaeae yellow; ?Brodiaea blue; Centranthus ruber red-blue 2x; Cirsium canescens whitish; Cirsium ochrocentrum rose-purple; Cirsium arvense blue; Cleome (Peritoma) serrulata pinkish (Scott and Scott 1978); f. nitra Coryphantha vivipara purple-pink; Cryptantha white small; Delphinium geyeri whitish; Eriogonum latifolium whitish; Eriogonum umbellatum yellow; Erodium ~vicutarium yellow; Erysimum asperum yellow; Erysimum capitatum orange 7x + 2x f. nitra; Erysimum ~capitatum yellow 4x + 8x f. nitra; Harbouria trachypleura yellow 1x + 1x f. nitra; Helianthus pumilus yellow; Heterotheca villosa yellow; Iris germanica blue; Jamesia americana white 4x; Medicago sativa violet; Monarda rose-purple (Scott and Scott 1978); Oxytropis lambertii purplish 4x (+ pinkish 1x f. nitra); Penstemon angustifolius blue; Penstemon secundiflorus purple 3x; Penstemon virens blue 25x; Plantago lanceolata white; Potentilla fissa yellow; Prunus americana white; Ribes cereum pinkish-white 8x + 1x f. nitra; Raphanus sativus bluish-white; Rudbeckia hirta yellow; Senecio canus yellow 7x; Senecio fendleri yellow; Senecio integerrimus yellow; Senecio yellow; Syringa vulgaris pink-purple; Hymenoxys (Tetraneuris) brevifolia yellow; Thermopsis divaricarpa yellow 3x; Townsendia grandiflora
Momus parasitizes a variety of wildflowers, including those of the Acanthaceae family. Euphorbia, Eryngium, and Eriogonum. P. eurymedon is found on white, yellow, and purple flowers.
Erysimum capitatum 4x (2 orange, 1 yellow); Hesperis matronalis pink; Jamesia americana white 8x; Lilium philadelphicum orange; Lupinus violet; Oxytropis lambertii reddish-purple 3x; Penstemon secundiflorus purple 4x; Penstemon virens blue 6x; Physocarpus monogynus white; Prunus virginiana white; Rubus delicious white; Solidago ~alissima “~canadensis” yellow; mud 12x.

Papilio multicaudata W. Kirby visits all colors of flowers (from purple or bluish to pinkish and red and white), except it seldom visits yellow ones. It definitely pollinates the lily Hemerocallis ~fulva. Because of its apparent ability to pollinate, I researched the literature (Shapiro 2007, Emmel and Emmel 1973, and mostly from numerous photos on the internet) and added those records with asterisk*. Aesculus californicus* white; Agastache rupestris* red 2x; Alcea rosea* white; Allium schoenoprasum* lavender 2x; Antirrhinum majus yellow 1 sec.; Asclepias fascicularis* white; Asclepias incarnata pink (3x, 1x*); Asclepias speciosa pink (6x, 4x*); Astilbe “Venus” pink 2x; Bouvardia glaberrima (Rubiaceae) long red tubular flower bush (all over S Ariz.); Buddleja davidii (violet 2x, also* blue 1x, pink 1x, purple 2x; purple with yellowish center 1x); Campanula persicifolia* pale-blue; Campanula rotundifolia blue 2 sec.; Carduus nutans rose-purple (25x, 1x*); Centaurea dealbata Bluet pinkish 5 sec.; Centaurea near ruthenica white 3x (one only 3 sec.); Centranthus ruber red 2x; Cirsium arizonicum* red 2x; Cirsium arvense purple; Cirsium canescens whitish; Cirsium neomexicanum ~pink; Cirsium ochrocentrum rose-purple; Cirsium undulatum rose-purple 2x; Cirsium ~undulatum* rose-purple 5x; Cirsium vulgare rose-purple 4x; Cirsium spp.* ~purple; Clematis ~jacksoni blue 2x (but both only 2 sec.); Crocosmia Xrocosmiiflora red (photo), Delosperma ~cooperti yellow; Delphinium ajacis violet 85x (male lands on lower flowers of inflorescence then helicopters up to the other ~4-5 flowers one by one by aiming body vertical and using fw to rise up), 1x*; Dianthus barbatus (orange 1x, plus* red 1x and violet-red 1x); Echinacea purpurea purple 31x (but three were 1-2 sec./brief), 2x*; Erysimum capitatum orange 4x; Eupatorium ~urticifolium* white; Euphorbia esula yellow-green; Geranium ~sanguineum red (1x, + only 2, 2, 3 sec.); Helianthus annuus yellow briefly; Hemerocallis ~fulva orange (with some red) 7x (~once only 3 sec.) (a very popular flower they seem to pollinate, as 1st male had orange-yellow pollen behind ventral forewing costa ~2 cm from middle of body, that looks like Hemerocallis pollen; 2nd had orange pollen on ventral forewing yellow area just behind costa 1.5 cm from body; 3rd had pollen on ventral forewing just behind costa 1.5 cm from body; 4th male on var. “Magnificence” was deep into flower [half visible]); Heracleum sphondylium montanum=lanatum white ¼ sec; Hesperis matronalis pink 21x (but 4 were only 1 sec. and two were 2 sec.); Ipomoea ~purpurea* violet with blue tube; Ipomopsis rubra “Fuchsia Gilia” red (photo Jean Morgan in Denver Post); Iris germanica blue 1x (another 1 sec.); Iris missouriensis pale-blue (SD Gary Marrone); Jamesia americana white; Liatris pectuncata purplish very briefly; Lobelia erinus “Blue Cascade”* blue; Lychnis chalconatica* (orange-red 1x, red 1x); Lychnis coronaria red 3x all 1 sec. (not very attractive in scent or nectar evidently); Lythrum salicaria purple; Medicago sativa violet; Monarda fistulosa rose-purple; Penstemon secundiflorus purple 5x; Penstemon virgatus asagrayi lavender-purple; Petunia hybrida ~pink 10 sec+ in area with few flowers (did not land on another), Petunia* (dark-red 1x, red 1x); Philadelphus lemoinei white; Phlox ~paniculata “peppermint twist”* pink with white stripes; Phlox divaricata* blue 2x; Phlox paniculata pink 2x incl. var. Brigadier 5 min. (even stopping wings from fluttering), purple* 1x; Platyodon grandiflorus* violet; Prunus cerasus* (cherry) white; Ribes cereum pinkish-white; Rosa cultivated red 6x (one bushy, one had single petals) (two only 2 sec.); Salvia sclarea pink 3x (but two only 1 sec. and several sec.); Saponaria officinalis pinkish 4x (one var. caucascica); Scabiosa caucascica whitish; Scabiosa columbaria blue; Scrophularia macrantha red; Sillyum marianum* pink-purple; Syringa vulgaris pink-purple (3x, 1x*); Tilia americana yellowish-cream 2x; Tilia ~europeae ochre 4x (two briefly when flowers old); Verbena ~wrightii* pink; Viola tricolor var. hortensis* [puple] [yellow around black center] 1x, violet-red outside around yellow and black center 1x); Zinnia elegans (crimson 1x, orange and red 4x, orange 2x); mud (7x, 14x*).

Papilio pilumnus Boisduval: mud.

PIERIDAE, DISMORPHIIINAE

Leptidea sinapis Linnaeus (Europe): Lamiaceae blue.
PIERIDAE, COLIADINAE

Kricogonia lyside (Godart): mud.

Nathalis iole Boisduval prefers yellow flowers, often whitish, sometimes purple/violet/blue: Achillea millefolium “lanulosa” white; Asteraceae yellow; Bidens frondosa yellowish 11x; Cerastium strictum “arvensis” white; Chrysanthemum Xsuperbum white; Chrysothamnus nauseosus yellow several; Coreopsis verticillata var. “Moonbeam” yellow 10x; Erigeron speciosus blue; Euphorbia “Agaloma” marginata green and white 2x; Geranium richardsonii whistish; Gutierrezia sarothrae yellow?; Heterotheca canescens yellow 2x; ?Heliopsis helianthoides big yellow sunflower 15 cm tall with serrate leaves; ?Heliopsis helianthoides yellow 2/3-m “sunflower” with yellow center and serrate oval leaves; Heterotheca canescens yellow ~20x; yellow-flowered low bush; Machaeranthera pattersoni purple/violet; Medicago sativa violet 4x; Oxalis ~stricta yellow; ?Pectis angustifolia (doubtfully Dyssodia papposa which has dissected leaves) yellow tiny Asteraceae 10 cm tall with filamentous leaves 2x; Phyla=Lippia papposa yellowish-white-blue; Sedum lanceolatum yellow; Solidago yellow many; Solidago missouriensis yellow: Taraxacum officinale yellow; Tribulus terrestris yellow; Trifolium repens whitish; Verbena hastata purple; Viola tricolor var. hortensis ?white to purple; white pea.

Eurema mexicana (Boisduval): Geranium caespitosum pink ½ sec; Oxytropis lambertii reddish-purple; Penstemon secundiflorus purple.

Eurema proterpia (Fabricius): Acacia angustissima spineless white-flowered; Cnidoscolus angustidens white; ~Lathyrus eucosmus pink pea; Senecio yellow; Solanum yellow; mud.

Eurema lisa (Boisduval and LeConte): Medicago sativa violet.

Eurema nise (Cramer): Hymenopappus filifolius yellow; Pinguincra tree.

Eurema nicippe (Cramer): Oxalis ~stricta yellow 2x; Psilostrophe sparsiflora yellow-flower shrub 30 cm tall with gray-green leaves and 3 rectangular petals with ~3 lobes at end; Raphanus sativus bluish-white; Sedum lanceolatum yellow; tiny white flower; Verbena purplish-blue; Viola tricolor var. tricolor purple 3 sec.; mud.

Colias meadii W. Edwards visits yellow flowers, sometimes blue/purple: Achillea millefolium “lanulosa” white; Agoseris glauca yellow; Arnica cordifolia yellow 2x; Arnica mollis yellow 6x; Arnica rydbergii yellow 17x; Aster foliaceus var. apricus blue-violet sometimes purple 4x; Erigeron elatior pink-purple; Erigeron pinnatisectus blue/purple 11x; Erigeron simplex usually blue 2x; Erigeron ursinus blue 21x; Haplopappus (Toneustus) pygmaeus yellow 3x; Heterotheca pumila yellow 5x; Heterotheca villosa yellow 2x; Hymenoxys grandiflora yellow 2x; Sedum lanceolatum yellow; Senecio atratus yellow; Senecio crassulus yellow 21x; Senecio dimorphophyllus yellow 3x; Senecio yellow; Solidago multiadiata yellow; Solidago simplex var. nana=decumbens yellow 7x; sunflower yellow.

Colias occidentalis chrysomelas H. Edwards: Brodiaea pulchella blue; Calochortus ?yellow-orange.

Colias occidentalis sacajawea Kohler: Taraxacum officinale yellow.

Colias occidentalis christina W. Edwards: mud.

Colias edwardsii edwardsii W. Edwards and Scott visits yellow, sometimes white or blue/purple flowers: Amsragus spatulatus 20 cm blue; Chrysanthemum vispodiflorus yellow; Erigeron pumilus white; Erysimum asperum yellow 4x; Gaillardia aristata yellow with red-purple base; Helianthus annuus yellow 2x; Heterotheca villosa yellow; Liatris punctata purplish 8x; Lobelia siphilitica violet-blue; Melilotus officinalis yellow; Senecio ~integerrimus yellow; Townsendia exscapa white.

Colias alexandra W. Edwards visits yellow, blue/purple, sometimes white or reddish flowers, and mud: Apocynum androsaemifolium pinkish-white 4x; Astragalus laxmanii “adsurgens” usually whitish 8x; “Cirsium vulgare” probably Carduus nutans rose-purple; Ceanothus fendleri white; Cirsium centaurae yellowish-white; Delphinium ?ramosum blue; Erigeron speciosus blue 1x; Eriogonum lobbii var. robustius cream; Erysimum asperum yellow; Erysimum capitatum orange 2x; Gaillardia aristata yellow with red-purple base 7x; Geranium caespitosum pink; Heterotheca villosa yellow 3x; Lupinus argenteus blue; Medicago sativa violet 2x; Oxytropis lambertii reddish-purple 2x; Rudbeckia hirta yellow 3x; Rudbeckia laciniata ampla yellow; Sedum lanceolatum yellow; Sisymbrium altissimum yellow; Solidago simplex var. nana=decumbens yellow; Trifolium pratense red-purple 8x; mud 4x.
Colias eurytheme Boisduval visits yellow or bluish-purplish, sometimes reddish or white flowers: *Achillea millefolium* cultivated variety rosy to white 1 sec.; *Apocynum androsaemifolium* pinkish-white; *Apocynum cannabinum* whitish 2x; *Aguilegia coerulea* blue; *Arnica mollis* yellow; *Asclepias incarnata* pink 3x; *Asclepias syriaca* pink 2x; *Asclepias tuberosa* orange; *Aster ascen dens* usually bluish; *Aster ericoides* white 27x + var. *falcatus* 2x; *Aster pauciflorus* blue-violet 3x; *Aster laevis* var. *geyeri* blue 3x; *Aster lanceolatus hesperius* bluish-white 67x (they prefer *A. hesperius* to *A. ericoides*); *Aster novae-angliae* purple 7x; *Aster porteri* white 7x; *Aster simplex* whitish 4x; *Astragalus agrestis* purple 2x; *Astragalus flexuosus* purple; *Astragalus laxmannii* “adsurgens” usually whitish 5x; *Berteroa incana* white; *Bidens cernua* yellowish; *Bidens frondosa* yellowish 5x; *Buddleja davidii* purple; *Carduus nutans* rose-purple 32x; *Centaura diffusa* (lavender 7x, white 17x); *Centaura maculosa* lavender 2x; *Chrysanthemum Xsuperbum* white 2x (once 4 sec.); *Chrysothamnus nauseosus* yellow 324x; *Cirsium arvense* purple 15x + var. *incanum* 23x; *Cirsium discolor* pinkish-violet 3x; *Cirsium ochrocentrum*; *Cirsium vulgar* rose-purple; *Cleome (Peritoma) serrulata* pinkish; *Convolvulus arvensis* whitish 8x (plus 1 sec. for another and <1 sec. for 2x) is not very popular; *Coronilla varia* pink 15x; *Coreopsis grandiflora* yellow; *Echinacea purpurea* (purple 5x, pink 1x) for albino (This Old House TV show); *Erigeron elati or pink-purple*; *Erigeron speciosus* blue 3x; *Erigeron ~blue; *Eriogonum effusum* white; *Eriogonum umbellatum* yellow 2x; *Erysimum capitatum* (1 yellow, 2 orange); *Gaillardia aristata* yellow with red-purple base 10x; *Gaillardia aristata Xgrandiflora* petals red with yellow tips; *Gaillardia pulchella* reddish with yellow apex 2x; *Gernanium caespitosum* pink 2x; *Grindelia squarrosa* yellow 3x; *Gutierrezia sarothrae* yellow 4x; *Helianthus divaricatus* yellow; *Helianthus petiolaris* yellow 6x; *Helianthus pumilus* yellow; *Helianthus tuberosus* yellow 23x; *Helianthus sp.* yellow; *?Heliopsis helianthoides* yellow 2 3-m “sunflower” with yellow center and serrat ed oval leaves; *Heterotheca canescens* yellow 4x; *Heterotheca villosa* yellow 36x; *Lathyrus polymorphus* incanus purple and pink; *Liatris punctata* purplish 28x; *Linaria vulgaris* yellow with orange palate; *Lobelia ~siphilitica* violet-blue; *Lotus corniculatus* yellow; *Machaeranthera canescens* deep-blue-purple 32x; *Machaeranthera pattersoni* purple/violet blue 19x; *Machaeranthera annua=phyllocephala* yellow; *Machaeranthera tanacetifolia* blue-purple; *Medicago sativa* violet 215x; *Melilotus alba* white 3x; *Melilotus officinalis* yellow 2x; *Mentha spicata* pink-white; *Musineon divaricatum* yellow; *Oxypolis lambertii* reddish-purple 3x; *Penstemon virens* blue 2x; *Phlox pilosa ~pinkish; *Ratibida columnifera* yellow 2x; *Rudbeckia hirta* yellow 6x; *Salvia farinacea* violet; *Scabiosa columbaria* blue; *Sedum lanceolatum* yellow 3x; *Senecio canus* yellow 2x; *Senecio crassuloides* yellow; *Senecio fendleri* yellow 4x; *Senecio sparrtioides* yellow 8x; *Solidago ~missouriensis* yellow 3x; *Solidago ~altissima ~canadensis* 3x; *Solidago (Euthamia) occidentalis* yellow 2x; *Solidago rigid* yellow; *Solidago yellow; sunflower big yellow; *Syringa vulgaris* lilac; *Tagetes patula* orange-yellow 2x; *Taraxacum officinale* yellow 17x; *Trifolium hybridum* pinkish-white; *Trifolium pratense* red-purple 58x; *Trifolium repens* whitish 7x; *Verbena hastata* purplish-blue 13x; *Verbena~encelioides* golden-orange 2x; *Viola canadensis scopulorum* violet to white 4x; white flowering plant; *Zinnia elegans* (1x, pink 1x, red "Thunbelina Series" 1x); mud 69x.

*Colias philodice* Godart visits blue/purple and yellow flowers, often whitish, sometimes pinkish/reddish etc. ones, and mud: *Allium textile* white to light-rose; *Arctium minus* rose-purple; *Asclepias incarnata* pink 2x; *Asclepias speciosa* pink; *Aster ascen dens* usually bluish 2x; *Aster ericoides* white 49x; *Aster pauciflorus* blue-violet; *Aster glaucoes* white to violet; *Aster laevis* var. *geyeri* blue 3x; *Aster lanceolatus hesperius* bluish-white 145x; *Aster novae-angliae* purple 4x; *Aster porteri* white; *Aster simplex* whitish; *Asteraceae* yellow abundant; *Astragalus flexuosus* purple; *Astragalus missouriensis* rose-purple; *Berteroa incana* white; *Carduus nutans* rose-purple 5x; *Centaura maculosa* lavender 2x; *Centaura ~maculosa* (no involucre spines, involucre fringed and green only near midrib) pink; *Centaura diffusa* (lavender 2x, white 13x); *Chrysothamnus nauseosus* yellow 98x; *Cichorium intybus* blue; *Cirsium arvense* purple (3x + var. *incanum* 4x); *Cirsium discolor* pinkish-violet 4x; *Cirsium vulgar* rose-purple 2x; *Cleome (Peritoma) serrulata* pinkish 2x; *Convolvulus arvensis* whitish 4x plus briefly 3x so an unpopular flower; *Cosmos bipinnatus* white; *Delphinium ~geyeri* blue; *Dimorphotheca sinuata=aurantiaca* orange; ~Draba* yellow; *Erigeron pumilus* usually white; *Erigeron speciosus* blue; *Erigeron urinus* blue-purplish 2x; *Eriogonum effusum* white; *Erysimum asperum* yellow 2x; *Erysimum capitatum* (yellow 1x, orange ½ sec. 32
Colias behrii

Colias scudderii scudderii

Colias pelidne skinneri

produces plants 1993, Monroe 2001, Gochfeld

difference. Son this species 2011) and is so different from preferences shown by most Colorado butterflies, I researched the literature opinion of the flowers that butterflies visit (tubular red flowers Medicago sativa purple 2x; Taraxacum officinale yellow 5x; Machaeranthera tanacetifolia blue-purple; Malva neglecta whitish; Medicago sativa violet 18x; Melilotus alba white 6x; Melilotus officinalis yellow; Oenothera albicaulis white; Oxytropis lambertii purple; Phlox pilosa (for C. philodice) ~pinkish; Polygonum pensylvanicum pink; Ratibida pinnata yellow 2x; Rorippa sinuata yellow 2x; Sedum lanceolatum yellow 2x; Senecio canus yellow 2x; Senecio fendleri yellow; Senecio spartioides yellow 5x; Sisyrinchium montanum deep violet; Solidago ~alitissima ~canadensis” yellow 5x; Solidago (Euthamia) gymnospermoides yellow; Solidago missouriensis yellow 7x; Solidago (Euthamia) occidentalis yellow; Solidago rigidia yellow 13x; Solidago yellow; Tagetes patula orange-yellow; Taraxacum officinale yellow 16x; Townsendia excappa white; Trifolium pratense red-purple 35x; Trifolium repens whitish 4x; Verbena hastata purplish-blue 2x; Verbena stricta purplish-blue 7x; Verbesina encelioides golden-orange 4x; Vicia americana purple; Viguiera (Heliomeris) multiflora yellow; Viola nutallii yellow; white flowering plant; mud 23x; philodiceXeu rytheme Aster lanceolatus hesperius bluish-white; philodiceX eurytheme Helianthus divaricatus yellow.

Colias pelidne skinneri W. Barnes visits yellow flowers at least: Senecio triangularis yellow; Senecio yellow; Taraxacum officinale yellow.

Colias scudderii scudderii Reakirt visits mostly Asteraceae, mostly yellow, seldom white or pinkish or blue/purple: Achillea millefolium “lanulosa” white 2x; Agoseris glauca var. parviflora yellow; Arnica cordifolia yellow 2x; Arnica mollis yellow 6x; Arnica rydbergii yellow 4x; Aster foliaceus var. apricus purple 2x; Barbarea orthoceras yellow; Cirsium centaurae yellowish-white; Cirsium scariosum=coloradense cream; Erigeron ursinus blue 35x; Haplopappus (Pyrocoma) lanceolata yellow; Polygonum bitoiroides whitish; Sedum rhodanthum pink 2x; Senecio canus yellow 2x; Senecio crassulus yellow 24x; Senecio dimorphophyllus yellow 2x; Senecio fremontii var. bitoides yellow 4x; Senecio triangularis yellow 3x; Senecio werneriaefolius yellow; Solidago simplex var. nana=decumbens yellow 5x; Taraxacum officinale yellow. C. scudderii harroweri Klots: Sedum roseum integrifolium dark-rose-purple 2x; Senecio yellow 11x.

Colias behrii W. Edwards: yellow Asteraceae.

Zerene cesonia (Stoll) probably visits flowers of all colors, and mud: Aster laevis var. geyeri blue; Carduus nutans rose-purple 3x; Clematis white; Cnidoscolus angustidens white; Helianthus nattallii yellow; Medicago sativa violet 2x (including Michael S. Fisher record); Oxytropis lambertii reddish-purple; Verbena purplish-blue; white-flowering plant; Zinnia ~elegans ?pink; mud.

Phoebis sennae (Linnaeus) visits all colors, but clearly prefers red and orange flowers, often visits yellow ones, less often visits white and pink, and least often visits purple/blue/violet flowers. It often visits long tubular red flowers, which it can profit from because it (and other Phoebis) has a very long proboscis. It visits hummingbird flowers, plus many others. Because its flower preference seems to fit the popular opinion of the flowers that butterflies visit (frequent visits to red tubular flowers, Proctor 1996, Willmer 2011) and is so different from preferences shown by most Colorado butterflies, I researched the literature on this species (and other Phoebis spp., which have the same flower preferences) to fully understand this difference. So I added literature records (from Allen 1997, Allen et al. 2005, Bailowitz and Brock 1991, Barcant 1970, Bright and Ogard 2010, Clark 1932, DeVries 1987, Glassberg 1999, 2000, Glassberg et al. 2001, Gochfeld and Burger 1997, Heitzman and Heitzman 1987, Iftner et al. 1992, Minno and Emmel 1993, Monroe and Monroe 2004, Opler and Krizek 1984, Orsak 1977, Shapiro 1966, Smith et al. 1994, Tveten and Tveten 1996) and added several hundred photos of the butterfly feeding on flowers that I found on the internet (of course photos cannot be identified as well as actual plants because different plants sometimes have very similar flowers, but laborious comparison with identified flower photos produces useful results). My meager six records for Phoebis have an asterisk* below. Phoebis sennae
visited: Aloe arborescens orange; Alcea rosea white; Anisacanthus quadrifidus var. wrightii (orange 2x; orange-red 1x; red 1x); Antirrhinum majus red with white lobe; Aquilegia canadensis red and yellow; Aster ericoides white with yellow disc; Aureolaria virginica yellow; Berberis repens yellow vertical petals; Bidens alba white; Bidens laevis yellow; Bidens leucantha white with yellow disc; Bidens mitis yellow; Bougainvillea glabra (purple bracts 3x, small white flowers among many red bracts 1x); Browallia americana violet; Buddleja davidii white; Calystegia sepium white; Campsis radicans –orange 2x; Canna generalis “Koenigen Charlotte” red; Cassia hebecarpa yellow; Cassia (most likely fusciculata=chamaecrista) yellow 3x; Castilleja albobarbata red-brown; ~"Cercocarpus"* (tiny white-yellow-flowered tiny-leaf); Chamaelaucium uncinatum (pink form) pink-lavender; Chrysanthemum (multipetaled) yellow; Cirsium arizonica red 6x; Cirsium ~discolor (lavender 3x; purple 1x; rose-purple 1x); Cirsium vulgare rose-purple 3x; Cirsium sp. ~rose-purple 4x; Cistus? crispus? “silken pink?” (5 pink petals, 2 large sepal translucent with green midrib); Cistus? (petals white with yellow base and red line curving across each petal 70% from base, triple-divided stigma, 6 petals, 6 stamens); Clerodendron speciosissimum red (petal lobes mostly white but in giant cluster of red flower buds); Convolvulus (Calystegia) sepium angulata white; Cordia globosa? white; Cordia (probably sebestena orange) 2x; Corrus florida white; Crossandra undulifolia =infundibuliformis orange; Cuphea melvillea red basally yellow distally 2x; Delphinium ?grandiflorum blue; Dianthus barbatus pink 1x (+ red 2x); ~Digitalis purpurea lavender; Dolichandra cynanchoides lavender; Echinacea purpurea purple; Encelia farinosa yellow; Epilobium canum=Zauschneria californica red; Eupatorium (Conoclinum) coelestinum (lavender-white 3x, lavender-pink 2x; pink 2x); Euphorbia milii red; Ferocactus wislizenii red; Gaillardia aristata yellow (reddish tops of lateral disc flowers); Geranium red (a favorite); Hamelia patens (dull yellow with red stems 1x, red 2x); Helianthus annuus ~"Pristine Hybrid" yellow with large brown disc; ~Helianthus tomentosus yellow with yellow disc; Hibiscus ~moschutos white to red (prefers this); Hibiscus ~moschutos white 4x; Hibiscus rosa-sinensis red 5x; Hibiscus syriacus white with red center 3x; Impatiens capensis orange; Impatiens walleriana red 2x; Ipomoea alba (pink 1x, white 1x); Ipomoea coccinea red 4x; Ipomoea congesta violet; ~Ipomoea pes-caprae light-pink; Ipomoea purpurea yellow with whiter tunnel 2x; Ipomoea white or blue 3x; Ipomopsis aggregata red; Isora coccinea red 3x; Justicia (Beloperone) californica dull red; Lantana camara (orange 2x, orange and yellow 2x, orange [+red flowers] 2x, reddish, red-orange, yellow 3x, yellow and red 3x, yellow among orange and pink, white with yellow center, lilac and pale-yellow); Lantana involucrata white; Liatris punctata puplish 4x; Lobelia cardinalis red 7x; Lonicera caprifolium white; Lonicera flavia yellow; Lonicera sempervirens (orange 3x, red 1x); Lonicera probably sempervirens (orange 2x, reddish 1x); Lonicera Xtellmanniana orange; Magnolia acuminata yellowish-white raised petals; Malvaceae native white to blue; Malvaviscus arboreus red 7x; Malvaviscus arboreus var. drummondii red 5x; Merremia probably tuberosa yellow; Mimulus ringens lavender; Mirabilis ~jalapa crimson/white/yellow; Nemesia nesia (purple 1x, violet 1x); Nemesia strumosa red 2x; Opuntia ~echios yellow; Opuntia paraguayensis orange; Pelargonium near zonale (Zonal) pink; Pelargonium red/pink/purple; Penstemon barbatus* red; Penstemon eatonii red; Penstemon secundiflorus* purple; Pentas lanceolata (lavender 2x, purplish-pink 2x, red 16x [locally preferred]); Petunia hybrida (red 4x, red with white center 1x, red with black around tunnel 1x, pink 1x, purple 1x, violet 1x, unknown color 1x); Petunia integrifolia=violacea (blue 1x, red 1x); Phlox divaricata (blue-purple 2x, lavender-pink 1x, white 1x); Phlox ~drummondii ~"Neon Pink Star" white with purple 5-rayed star; Phloxpaniculata (pink 6x, red-pink 1x, red 2x); Plumbago auriculata=capensis (blue 2x, white 3x, ~light blue 1x, purple [whiter rim of petals] 1x); Poinciana pulcherrima red with petal tips and stigma yellow; Prunella vulgaris pale blue; unidentified red flowers; Rhaphiolepis umbellata (pinkish-white with red stamens 1x, white with red stamens 2x); Rhododendron (Azalea) ~"Exotic" red; Rhododendron (Azalea) (pinkish-white 1x, white 1x); Rosa sp. like woodsi (wild) red with white center and yellow stamens; Ruellia brittoniana violet; Salvia ~broussonetii white; Salvia coccinea red 5x; Salvia ~confertiflora dull-red; Salvia ~darcy red 2x; Salvia elegans red 2x; Salvia ~roemeriana red; Salvia splendens red 2x; Salvia sp. (red 1x, unknown color 1x); Salvia “Pineapple Sage ‘Golden Delicious’” (P. Allen Smith TV show Garden to Home); Saponaria officinalis (lavender 3x, pale-blue 4x, pink 1x, pinkish-white 1x, purplish-white 1x); Senecio ~glabella yellow; Senna roemeriana yellow; Solidago
yellow; Stachytarpheta jamaicensis blue or purple-blue 2x; sunflower* yellow; Tanacetum coccineum violet-red; Temnadenia violacea red with white star; ~Tithonia rotundifolia red-orange; ~Tithonia rotundifolia with wilted rays orangish-yellow; Tropaeolum majus orange; Valerianella radiata white; Verbena nervosa* purple 4x; Vernonia gigantea pinkish with lilac lateral florets; Viola tricolor var. hortensis (violet with yellow tube 1x, dark-violet 1x); ~Watsonia cocinea red-orange; Zinnia elegans 32x (light-orange [peach], orange 7x, orangish-yellow, X“cactus-flowered” yellow, yellow 2x, pale-yellow, pink 4x, pink with yellow disc 3x, pink with Thumbellina series yellow disc flowers around red disc, purplish-pink with yellow stamens, purplish-pink 3x, purple 2x, red 4x, red with yellow stamens, reddish-orange, red-orange); ~Zinnia elegans orange with ray petals wilted and orange disc; Zinnia haageana “Aztec Sunset” russet; wet sand/mud 49x; mud 1x*; garbage; carrion; dung.

Phoebis philea (Linnaeus) (all records of P. philea [and of P. argente, P. neocypis, and P. statira below] are from literature and internet photos cited under Phoebis sennae above): Bougainvillea glabra purple 2x; ~Browallia americana violet 2x; Crocosmia Xrurtonus “Lucifer” red; Hibiscus ~moscheutos white to red 2x; Impatiens walleriana orange; Jatropha ~integrerrima red with many yellow stamens 2x; Lantana camara orange (+red flowers); Liatris punctata purple 2x; Malvaviscus arboreus red 3x; Pentas lanceolata red; Rhododendron ~arboreum red; Stachytarpheta jamaicensis dark-purple.

Phoebis agarihe (Boisduval): Bauhinia; Bidens alba white; Borrichia frutescens yellow; Bougainvillea glabra purple; Bournieria ovata yellow; Catharanthus roseus red to white; Chamaelaucium uncinatum pink; Colocobola diversifolia whitish-green; Combretum rotundifolium red; Cordia sebestena orange; Cordia probably sebestena orange; ?Cordia globosa white; Dicliptera assurgens red; Eupatorium coelestium lavender 3x; Eupatorium odoratum lavender; Flaveria linearis yellow; Hibiscus ~syriacus white; Isora red; Lantana camara yellow; Lantana involucrata white; Liatris punctata purplish (my only record); Lobelia ~cardinalis red; Lythrum ~salicaria pink; Malvaviscus arboreus var. drummondii red; Metopium toxiferum white with yellow anthers; Morinda royoc white with yellow anthers; Pithecellobium keyense white 2x; Poinciana red and yellow; Salvia nemorosa “Mainacht” dark-violet; Scandix pectin-veneris white; Senecio mexicana yellow; Stachytarpheta jamaicensis blue-purple; Tournefortia white; mud 2x.

Phoebis argante (Fabricius): Poinciana pulcherrima pink and white.

Phoebis neocypis Hübner: Tillandsia ~aeranthos dark-blue flowers above red unopened flowers.

Phoebis statira (Cramer): Asteraceae several ~yellow spp.; Cordia probably sebestena orange; Hamelia patens red-orange.

PIERIDAE, PIERINAE, ANTHOCHARINI

Anthocharis sara coriandri Scott and M. Fisher: mud.

Euchloe ausonides ausonides (Lucas) most often visits yellow or white flowers, occasionally orange, but often visits purple-blue flowers as well (Scott 1975a studied this species in Calif.): Achillea millefolium “lanulosa” white 7x; Alcea=Althaea rosea whitish? 1x; Brassica nigra yellow 41x; Brodiaea pulchella blue 7x; Eschscholzia californica orange 1x; Erodium ~cicutarium violet 1x; Cirsium arvense purple 8x [does not visit Cirsium arvense in Colo.]; Plantago lanceolata white 15x; Ranunculus sp. yellow buttercup 1x; Raphanus sativus bluish-white 26x; Rubus sp. (blackberry) white 1x; Sisyrinchium bellum blue-violet 2x; Wyethia helenoides yellow 1x.

Euchloe ausonides coloradensis (H. Edwards) prefers yellow, often white, esp. Brassicaceae, but sometimes orange or purple or blue or red-purple flowers: Achillea millefolium “lanulosa” white; Arabis glabra (purple, some white) 5x; Arabis stricta white; Arnica cordifolia yellow 2x; Barbarea orthoceras yellow 8x; Berberis (Mahonia) repens yellow; Cardamine cordifolia white 2x; Cerastium strictum “arvense” white 9x +2 sec.; Draba stenoloba? yellow; Eryssimum ~capitatum 12x (orange except 1 yellow-orange and 1 yellow); Heterotheca villosa yellow; Lesquerella montana yellow; Mertensia lanceolata blue; Potentilla pulcherrima yellow; Prunus americana white; Senecio catans yellow 2x; Senecio crassulus yellow; Senecio fendleri yellow; Senecio integerrimus yellow; Taraxacum officinale yellow; Thlaspi arvense white; Townsendia hookeri white 2x; Trifolium pratense red-purple; orange flower; mud 2x.
Euchloe olympia (W. Edwards) prefers yellow and white flowers esp. Brassicaceae, but also visits blue, purple, pink, and orange: Allium textile white to light-rose 9x; Anaphalis margaritacea whitish; Barbarea orthoceras yellow; Cerastium strictum ~arvensis~ white 36x; Cerastium strictum ~arvensis~ white 2x; Chorispora tenella pink 4x and purple 1x; ~Draba~ yellow tiny; Erysimum asperum yellow 10x; Erysimum ~capitatum~ yellow 6x; Erysimum capitatum orange 3x; Lathyrus polymorphus incanus purple and pink; Lepidium campestre white; Lesquerella montana yellow 16x; Linum lewisii blue 4x; Mertensia lanceolata blue; Penstemon virens blue briefly; Physaria ~vitiulifera~ yellow; Sedum lanceolatum yellow; Thlaspi arvense white 6x; Viola nuttallii yellow 3x.

PIERIDAE, PIERINAE, PIERINI

Neophasia menapia (C. Felder and R. Felder) visits whitish, yellow, blue/purple/violet, and sometimes reddish flowers: Achillea millefolium "lamulosa" white 1x and another only ½ sec.; Aster laevis var. geyeri blue 9x; Aster porteri white 3x; Berteroa incana white; "Cirsium vulgare" probably Carduus nutans rose-purple; Centaurea diffusa white 7x; Cerastium arvense purple 7x; Cleome (Peritoma) serrulata pinkish 3x; Erigeron speciosus blue 5x; Grindelia squarrosa yellow 2x; Heterotheca villosa yellow 6x; Lepidium montanum white; Machaeranthera pattersoni purple/violet 3x; “Aster” prob. Machaeranthera bigelovii purple/violet; Raphanus sativus bluish-white; Rudbeckia hirta yellow; Rudbeckia lacinifolia ampla yellow 6x; Solidago missouriensis yellow 3x; Solidago yellow 2x; sunflower yellow 2x.

Pieris rapae (Linnaeus) visits all colors of flowers, more often on yellow and whitish than other colors, though not often on red; it often visits small Lamiaceae flowers (especially Nepeta), and as Opler and Krizek (1984) note, it seldom visits Asclepias and large-headed Asteraceae such as Cirsium, Carduus, and Gaillardia: Anchusa azurea blue; Apocynum androsaemifolium pinkish-white 3x; Apocynum cannabinum whitish 19x; Arctium minus red-violet 20x; Asclepias speciosa pink 2x (one had pollinia on leg and the other was dead caught by proboscis with 4 pollinia on legs); Asclepias syriaca pink (had pollinia on leg); Astr ericoides white (10x and var. falcatus 3x); Aster lanceolatus hesperius bluish-white 33x; Aster novae-angliae purple 6x; Aster porteri white 5x; Aster simplex whitish 5x; Barbarea orthoceras yellow 6x; Berteroa incana white 7x; Bidens cernua yellowish 3x; Bidens frondosa yellowish 2x; Brassica nigra yellow; Brickellia californica greenish-white; Buddleja davidii violet/purple 10x white 3x; Carduus nutans rose-purple 3x (another only hovered over); Carpyopterus clandonensis blue 3x; Centaurea diffusa white 14x; Centranthus ruber red 4x; Cerastium ~strictum?~ white did not land on; Chrysanthemum leucanthemum white; Chrysanthemum Xsuperbum white; Chrysanthemum nauseosus yellow 23x; Cirsium arvense purple 60x + var. incanus 10x; Cirsium vulgare rose-purple 2x; Cleome (Peritoma) serrulata pinkish; Convolvulus arvensis whitish 7x (+ 4 only 1 sec., one only 6 sec., one only 30 sec.); Conya canadensis whitish; Coronilla varia pink; Cryptantha virgata white 50 cm tall; Cucumis sativus yellow 5x (proboscis sucking) + one only 1 sec.; Cucurbita maxima yellow ½ sec; Cuphea rosea purple 10x; Delphinium ajacis (violet 2x [+ one 1 only 1 sec., 1x]) 1x; Dipsacus fullonum var. sylvestris white to lilac; Epilobium brachycarpum=paniculatum pink tiny flowers; Erigeron speciosus blue; Eriodictyon white to lavender; Eupatorium rugosum white; Gazania orange-yellow with uv middle landed on and flew (poor nectar); Geranium caespitosus pink 2x; Geranium hybridra orange 3x; Grindelia squarrosa yellow 11x; Hesperis matronalis pink 30x + several only 3 sec.; Heterotheca ~canescens~ yellow; Heterotheca pumila yellow; Heterotheca villosa yellow 3x; Lactuca serriola yellow 4x; Lavandula angustifolia light-purple 13x; Lepidium campestre white 4x; Lepidium montanum white; Lepidium ?ramosissimum white; Lepidium ?virginicum white; Lesquerella montana yellow; Liatris punctata purplish; Linaria genistifolia dalmatica yellow but red at apex; Lycium barbarum halimifolium violet 4x a long time; (Lazri and Barrows 1984 observed them on Lythrum); Machaeranthera canescens deep blue/purple; Machaeranthera pattersoni purple/violet blue 5x; Machaeranthera annua=phyllocephala yellow; Marrubium vulgare cream 23x; Matricaria inodora white; Medicago sativa violet 229x; Mentha arvensis pink 4x; Mertensia lanceolata blue; Monarda fistulosa rose-purple 1 sec. then flew; Nasturtium officinale white 23x; Nepeta cataria white 93x (+7x only a few sec. each on old flowers lacking nectar); Nepeta Xfaassenii (blue/pink-violet 59x, white 1x); Origanum vulgare purplish-pink 4x; Perovskia atriplicifolia blue 4x; Phaseolus vulgaris whitish 1 only 1 sec.; Plantago lanceolata ~whitish; Polygonum
Pieris marginalis mcdunnoughii C. Remington visits all flower colors except red: Achillea millefolium “lanulosa” white 3x; Arnica cordifolia yellow 5x; Arctium minus rose-purpel; Aster ascendens bluish; Aster glaucodes white to violet; Astragalus alpinus purple; Cardamine cordifolia white 2x; Erigeron couleri white; Erigeron elatior pink-purple 2x; Erigeron ursinus blue/purplish 9x; Eriogonum subalpinum cream; Fragaria virginiana glauca white 2x; Geranium caespitosum pink 2x; Geranium richardsonii white; ?Monarda fistulosa rose-purple; Oxypolis fendleri white a bit; Senecio atratus yellow; Senecio crassulus yellow 8x; Senecio triangularis yellow many and 11x; Senecio yellow; Smilacina (Maianthemum) stellata white; Solidago simplex var. nana=decumbens yellow 2x; Taraxacum officinale yellow 4x.

Pontia protodice (Boisduval and LeConte) visits all colors of flowers except perhaps pure red, and rarely visits catkins and mud: Abronia elliptica white; Achillea millefolium “lanulosa” white; Allium textile white to light-rose; Apocynum androsaemifolium pinkish-white; Apocynum cannabinum whitish 3x; Arctium minus rose-purple; Arnica mollis yellow 2x; Asclepias speciosa pink; Aster erycoides white 12x + var. falcatus 4x; Aster lanceolatus hesperius bluish-white 5x; Aster porteri white 5x; Astragalus laxmannii “adsurgens” usually whitish; Berteroa incana white 3x; Bidens frondosa yellowish 2x; Campanula rotundifolia blue briefly; Centaurea diffusa lavender; Centaurea scabiosa blue; Chorispora tenella purple-pose 2x; Chrysanthemum orange; Chrysothamnus nauseosus yellow 14x; Cirsium arvense purple 12x + var. incanum 1x; Cirsium undulatum rose-purple; Cirsium vulgare rose-purple; Cleome (Peritoma) serrulata pinkish 7x; Convolvulus arvensis whitish 5x; Cosmos bipinnatus white (filiform leaves 2m plants): Cryptantha jessii white 8x; Delphinium ajacis violet 2x; Descurainia pinnata yellow; Echinacea purpurea purple; Epilobium (Chamerion) danielsi=angustifolium red-purple 2x; Erigeron divergens rose-purple to white; Erigeron pumilus white 3x; Erigeron ~simplex violet hairy-leaf; Erigeron speciosus blue-pink 2x; Erigeron ursinus blue-purplish 2x; Erigeron ~blue Janet Chu; Eriogonum effusum white; Eriogonum umbellatum yellow 3x; Erysimum asperum yellow; Euryops pectinatus “viridis” yellow; Grindelia squarrosa yellow 4x; Helianthus pulimus yellow 2x; Helianthus tuberosus yellow; Hesperis matronalis pink 4x; Heterotheca canescens yellow 2x; Heterotheca villosa yellow 11x incl. Janet Chu; Hymenopappus filifolius yellow 3x; Lavandula angustifolia light-purple; Lepidium campestre white 5x; Lepidium montanum white; Lepidium white tall; Limonium latifolium violet-blue; Linum lewissii blue (1x, + another only 1 sec.); Lygodesmia juncea pink; Machaeranthera canescens deep blue/purple; Machaeranthera patternsi purple/violet; Machaeranthera tanacetifolia blue-purple; Medicago sativa violet 64x; ~Melephora crocea yellow ~Aizoaceae; Melilotus alba white 2x incl. Janet Chu; Melilotus officinalis yellow; Nepeta faassenii violet; Potentilla fruticosa yellow 2x; Potentilla pulcherrima yellow; Potentilla sp. yellow herb with very large lvs. in garden; Psoralea tenuiflora blue-purple 2x; Salvia nemorosa “East Friesland” blue; Sedum lanceolatum yellow 2x; Senecio fendleri yellow 7x; Senecio spartioides yellow; Senecio tridenticulatus yellow; Solidago ~simplex var. nana=decumbens yellow; Solidago yellow Janet Chu; Solidago (Euthamia) occidentalis yellow;
Sphaeralcea coccinea orange; Spiraea ×japonica var. ovalifolia white; big yellow sunflower; Tagetes patula 1x + yellow with red center 2x; Taraxacum officinale yellow 5x; Thelesperma filifolium yellow; Tribulus terrestris yellow 2x; Verbena hastata purplish-blue; Verbesina encelioides golden-orange 2x; Veronica americana blue or nearly white; white flowering plant; Zinnia elegans Thumbelina pink; catkin Salix; mud.

Pontia callidice occidentalis (Reakirt) visits yellow and white and violet-blue-purplish flowers, rarely pinkish, and rarely visits catkins: Achillea millefolium “lanulosa” white; Aster ericoides white 4x + var. falcatus 1x; Aster glaucodes white to violet 2x; Aster lanceolatus hesperius bluish-white 3x; Berteroa incana white 2x; Chrysothamnus nauseosus yellow 2x; Cleome (Peritoma) serrulata pinkish 2x; Erigeron pumilus white; Erigeron speciosus blue; Erigeron ursinus blue-purplish; Heterotheca pumila yellow 3x; Heterotheca villosa yellow 3x; ?Heuchera -greenish/yellowish; Hymenoxys (Tetranurus) acaulis yellow; Leucelene ericoides= Aster arenosus white; Ligusticum tenuifolium white; Machaeranthera patersonii purple/violet 2x; Medicago sativa violet 9x; Potentilla pulcherrima yellow; Raphanus sativus bluish-white; Senecio canus yellow; Senecio crassulus yellow; Senecio fendleri yellow 3x; catkin of Salix planifolia.

Pontia sisymbrii (Boisduval) visits mostly whitish flowers, sometimes other colors, rarely mud: Arabis fendleri blue 1x + pinkish-white 1x; Arabis glabra pink-purple 4x; Arabis pycnocarpa “hirsuta” white 2x; Brassicaceae yellow 3x; Cerastium strictum “arvense” white; Claytonia rosea pinkish-white; Collinsia parviflora tiny 4 mm blue-white; Lathyrus leucanthus white; Lesquerella montana yellow; Lomatium marginatum yellow or reddish-purple; Lomatium orientale white 2x; Thlaspi arvense white 18x; Thlaspi (Noccaea) fendleri “montanum” white 5x; Viola nuttallii yellow 3x; mud.

Pontia beckerii (W. Edwards) visits flowers of all colors except perhaps pure red: Centaurea repens blue; Chrysothamnus nauseosus yellow; Cleome (Peritoma) serrulata pinkish; Cryptantha white; Eriogonum lonchophyllum white 10x; Medicago sativa violet; Phlox longifolia lavender; sunflower yellow; tiny white flower.

Ascia monuste (Linnaeus): Pinguinca tree.

NYMPHALIDAE, LIBYTHEINAE

Libythea carinenta (Cramer) usually visits white flowers, often yellow, occasionally visits pink or purple, and rarely visits orange or blue or red or greenish. Ssp. bachmanii: Asteraceae yellow shrub; Boltonia asteroides white; Polygonum ×pensylvanicum pink; Senecio spartioides yellow; Solidago yellow 2x; Trifolium repens whitish 6x; mud 4x. Ssp. larvata: Baccharis whitish; ~Baccharis sarothroides whitish very common; Medicago sativa violet; tiny white-yellow-flowered tiny-leaf “Cercocarpus” common; white flowered shrub similar to Amelanchier; white flowering plant; mud 3x. This species represents the basal subfamily of Nympalidae, so to confirm its color preference I added the following flower visits compiled from Shields (1985), Kawahara and Dirig (2006), Allen (1997), Bailowitz and Brock (1991), Bright and Ogard (2010), Emmel and Emmel (1973), Harris (1972), Iftner et al. (1992), Nielsen (1999), Opler and Krizek (1984), Shapiro (1966), and internet photos: Ssp. bachmanii: Anredera cordifolia white; Anredera leptostachys white; Apocynum cannabinum whitish; Apocynum whitish 2x; Asclepias pink; Asclepias incarnata pink; Asclepias syriaca pink 2x; Aster pilosus white; Aster vimineus white; Aster white with yellow disc; Aster whitish or bluish 2x; Avicennia germinans white or yellow; Baccharis halimifolia whitish or yellowish; Berteroa incana white; Bidens alba var. radiata white and yellow; Bidens aristosa yellow; Brassicaceae yellow; Buddleja davidii white; Bunelia lanuginosa white; Centaurea maculosa purple; Cephalanthus occidentalis white; Chrysanthemum yellow and pink; Cicutia maculata white; Cirsium arvense purple 2x; Cirsium purple 2x; Clematis drummondii white; Clematis viorna “vitalba” purple?: Clethra alnifolia white (pink); Cordia white pink or red; Cornus white (pinkish) 4x; Croton white?: Daucus carota white 3x; ?Dithyrea wislizenii white; Erica cinerea purple; ?Eriogonum white; Eupatorium altissimum white; Eupatorium fistulosum pink or purple; Eupatorium perfoliatum whitish; Eupatorium white to purple; Gymnema globosa white or red; Humulus lupulus cream; Isocoma acradenia cream-yellow; Lamiaceae with orange flowers at top; Lamiaceae with white flowers at top; Lantana yellow/red; legume yellow; Ligustrum vulgare white; Lobelia cardinalis red;
?Lythrum salicaria pink; Melilotus alba white; Melilotus officinalis yellow; Mentha arvensis white or pink; Mentha purpurea white; Oreganum vulgare white; Pastinaca sativa yellow; Philadelphus coronarius white; Potentilla fruticosa yellow; Prunus (plum) ~whitish; Prunus americana white; Prunus caroliniana white; Prunus persica pink; Psilostrophe sparsiflora yellow; Pycnanthemum tenuifolium “flexuosum” white or purple-dotted; Rhus copallina yellow; Rhus typhina greenish-white; Rubus sp. white 3x; Rubus idaeus white; Rubus [Potentilla?] “fruticosus” white; Salvia guaranitica purple; Senecio yellow; Solidago (Euthamia) tenuifolia yellow; Sium suave white; Solidago yellow 5x; Solidago canadensis yellow; Sorghum greenish; Spiraea latifolia white or pinkish; Tilia sp. ochre; Tournefortia hirsutissima white; Verbena bonariensis purple; Verbesina virginica white; mud 5x; dead wood (for moisture?, Bright and Ogard 2010 p. 219); perspiration salts . Ssp. larvata: Aloysia white or pink; Aster white; Baccharis glutinosa white; Baccharis sarothroides whitish; Chrysothamnus incl. nauseosus yellow 3x; Condalia yellow; Eriogonum sp. cream 2x; Eysenhardtia polystachya white; Eysenhardtia texana white or yellow; Heteropogon contortus greenish grass regularly; Isocoma acradenia pale yellow; Senecio flaccidus var. douglasii yellow; Senecio yellow; Verbesina encelioides yellow.

NYMPHALIDAE, DANAINAE
Danaus plexippus (Linnaeus) visits flowers of all colors, rarely even red: Achillea millefolium “lunulosa” white; Asclepias incarnata pink 36x; Asclepias speciosa pink 10x; Asclepias syriaca pink; Asclepias tuberosa orange; Aster ericoides white; Aster lanceolatus hesperius bluish-white 2x; Aster novae-angliae purple 2x; Aster simplex whitish 8x; Buddleja davidii (violet 5x, purple 2x, white 6x); Chrysanthemum ~white; Chrysothamnus nauseosus yellow 67x; Carduus nutans rose-purple 2x; “Cirsium vulgare” probably Carduus glutinosa rose-purple 5x; Cirsium arvense purple 10x; Cirsium ~canescens white; Cirsium discolor pinkish-violet 14x; Cirsium ochrocentrum rose-purple; Cirsium parryi yellowish; Cirsium vulgare rose-purple 5x; Cirsium prob. rose-purple; Cleome (Pertomapa) serratula pinkish 2x; Cosmos bipinnatus; Dipsacus fullonum var. sylvestris violet-pink 4x; Echinacea angustifolia purple; Echinacea purpurea purple 4x; Echinocystus lobata cream 1 sec.; Eupatorium maculatum reddish 5x; Eupatorium rugosum white 2x; Helianthus annuus yellow 2x; Helianthus tuberosus yellow 3x; Liatris punctata purplish 3x; Lonicera tatarica pink; ?Machaeanthera bigelovii blue; Medicago sativa violet 13x; Pastinaca sativa yellow; Phlox paniculata (pink 5x, white 2x); Phlox pilosa ~pinkish; Polygonum amphibium coccineum pink 2x; Ratibida columnifera yellow; Senecio ~paucercus yellow, leaves coarsely serrate; Senecio spartioides yellow 4x; Solidago yellow; Solidago ~altissima ~canadensis” yellow 2x; Solidago (Euthamia) occidentalis yellow 4x; Solidago rigida yellow; Sonchus uliginosus yellow 2x; sunflower big yellow; Symphoricarpos ~occidentalis pink; Tagetes patula orange 1x (+ another 3 sec.); Taraxacum officinale yellow 4x; Trifolium pratense red-purple 14x; Verbena “Purple Top” purplish-blue; Verbena hastata purple 3x; ~Vicia tall skinny “wild pea” ?blue or purple; Zinnia elegans (?pink 1x, pink 1x); mud. Wikipedia adds these flowers: Apocynum cannabinum whitish; Asclepias californica purplish; Daucus carota white; Conyza canadensis whitish; Eupatorium perfoliatum white; Hesperis matronalis pink; Syringa vulgaris pink-purple; Vernonia altissima purple. Danaus gilippus (Cramer) visits flowers of all colors: Apocynum cannabinum whitish; Asclepias incarnata pink 2x; Asclepias speciosa pink 4x; Asclepias tuberosa orange; Aster laevis var. geyeri blue; Asteraceae yellow shrub; Baccharis whitish; ~Baccharis sarothroides whitish 4x; Carduus nutans rose-purple; Chrysothamnus nauseosus yellow; Cirsium arvense purple; Clematis white; Medicago sativa violet; Rudbeckia hirta yellow; Tamarix chinensis=ramosissima rosy-white; yellow-flowered tiny-leaf “Cercocarpus”; white flowering plant; mud 6x.

NYMPHALIDAE, SATYRINAE
Many Satyrinae seldom visit flowers, but Coenonympha, Cercyonis, and Erebia often visit flowers. Lethe anthodon A. Clark: female probed dirt for moisture. Lethe eurydice fumosus (Leuless) seldom visits flowers, but when it does it seems to prefer pink Asclepias, no doubt in part because they are frequent in its moist habitat: Asclepias syriaca pink 4x including male with pollinia on leg; Asclepias incarnata pink or A. syriaca pollinia on leg of 2 males (one had 3 pollinia
on each middle leg); *Asclepias incarnata* pink 6x including pollinia on leg of 3 adults; *Asclepias speciosa* pink; *Cirsium arvense* var. *incanum* purple 6x; *Nasturtium officinale* white; probing red ribbon with proboscis; dung; mud.

*Coenonympha haydenii* (W. Edwards): *Achillea millefolium* “lanulosa” white; *Senecio* yellow.

*Coenonympha tullia* (Müller) visits almost only yellow or sometimes white flowers, rarely pink or orange etc.

*Coenonympha tullia ochracea* W. Edwards: *Antennaria parvifolia* whitish 8x; *Arnica rydbergii* yellow; *Astragalus laxmannii* “adsurgens” white; *Barbara* orthoceras yellow 3x; *Ceanothus fendleri* white 3x; *Cerastium ~strictum* white 12x; *Chrysanthus nauseosus* yellow; *Cryptantha jamesii* white; *Erigeron divergens* rose-purple to white 2x; *Erigeron pumilus* 4x (+ 2x Bluish-white + 4x white); *Eriogonum subalpinum* [pinkish]-cream; *Eriogonum umbellatum* yellow 6x; *Erysimum capitatum* orange; *Geranium caespitosum* pink; *Harbouria trachyleura* yellow 5x; *Helianthus?* yellow; *Heterotheca villosa* yellow 5x; *Hymenopappus filifolius* yellow 3x; *Lesquerella montana* yellow 7x; *Potentilla fissa* yellow; *Potentilla gracilis* yellow; *Prunus virginiana* white; *Purshia tridentata* pale-yellow; *Rubus delicious* white; *Sedum lanceolatum* yellow 27x; *Senecio* yellow; *Senecio canus* yellow 2x plus one only ½ sec.; *Senecio ~dimophyllus* yellow; *Senecio fendleri* yellow 15x; *Senecio streptanthifolius* yellow; mud 4x.

*Coenonympha tullia* ssp: Ssp. *california* Westwood: *Achillea millefolium* “lanulosa” white 5x; *Asteraceae* small yellow common; *Asteraceae shrub* yellow; *Brassica nigra* yellow 23x; orange flower; *Ranunculus sp.* yellow buttercup 2x; *Rosaceae shrub* white; *Wyethia helenoides* yellow 3x. Ssp. *ampelos* W. Edwards: *Eriogonum compositum* cream “dense *Eriogonum* vaguely like *effusum*” few. Ssp. *inornata* W. Edwards: *Achillea millefolium* “lanulosa” white.

*Clytus perepetida* (Dyar) never visits flowers. A female was seen on sap of *Salix*, a male on dry cow manure, one on mud.

*Cercyonis pegala* (Fabricius) visits flowers of all colors, in contrast with *C. oetus*, and they particularly often visit sap: *Apocynum androsaemifolium* pinkish-white 5x (male proboscis caught by stamens on one); *Apocynum cannabinum* whitish 8x; *Asclepias speciosa* pink; *Aster ascendens* usually bluish; *Aster ericoides* white; *Aster laevis* var. *geyeri* blue 4x; *Aster lanceolatus hesperius* bluish-white; *Aster porteri* white 5x; *Carduus nutans* rose-purple 4x; “*Cirsium vulgar*” probably *Carduus nutans* rose-purple 16x; *Centauraea diffusa* (linden 5x, white 8x); *Chrysanthus nauseosus* yellow 15x; *Cirsium arvense* purple 34x + var. *incanum* 5x; *Cirsium undulatum* rose-purple; *Cirsium vulgare* rose-purple; *Clematis ligusticifolia* white 8x; *Cleome (Peritoma) serrulata* pinkish 2x; *Dipsacus fullonum* var. *sylvestris* white to lilac; *Echinacea angustifolia* purple; *Erigeron speciosus* blue 4x; *Eriogonum effusum* white 2x; *Gaillardia aristata* yellow with red-purple base; *Geranium caespitosum* pink 6x; *Heterotheca villosa* yellow 2x; *Liatris punctata* purplish 18x; *Lobelia siphilitica* violet-blue 2x; *Lythrum salicaria* purple 3x; *Medicago sativa* violet 110x; *Mentha arvensis* pink-violet 4x; *Monarda fistulosa* rose-purple 89x; *Nasturtium officinale* white Janet *Nepeta cataria* white 8x; *Pericome caudata* yellow 4x; *Rhus glabra* whitish or greenish-yellow; *Rosa* pink 2 flower 1 sec.; *Rudbeckia hirta* yellow 2x; *Rudbeckia laciniata* amplus yellow; *Solidago altilissima* “canadensis” yellow 21x; *Solidago missourensis* yellow 7x; *Symphoricarpos ~occidentalis* pink several; *Tamarix chinensis*=ramosissima rosy-white 30x; *Verbena hastata* purplish-blue; *Verbena stricta* purplish-blue; sucking berries *Rubus delicious*; rotten fruit (bananas-peaches) 7x; sap of *Ulmus pumila* 83x; sap of *Salix amygdaloides* 3x; dung 3x incl. horse; urine; mud 6x.

*Cercyonis stenele behrii* F. Grinnell: ?Eriodyctyon californicum white to lavender.

*Cercyonis stenele masoni* Cross: *Chrysanthus nauseosus* yellow 12x.

*Cercyonis meadii meadii* (W. Edwards) mostly visits white or yellow flowers, sometimes pink or purple ones: *Achillea millefolium* “lanulosa” white 2x (+ once only ½ sec.); *Aster porteri* white 34x; *Asteraceae shrub* yellow 6x; *Chrysanthus nauseosus* yellow 4x; *Cirsium arvense* purple (1x, var. *incanum* 1x); *Geranium caespitosum* pink only ½ sec.; *Grindelia squarrosa* yellow (two for only 1 sec.); *Heterotheca villosa* yellow 350x; *Senecio spartioides* yellow (2x, but ignored it 3x); *Solidago missouriensis* yellow 2x; mud 3x and probed ground and cones etc. after a slight rain.

*Cercyonis meadii alamosa* T. Emmel and J. Emmel: *Chrysanthus nauseosus* yellow 29x.
Cercyonis oetus charon (W. Edwards) usually visits yellow flowers, often white, seldom pink or blue/purple. It seldom visits Medicago sativa because it occurs in natural habitats, whereas Cercyonis pega often occurs in human-disturbed habitats and often visits M. sativa: Achillea millefolium “lanulosa” white 4x; Anaphalis margaritacea whith; Apocynum androsaemifolium pinkish-white 3x; Arnica mollis yellow ~20x; Aster ascendens blue 4x; Aster ericoides var. fulcatus white; Aster laevis var. geyeri blue 23x incl. Janet Chu; Aster porteri white 50x; Berteroa incana white 23x; Ceanothus fendleri white 2x; Centaurea diffusa white 31x; Chrysanthemum nauseosus yellow 32x; Cirsium arvense (purple 16x, white 1x, var. incanum purple 3x); “Cirsium vulgare” probably Carduus nutans rose-purple; Clematis ligusticifolia white 12x; Erigeron ~glabellus blue hairy; Erigeron pumilus usually white; Erigeron speciosus blue 34x; Erigeron ursinus blue-purplish; Eriogonum flavum yellow 19x; Eriogonum jamesii cream 2x; Eriogonum subalpinum [pinkish]-cream; Eriogonum umbellatum yellow 19x incl. Janet Chu; Geranium caespitosum pink 2x; Grindelia squarrosa yellow Janet Chu; Gutierrezia sarothrae yellow; Heterotheca villosa yellow 148x (they prefer Aster porteri); Lamiaeae (for Cercyonis oetus oetus); Medicago sativa violet; Melilotus alba white 2x; Melilotus officinalis yellow; Mentha arvensis pink 10x; Monarda fistulosa rose-purple (proboscis must be too small for this); Potentilla fruticosa yellow 4x; Rudbeckia hirta yellow 12x; Rudbeckia laciniata ampla yellow 40x; Senecio yellow; Sisymbrium altissimum? yellow; Solidago altissima “canadensis” yellow 14x; Solidago missouriensis yellow 3x; Solidago nana yellow sprawling low mat 6x; Solidago yellow; Tetradyemia canescens yellow 6x; Viguiera (Heliomeris) multiflora yellow 3x; fruit bait (visited by female); carrion (dead deer leg) 3x; dung horse; mud 30x.

Gyrocheilus patrobas (Hewitson); mud 2x.

Erebia magdalena magdalena Strecker visits low flowers of most colors based on few observations: Dryas octopetalala white; Erigeron simplex usually blue; Haplopappus (Tonestus) pygmaeus yellow; Silene acaulis pink/purple 11x.

Erebia epipsodea Butler prefers white and yellow flowers, and sometimes visits pink or bluish etc. colors: Achillea millefolium “lanulosa” white 2x; Agoseris glauca yellow 2x; Allium geyeri violet; Arnica cordifolia yellow 3x; Arnica mollis yellow 21x (incl. 2 E. epipsodea form brucei); Arnica rhybergii yellow 9x; Aster foliaceus var. apricus purple 2x (for form brucei); Barbarea orthoceras yellow 12x; Caltha “Psychrophila” leptosepala white; Cerastium strictum “arvensis” white 5x; Cryptantha virginia white; Erigeron pumilus bluish-white 1x; Erigeron ursinus blue-purplish 14x (including 5x for form brucei); Eriogonum subalpinum [pinkish]-cream 4x; Euphorbia esula yellow-green; Geranium richardsonii white 2x; Helianthus pumilus yellow; Jimesia americana white; Leucocrinum montanum white; Medicago sativa violet; Physocarpus monogynus white; Polygonum bistortoides whitish 3x; Rubus idaeus melanolasius white; Saxifraga (Micranthes) rhomboidea white; Sedum lanceolatum yellow 3x; Sedum roseum integrifolium dark-rose-purple; Senecio atratus yellow 2x (including form brucei 1x); Senecio canus yellow 2x; Senecio crassuluss yellow 32x (incl. form brucei 2x); Senecio dimorphophyllus yellow 2x; Senecio fendleri yellow; Senecio fremontii var. blitoides yellow 4x (incl. form brucei 1x); Senecio integerrimus yellow; Senecio triangulare yellow 4x (incl. form brucei 1x); Solidago multiradiata yellow; Symphoricarpos rotundifolius pink 7x; Taraxacum officinale yellow 3x; mud 4x.

Erebia stubbendorfii “theano” ethela W. Edwards visits were mostly to yellow or white flowers, some to pink or red-purple ones: Achillea millefolium “lanulosa” white 4x; Epilobium (Chamerion) daniels=angustifolium red-purple 2x; Sedum lanceolatum yellow 8x; Solidago simplex var. nana=decumbens yellow 60x; sunflower yellow two species. E. stubbendorfii “theano” demmia visits: Sedum rhodanthum pink; Senecio dimorphophyllus yellow.

Erebia callias W. Edwards frequents mud, and usually visits yellow flowers, sometimes white or blue/purple ones: Achillea millefolium “lanulosa” white; Agoseris glauca dasycephala yellow; Arnica cordifolia yellow; Arnica mollis yellow; Erigeron melanoecephalus (black phyllaries) white; Erigeron pinatisectus blue/purple 3x; “Aster” probably Erigeron ursinus blue-purplish blue; Heterotheca pumila yellow; Hymenoxys grandiflora yellow 2x (one male of these covered with pollen); Potentilla ~diversifolia yellow; Sedum lanceolatum yellow 7x; Senecio canus yellow; “aster” prob. Senecio yellow; Solidago simplex var. nana=decumbens yellow; dung many; mud 67x.
Neominois ridingsii (W. Edwards) seldom visits flowers (yellow, often white, sometimes cream) (Scott 1973d studied this species): Achillea millefolium “lanulosa” white 2x; Astragalus miser white; Chrysothamnus nauseosus yellow 3x; Cryptantha jamesii white; Eriogonum flavum yellow-cream 2x; Eriogonum lonchophyllum white 6x; Eriogonum subalpinum [pinkish]-cream; Eriogonum umbellatum yellow; Helianthus pumilus yellow 3x; Heterotheca villosa yellow 5x; Hymenopappus filifolius yellow 4x; Hymenoxys (Tetraneuris) acaulis yellow; Melilotus alba white; Penstemon albidos white with violet guide lines; Sedum lanceolatum yellow; Senecio small yellow.

Neominois ridingsii wyomingo; Scott: Chrysothamnus nauseosus yellow 5x; Heterotheca villosa yellow.

Oeneis visit flowers infrequently:

Oeneis uhleri (Reakirt) visits yellow and whitish flowers, and frequents mud; Eriogonum subalpinum [pinkish]-cream 2x; Prunus virginiana white 2x; Senecio fendleri yellow 3x; Thermopsis divaricarpa yellow; mud 215x incl. females (10 flew down-valley to seek mud).

Oeneis chryxus (E. Doubleday) prefers yellow and white flowers, and often visits mud; Aletes acaulis yellow; Aletes anisatus yellow; Allium textile white to light-rose; Antennaria parvifolia whitish; Arnica mollis yellow; Ceanothus fendleri white; Eriogonum umbellatum yellow ~5x 12 minutes; Helianthus pumilus yellow 3x; Heracleum spondylium montanum=lanatum white; Jamesia americana white; Rudbeckia hirta yellow 4x; Rudbeckia laciniata ampla yellow; Sedum lanceolatum yellow 3x; Senecio canus yellow 3x; Senecio fendleri yellow 4x; mud 17x (incl. 5 females).

Oeneis calais altacordillera Scott visits yellow and white flowers, sometimes blue-purplish, and often visits mud; Achillea millefolium “lanulosa” white 3x (+ two 1/3 sec., and several a few sec.); Antennaria parvifolia white 5 sec.; Arnica cordifolia yellow 3x; Arnica rydbergii yellow 2x; Erigeron ursinus blue-purplish 4x; Eriogonum subalpinum [pinkish]-cream often; Heterotheca pumila yellow 2x; Potentilla fruticosa yellow; Sedum lanceolatum yellow 3x; Senecio atratus yellow 5x; Senecio crassulus yellow 2x; Solidago simplex var. nana=decumbens yellow 2x; Taraxacum officinale yellow 12x; mud 2x (both were females visiting 3 min. and a minute).

Oeneis calais ivallda (Mead): male covered with yellow pollen evidently from Asteraceae.

Oeneis alberta Elwes: mud abundant ~50x (Scott and Scott 1978).


Oeneis jutta (Hübner): Arnica mollis yellow sucking it from below; Geranium caespitosum pink.

Oeneis melissa lucilla W. Barnes and McDunnough: no observations! They rarely feed on flowers.

Oeneis polexenes brucei (W. Edwards) visits white and yellow flowers: Arenaria (Eremogone) fendleri white; Dryas octopetala white 2x; Haplopappus (Tonestus) pygmaeus yellow.

Lasionumata megera Linnaeus (Europe): “Epilobium”-like.

NYMPHALIDAE, CHARAXINAE

Anaea andria Scudder never feeds on flowers, but visits mud sometimes, and often visits Salix [probably amygdaloides] sap 3x and Populus [deltoides monilifera] sap 3x (Scott and Scott 1978).

NYMPHALIDAE, NYMPHALINAE, LIMENITIDINAE

Limenitis archippus (Cramer) visits pink, whitish, yellowish, and purple flowers: Asclepias incarnata pink; Asclepias syriaca pink; Bidens cernua yellowish; Cleome (Peritoma) serratula pinkish 2x; Echinacea angustifolia purple; Polygonum pensylvanicum pink; Tamarix chinensis=ramosissima rosy-white.

Limenitis arthemis (Drury): Ssp. arizonensis W. Edwards white flowering plant. Ssp. astyanax (Fabricius): fruit of Aesculus glabra var. arguta; mud.

Limenitis weidemeyerii W. Edwards feeds on all colors of flowers and also often visits sap and mud etc.: Apocynum androsaemifolium pinkish-white 16x; Asclepias speciosa pink many pollinia on leg; Aster laevis var. geyeri blue 2x; Buddleja davidii violet; Carduus nutans rose-purple 2x; Ceanothus fendleri white 2x; Chrysothamnus nauseosus yellow; Clematis ligusticifolia white; Conium maculatum white; Helianthus petiolaris yellow?; Heracleum spondylium montanum=lanatum white (photo in “Colorado’s Best Wildflower Hikes. The Front Range” 1998); Jamesia americana white 3x; Lupinus argenteus blue fed on; Medicago sativa violet; Monarda fistulosa rose-purple 3x; Oxypolis fendleri white; Physocarpus
monogynus white 6x; Rhus glabra greenish flowers 2x; Rudbeckia hirta yellow; Senecio spartioides yellow; Senecio triangularis yellow; Solidago ~alissima “~canadensis” yellow; Tilia europaea ochre; Crataegus erythropoda immature fruit; sap of Populus tremula tremuloides upside down on; sap of Salix amygdaloides 3x; sap probed Quercus gambelii and Pseudotsuga menziesii twigs for sap; coccids white (sucking something from fungus-infested [orange-yellow spots] leaf of Crataegus macracantha that had curled edge and white coccids in curl of underside); “carrion” sucking inside of a dead pupa; dung of coyote Janet Chu; mud 10x incl. female.

Limenitis lorquini Boisduval: Eriodictyon white to lavender; Heracleum spondylium montanum=lanatum? white.

Adelpha eulalia (E. Doubleday): white flowering plant; mud 73x.
Adelpha californica (Butler): My few records were mostly on whitish flowers, although Shapiro (2007) records it on reddish/blue Cirsium/Carduus/Silybum, and notes that it prefers sap, rotting fruit, dung, and carrion. Aesculus californica whitish 3x; Asclepias speciosa pink; Baccharis salicifolia whitish; Eriodictyon white to lavender; aphid honeydew.

NYMPHALIDAE, NYMPHALINAE, HELICONIINI

Dione vanillae (Linnaeus): Asclepias pollinia on leg; Cirsium vulgare rose-purple; Clematis white; Lamiaceae red.

Euptoieta claudia (Cramer) visits all colors: Agoseris glauca yellow; Allium textile white to light-rose 2x; Apocynum androsaemifolium pinkish-white; Arctium minus rose-purple; Arnica [cordifolia or fulgens] yellow 2x Anne U. White and Janet Chu; Asclepias speciosa pink 1 sec. then 1 sec. (proboscis too short?); Aster ericoides white; Aster lanceolatus hesperius blush-white; Aster porteri white 2x; Bahia dissecta yellow; Bidens cernua yellowish 2x; Carduus nutans rose-purple 5x; Centaurea diffusa white; Centaurea maculosa lavender 2x; Chamaactis alpina white; Chrysothamnus nauseosus yellow 25x; Cirsium arvense purple 8x; Comandra umbellata whitish 2x; Convulvulus arvensis whitish 3x + 2x briefly; Cosmos sulphureus coppery; Cryptantha jamesii white 3x; Cryptantha virgata white; Delphinium ajacis violet; Echinacea purpurea purple 3x; Erigeron pumilus 3x (+1x blush-white, 1x white); Erigeron ursinus blue-purplish; Eriogonum effusum white 2x; Eriogonum flaveum yellow-cream 3x; Erysimum asperum yellow 5x; Erysimum ~capitatum yellow, orange 2x; Euphoria “Agaloma” marginata green and white ½ sec.; Gaillardia aristata yellow with red-purple base 11x incl. Janet Chu; Gaura coccinea white, pink, or red 2x; Geranium caespitosum pink; Grindelia squarrosa yellow 6x incl. Janet Chu; but one approached it but did not land; Gutierrezia sarothrae yellow 4x; Harbouria trachyleura yellow 2 sec; Helianthus pumilus yellow 6x; Helianthus tuberosus yellow 3x; Heterotheca canescens yellow 2x; Heterotheca pumila yellow; Heterotheca villosa yellow 20x incl. Janet Chu; Hymenopappus filifolius yellow 2x; Lesquerella montana yellow 3x; Liatris punctata purplish 15x; Limaria genistifolia dalmatica yellow and redder at apex ½ sec.; Linum lewisii blue; Lobelia siphilitica violet-blue 12x; Machaeranthera pattersoni purple/violet; Medicago sativa violet 24x; Melilotus alba white; Monarda fistulosa rose-purple (hanging below flower maybe caught by predator); Paeonia lactiflora white and yellow-centered; Penstemon secundiflorus purple ½ sec; Physocarpus monogynus white 3x; Polygonum amphibium coccineum pink; Psilostrophe sparsiflora yellow-flower shrub 30 cm tall with gray-green leaves and 3 rectangular petals with ~3 lobes at end 5x; Psoralea tenuiflora blue-purple; Ratibida pinnata yellow; Rudbeckia hirta yellow; Rudbeckia laciniata ampla yellow; Salvia farinacea purple-blue; Sedum lanceolatum yellow 11x; Senecio canus yellow 2x; Senecio fendleri yellow 9x; Senecio spartioides yellow; small primrose violet; Solidago missouriensis yellow; Tagetes patula orangish 3x; Taraxacum officinale yellow 20x + one only 1 sec.; Thlaspi (Noccaea) fendleri “montanum” white; Townsendia grandiflora blush-white; Trifolium pratense red-purple 4x; Trifolium repens whitish; Verbena purple; Verbena stricta purplish-blue; Viola nuttallii yellow 5x; Zinnia grandiflora 5-10 cm roadside yellow-with-orange-center sunflowers; mud 6x.

Argynnis (Speyeria) cybele (Fabricius) visits pinkish and purplish flowers, sometimes blue yellow white etc. Ssp. cybele: Asclepias incarnata pink; Asclepias speciosa pink pollinia on leg; Asclepias syriaca pink 4x;
Buddleja davidii pink (This Old House TV show); Carduus nutans rose-purple 3x; Echinacea purpurea purple (This Old House TV show); Trifolium hybridum pinkish-white; mud 2x. Ssp. leto (Behr): Cirsium neomexicanum —pink-cream; Medicago sativa violet 24x; Monarda ~rose-purple. Ssp. carpenterii (W. Edwards): sunflower yellow. Ssp. charlottii (W. Barnes): Agastache urticifolia pinkish; Cirsium ~centaureae yellowish-white; Cirsium undulatum rose-purple; Helianthus —petiolaris yellow; Erigeron speciosus blue; Nepeta cataria white; sap sugary viscous stuff on Quercus gambeli leaves.

Argynnis (Speyeria) aphrodite (Fabricius). Ssp. whitehousei (Gunder) =ethne (Hemming) greatly prefers rose-purple Monarda fistulosa, and otherwise visits all colors (even orange and reddish) esp. purplish: Achillea millefolium “lanulosa” white 2x; Agoseris glauca yellow; Apocynum androsaemifolium pinkish-white 29x; Arctium minus rose-purple 7x; Asclepias speciosa pink 4x (one has pollinia on leg); Asclepias tuberosa orange; Aster laevis var. geyeri blue 11x; Aster porteri white 3x; Buddleja davidii white 3x; Carduus nutans rose-purple 73x; Ceanothus fendleri white; Centaurea diffusa (lavender 6x, white 2x); Chrysothemnus nauseosus yellow 45x; Cirsium arvense purple 12x + var. incanum 4x; Cirsium canescens white; Cirsium undulatum rose-purple; Cirsium vulgare rose-purple 5x; Cleome (Peritoma) serrulata pinkish?; Dipsacus fullonum var. sylvestris white to lilac Anne U. White: Echinacea purpurea purple 2x; Epilobium (Chamerion) danielsii=—angustifolium red-purple; E. (C.) danielsii (or leptophyllum?) red-purple; Erigeron speciosus blue; Eriogonum effusum white; Eriogonum flavum yellow; Eriogonum umbellatum yellow some; Erysimum —capitatum yellow; Eupatorium maculatum reddish; Gaillardia aristata yellow with red-purple base 19x; Geranium caespitosum pink 2x; Grindelia squarrosa yellow; Heterotheca villosa yellow 5x; Jamesia americana white; Liatris ligustylis purplish; Liatris pumila white; Machaeranthera canescens deep blue/purple; Machaeranthera patternsoni purple/violet; Medicago sativa violet 4x; Monarda fistulosa rose-purple 60x?; Nepeta cataria white; Rhus aromatica triloba yellowish repeatedly flying into it, perhaps getting sap on seed bunches Janet Chu; Rudbeckia hirta yellow; Rudbeckia laciniata ampla yellow 9x; Sedum lanceolatum yellow 3x; Senecio fendleri yellow; Solidago altissima “canadensis” yellow; Solidago missouriensis yellow 2x; Symphoricarpos ocidentalis pink; Trifolium pratense red-purple 11x (one only 1 sec.); Verbena bluish-purple Janet Chu; Verbena stricta purplish-blue 5x; Verbena encelia golden-orange; Zinnia ~elegans orange; carrion (dead deer); dung of dog and horse; sap of Salix amygdaloides; mud 7x. Ssp. byblis: Cirsium —centaureae yellowish-white.

Argynnis (Speyeria) nokomis (W. Edwards) (mostly ssp. nokomis) evidently visits all colors of flowers, plus mud: Arctium minus rose-purple 2x; Aster novae-angliae purple 3x; blue Lamiaecae; “Cirsium vulgare” probably Carduus nutans rose-purple 34x; Chrysothemnus nauseosus yellow 11x; Cirsium ~canescens white 6x; Cirsium vulgare rose-purple 64x; Cirsium prob. rose-purple; Cirsium tall whitish-blue; Cleome (Peritoma) serrulata pinkish; Dipsacus fullonum var. sylvestris white to lilac 2x; Helianthus annuus yellow 2x; Rudbeckia hirta yellow; Rudbeckia laciniata ampla yellow; Trifolium pratense red-purple 8x; yellow sunflower (perhaps Helium carinale which is frequent in nokomis meadows) 2x; mud visit by female. Ssp. near-apacheana (Skinner): Cirsium 2x.

Argynnis (Speyeria) idalia (Drury) visits all colors, based on few observations: Asclepias syriaca pink; Carduus nutans rose-purple often; Cirsium undulatum pale-purple 6x; Echinacea angustifolia purple 2x; Lobelia siphilitica violet-blue. Asclepias and Cirsium are favorites. Dunford (2007) compiled the following nectar sources: Apocynum pinkish-white; Asclepias syriaca pink; A. tuberosa orange 2x; Centaurea maculosa white to purple; Chrysanthemum leucanthemum white; Cirsium discolor light-purplish; Cirsium pumilus purple; Coronilla varia yellow; Dianthus armeria roseate dotted with white; Echinacea purpurea purple; Liatris punctata purple; Liatris pycnostachya purple; Medicago sativa violet; Monarda fistulosa pink; “black sampa” (Psoralea psoralioides lilac-purple); Rudbeckia hirta yellow; Rubus blackberry white. Opler and Krizek (1984) reported: Asclepias sullivantii purplish to whitish; Pycnanthemum whitish or purplish; Trifolium pratense red-purple.

Argynnis (Speyeria) mormonia eurynome (W. Edwards) visits flowers of all colors (even part-red) but usually yellow, and mud: Achillea millefolium “lanulosa” white 2x; Agoseris aurantiaca burnt-orange 4x; Agoseris glauca yellow 5x and var. parviflora 1x; Arenaria (Emermone) fenderi white; Arnica cordifolia yellow 3x; Arnica mollis yellow 74x; Arnica parryi (rayless) yellow 2x; Arnica rydbergii
yellow 14x; Aster foliaceus var. apricus purple 2x; Aster laevis var. geyeri blue; Carduus nutans rose-purple; Chrysanthemum nauseosus yellow 2x; cushion plant blue flower; Dryas octopetala white; Erigeron coulteri white; Erigeron elatior pink-purple 3x; Erigeron simplex blue; Erigeron speciosus blue 16x; Erigeron ursinus blue 69x; Eriogonum subalpinum cream; Gaillardia aristata yellow with red-purple base; Geranium richardsonii white; Haplopappus (Oreochrysum) parryi yellow 20x; Haplopappus (Toneustus) lylalli yellow; Heterotheca pumila yellow 32x; Hymenoxys grandiflora yellow 2x; Hymenoxys (Tetrandeireus) brevifolia yellow; Medicago sativa violet 2x; Potentilla pulcherrima yellow 3x; Rudbeckia hirta yellow 2x; Senecio atratus yellow 13x; Senecio canus yellow; Senecio crassulus yellow 9x; Senecio dimorphophyllus yellow 3x; Senecio fremontii var. blotoides yellow 2x; Senecio integerrimus yellow 19x; Senecio pseudaureus orange-red; Senecio triangularis yellow 27x; Senecio yellow 4x; Solidago altissima ~canadensis yellow; Solidago multiflora yellow; Solidago simplex var. nana=decumbens yellow 6x (one after passing over 10 Achillea millefolium “lanulosa” white); sunflower yellow; Taraxacum officinale yellow 13x; Trifolium pratense red-purple; Trifolium repens whitish 9x; mud.

Argynnis (Speyeria) monomima luski (W. Barnes and McDunnough): Cirsium ?arvense small blue head; Rudbeckia hirta yellow.

Argynnis (Speyeria) hydaspes rhodope (W. Edwards) probably visits all colors and mud like other Argynnis (Speyeria): Aster glauces white to violet 2x; Heterotheca villosa yellow; Lamiaceae some; Senecio integerrimus yellow 2x; Senecio yellow 3x; thistles ?purple Ore.; mud.

Argynnis (Speyeria) callippe (Boisduval) visits yellow and white flowers especially, often purplish, and sometimes reddish and orange and violet ones, and visits mud. Ssp meadii (W. Edwards): Achillea millefolium “lanulosa” white; Agastache urticifolia pink 2x; Agoseris aurantiaca orange; Allium textile white to light rose; Apocynum androsaemifolium pinkish-white 57x; Aster glauces white to violet 3x; Asteraeae yellow; Berberis (Mahonia) repens yellow; Brassicaceae yellow 2x; Carduus nutans rose-purple 18x; Ceanoptis fendleri white 4x; Centaurea diffusa white; Cirsium arvense purple 5x; Cirsium canescenses whitish; Cirsium ochrocephalum rose-purple; Cirsium scariosum=coloradense whitish; Cirsium ?undulaturn purple; Clematis ligusticifolia white 3x; Crepis acuminata yellow; Erigeron pumilus usually white; Eriogonum flavum yellow 20x; Eriogonum subalpinum [pinkish]-cream 4x; Eriogonum umbellatum yellow 8x; Erysimum asperum yellow; Erysimum capitatum (yellow 2x, orange 9x); Gaillardia aristata yellow with red-purple base 14x; Geranium caespitosum pink; Grindelia squarrosa yellow; Harbournia trachyleura yellow; Helianthus ~petiolaris yellow ~10x; Helianthus pulchellum yellow; Heterotheca villosa yellow 21x; Jamesia americana white 10x; Medicago sativa violet; Lamiaceae; Monarda fistulosa rose-purple 22x; Nepeta cataria white; Oxytropis lambertii reddish-purple; Rudbeckia hirta yellow; Rudbeckia laciniata amela yellow 33x; Sedum lanceolatum yellow 27x; Senecio canus yellow 2x; Senecio fendleri yellow 5x (incl. much pollen on body); Senecio triangularis yellow; Senecio yellow; Solidago altissima “canadensis” yellow 2x; Symphoricarpus albus pink; Trifolium repens whitish; spit of human; mud 12x. Ssp. nevadensis (W. Edwards): Eriogonum lobbii var. robustus cream. Ssp. calgariana (McDunnough): Arnica mollis yellow; Cirsium centaureae yellowish-white; Eriogonum subalpinum [pinkish]-cream. Ssp. shasta J. Emmel, T. Emmel, and Mattoon: Calytridium umbellatum white 2x; Lamiaceae. Ssp. juba (Boisduval): Calytridium umbellatum white some. Ssp. near-callippe: Lamiaceae; Eriodictyon white to lavender.

Argynnis (Speyeria) atlantis sorocco Scott, Kondla and Sperner visits yellow flowers the most, often white or purple ones, occasionally all other colors: Achillea millefolium “lanulosa” white; Agastache urticifolia pinkish; Agoseris aurantiaca orange; Agoseris glauca yellow 19x; Apocynum androsaeifolium pinkish-white; Arnica mollis yellow; Aster foliaceus purple; Cirsium canescenses whitish; ~Cirsium centaureae “thistle” low white; Erigeron speciosus blue 2x; Galium ~septentirene white; Heterotheca villosa yellow; Monarda fistulosa rose-purple; Potentilla gracilis yellow; Rudbeckia hirta yellow 31x; Rudbeckia laciniata amela yellow 6x; Senecio triangularis yellow ~4x; Taraxacum officinale yellow 2x; Trifolium pratense red-purple.

Argynnis (Speyeria) hesperis (W. Edwards) visits flowers of all colors except perhaps pure red: Ssp. hesperis: Achillea millefolium “lanulosa” white 2x; Agoseris aurantiaca orange; Agoseris glauca yellow 8x; Anaphalis margaritacea whitish 2x; Anemone cilindrica greenish-white; Apocynum
androsaemifolium pinkish-white 47x; Arctium minus rose-purple 42x; Asclepias speciosa pink pollinia on leg; Aster laevis var. geyeri blue 29x; Aster porteri white 3x; Buddleja davidii white; Carduus nutans rose-purple 28x; Ceanothus fendleri white 6x; Centaurea diffusa lavender 10x (+ two <1/2 sec.) + white 27x; Chrysothamnus nauseosus yellow; Cirsium arvense purple 21x + var. incanum 11x; Cirsium vulgare rose-purple; Clematis ligusticifolia white; Conium maculatum white; Dipsacus fullonum var. sylvestris white to lilac Anne U. White; Eriogonum speciosum blue 5x; Eriogonum flavum yellow 8x; Euphorbia esula yellow-green 4x; Gaillardia aristata yellow with red-purple base 25x incl. 1x ray bases orange then yellow beyond and 10x red-centered; Geranium caesitotum pink 3x; Grindelia squarrosa yellow; Heracleum spondylium montanum=lanatum white 7x; Heterotheca villosa yellow 14x + 1x briefly; Holodiscus discolor whitish; Jamesia americana white 3x; Liatris ligulistylis purplish 10x; Monarda fistulosa rose-purple 118x incl. Anne U. White and Janet Chu; Nepeta cataria white 12x; Physocarpus monogynus white; Prunus virginiana white; Rhus glabra greenish flower 6x; Rudbeckia hirta yellow 40x; Rudbeckia laciniata ampla yellow (favorite) 134x; Sedum lanceolatum yellow; Senecio fendleri yellow; Senecio yellow many 2x; Solidago altissima “canadensis” yellow 11x; Solidago missouriensis yellow; Solidago yellow; Symphoricarpos ~albus pink; Taraxacum officinale yellow; Trifolium pratense red-purple 3x; Viguiera (Helianeris) multiflora yellow 3x; sap of Salix amygdaloides; dung of horse; mud 6x. Other A. hesperis ssp.: Agastache urticifolia pinkish; Arnica mollis yellow; Aster ascendens usually bluish; Aster foliacaeus purple; Calyptridium umbellatum white 2x; Carduus nutans rose-purple; Cirsium arvense purple 2x; Cirsium prob. rose-purple; Cirsium small blue head ?arvense; Cirsium white several; Eriogonum speciosus blue 2x; Eriogonum ursinus blue; Haplopappus (Oreochrysum) parryi yellow; Lamiaceae 2x; Monarda fistulosa rose-purple several; Rudbeckia hirta yellow; Rudbeckia laciniata ampla yellow 21x; Senecio yellow; Senecio triangularis yellow ~2x; sunflowers orange and yellow many; Viguiera (Heliomeris) multiflora yellow 2x; mud.

Argynnis (Speyeria) egleis (Behr). Ssp. secreta dos Passos and Grey: Agastache urticifolia whitish; mud. Ssp. mcdunnoughi: Senecio yellow 12x. Ssp. egleis: Calyptridium umbellatum white many; Lamiaceae. Ssp. oweni (W. Edwards): Asteraceae yellow, Calyptridium umbellatum white; Prunus ~virginiana white.

Argynnis (Speyeria) zerene (Boisduval). Ssp. sineope dos Passos and Grey visits all colors of flowers except red, esp. yellow: Agastache urticifolia pinkish 3x; Arnica mollis yellow 6x; Aster foliacaeus purple; Berteroa incana white 2x; Cardamine cordifolia white 2x; Ceanothus velutinus white; Chrysothamnus nauseosus yellow 4x; Cirsium prob. purple 2x; Cirsium scariosum=coloradense whitish; Eriogonum speciosus blue 4x; Eriogonum brevicaule yellow; Eriogonum umbellatum yellow; Heterotheca villosa yellow; Medicago sativa violet 55x; Rudbeckia laciniata ampla yellow 8x; Senecio integrigermius yellow 3x; Senecio triangularis yellow 10x; Senecio yellow 21x; Taraxacum officinale yellow 3x; Trifolium pratense red-purple; dog turd. Ssp. platina (Skinner): Eriogonum subalpinum [pinkish]-cream; Senecio emertophilus kingi pinnate yellow. Ssp. pica (McDunnough): ~Eriogonum compositum whitish “dense Eriogonum vaguely like effusum”. Ssp. gunderi (J. Comstack): Chrysothamnus nauseosus yellow 2x; Cirsium prob. rose-purple; Lamiaceae some. Ssp. malcolm (J. Comstack): Chrysothamnus nauseosus yellow 2x; Eriogonum lobbia var. robustum cream. Ssp. zerene: Calyptridium umbellatum white, Lamiaceae several.

Argynnis (Speyeria) coronis (Behr) mostly visits yellow and white flowers, and often purplish/blue ones. Ssp. halcyone (W. Edwards): Apocynum androsaemifolium pinkish-white 14x: Aster glaucodes white to violet; Aster laevis var. geyeri blue 2x; Aster porteri white; Astragalus laxmannii “adsurgens” usually whitish; Barbarea orthoceras yellow; Carduus nutans rose-purple 29x; Centaurea diffusa white 2x; Chrysothamnus nauseosus yellow 19x; Cirsium arvense purple; Cirsium canescens whitish 2x; Cirsium vulgare rose-purple; “thistle” low white; Eriogonum speciosus blue; Eriogonum umbellatum yellow; Erysimum ~capitatum (yellow 2x, orange 6x); Gaillardia aristata yellow with red-purple base; Heracleum spondylium montanum=lanatum white; Heterotheca villosa yellow 3x; Jamesia americana white 4x; Lesquerella montana yellow; Liatris punctata purplish 3x; Medicago sativa violet ~9x; Monarda fistulosa rose-purple 5x; Oxytropis lambertii reddish-purple; Physocarpus monogynus white; Sedum lanceolatum yellow; Senecio fendleri yellow 2x; Senecio triangularis yellow; Senecio yellow 3x; Solidago ~altissima “~canadensis” yellow; Taraxacum officinale yellow 2x; Verbena stricta purplish-
blue 3x; visiting plant 6” tall with leaves like elm and tiny white bell flowers; mud 4x.  Ssp. snyderi (Skinner): Brassica ~yellow.  Ssp. coronis: Lamiaceae.  Ssp. carolae dos Passos and Grey (an unconvincing majority of traits suggest carolae belongs to S. zereae; but mtDNA study of C. Guppy and N. Kondla suggest it is actually S. coronis carolae): Heterotheca villosa yellow several; Solidago yellow many.

Argynnis (Speyeria) edwardsii (Reakirt) visits flowers of all colors (even red) and dug and mud: Agoseris glauca yellow; Apocynum androsaemifolium pinkish-white 10x + one very brief; Astragalus spatulatus 20 cm blue; Buddleja davidii pink-purple; Carduus nutans rose-purple 47x; Ceanothus fendleri white; Ceanothus velutinus white; Centaurea diffusa lavender; Chrysothamnus nauseosus yellow 21x; Cirsium arvense purple M. Fisher; Cirsium canescens whitish 4x; Cirsium ochrocentrum rose-purple 3x; Cirsium undulatum rose-purple 2x; Eleagnus angustifolia yellow; Eriogonum effusum white; Eriogonum umbellatum yellow; Erysimum ~capitatum yellow + 1 sec twice; Erysimum capitatum orange 16x + one red-orange; Eupatorium maculatum reddish 2x; Gaillardia aristata yellow with red-purple base 2x; Grindelia squarrosa yellow 2x; Harbouria trachypleurura yellow; Heracleum spongii montanum~lanatum white; Hesperis matronalis var. alba white; Heterotheca villosa yellow 3x; Jamesia americana white 10x incl. Janet Chu; Liatris punctata purplish 9x; Lithospermum multiflorum yellow; Medicago sativa violet; Melilotus alba white 2x; Monarda fistulosa rose-purple 8x; Onopordum acanthium rose-purple; Oxytropis lambertii reddish-purple; Penstemon secundiflorus purple; Prunus virginiana white; ~Rudbeckia laciniata hortensis (yellow with yellowish centers); Rorippa sinuata yellow; Sedum lanceolatum yellow 3x; Senecio “fendleri” yellow; Symphoricarpos rotundifolius pink 2x; Trifolium pratense red-purple; Verbena bracteata bluish-purple; Verbena stricta purplish-blue 5x; Verbesina encelioides golden-orange; dung 2x; mud 5x.

Boloria alaskensis [“napaea”] halli Klots: Erigeron “ursinus short blue sometimes; sometimes Polygonum bistortoides whithish; often Senecio 30 cm yellow.

Boloria eunomia caelestis (Hemming) visits many colors, most often yellow. Arnica cordifolia yellow; Arnica mollis yellow 3x; Caltha “Psychrophila” leptosepala whitish 2x; Cardamine cordifolia white; Castilleja rhexifolia lavender half sec; Delphinium ramosum blue; Erigeron ursinus blue-purplish 4x; Polygonum bistortoides whitish 16x; Potentilla diversifolia yellow; Potentilla fruticosa yellow 3x; Sedum rhodanthum pink ~30x (incl. Richard O. Bray); Sedum roseum integrifolium dark-rose-purple; Senecio canus yellow; Senecio crassulus yellow; Senecio dimorphophyllus yellow; Senecio fremontii var. blitoides yellow; Senecio triangularis yellow 5x; Trifolium dasyphyllum purple/pink.

Boloria selene (Schiffermüller).  Ssp. nebraskensis (W. Holland): Asclepias syriaca pink, male has pollinia on leg; Helianthus divaricatus yellow; Verbena hastata purplish-blue.  Ssp. tollandensis: Erigeron ursinus blue-purplish; Senecio integerrimus yellow 2x; Verbena ~stricta purplish-blue.  Ssp. mtn.-sabulocollis Kohler: Solidago yellow Las Animas Co. Colo.

Boloria epithore (W. Edwards): Calyptridium umbellatum white; Senecio yellow 2x.

Boloria bellona (Fabricius): Penstemon confertus procerus tiny blue flowers 6x; Senecio triangularis yellow; mud.

Boloria frigga sagara (W. Barnes and Benjamin) visits whitish flowers and probably all other colors: Cardamine cordifolia white 3x; Pedicularis groenlandica reddish-purple to dark-red; Polygonum bistortoides whitish; Sedum rhodanthum pink 5x; Valeriana capitata acutiloba pinkish-white 5 min; catkin? of Salix ?planifolia whitish; catkin (dry) of Salix so flew after ~1 sec.; mud.

Boloria improba acrocnema Gall and Sperling (Scott 1982 studied this species): Erigeron ursinus blue; Hymenoxys grandiflora yellow; Phlox multiflora [white-pink-blue]; Silene acaulis pink/purplish pink 3x; sunflower yellow 1x; soil moisture 2x.

Boloria improba harryi Ferris: Erigeron ~simplex bluish-white with rosette of basal leaves 5 cm; Polygonum bistortoides whitish cream; Salix arctica female flowers ~whitish; Silene acaulis pink/purplish pink 4x; wet soil 2x.

Boloria freja browni (Higgins): Arnica cordifolia yellow; Calth “Psychrophila” leptosepala white; Draba lanceolata white; Oreoxis alpina yellow; Pulsatilla patens multifida purplish-white; Salix planifolia male catkin; mud.
Boloria titania helena (W. Edwards) visits all colors, mostly yellow and white: Achillea millefolium “lanulosa” white; Agoseris glauca yellow; Arnica cordifolia yellow 3x; Arnica mollis yellow 73x; Arnica rydbergii yellow 3x; Aster foliaceus var. apricus purple; Caltha “Psychrophila” leptosepala white 2x; Cardamine cordifolia white 4x (and one only 3 sec); Cirsium scopulorum yellowish-white; Erigeron elatior pink-purple 8x; Erigeron -simplex violet hairy-leaf; Erigeron speciosus blue; Erigeron ursinus blue 79x; Erigeron “Aster”; Hymenoxys grandiflora yellow; Ligusticum porteri white; Polygonum bistortoides whitish 10x; Potentilla diversifolia yellow 2x; Ranunculus adoneus? yellow (not “Silene acaulis pink/purplish”) (pinnate leaf and yellow buttercup flower); Saxifraga (Micranthes) oregana yellow; Sedum lanceolatum yellow; Sedum rhodanthum pink 5x; Senecio atratus yellow; Senecio crassulus yellow-orange 7x; Senecio crocatus orange-red to yellow; Senecio dimorphophyllus yellow 11x; Senecio fremontii var. bitoides yellow 3x; Senecio integerrimus yellow; Senecio triangularis yellow 22x; Senecio yellow 2x; Solidago multiradiata yellow 2x; Solidago simplex var. nana=decumbens yellow 2x; sunflower yellow 2x; Taraxacum ~officinale yellow 3x; mud.

NYMPHALIDAE, NYMPHALINAE, APATURINI

Asterocampa celtis (Boisduval and LeConte) visits all flower colors but prefers whitish and yellow colors, and mostly visits tree sap. A. celtis celtis: Centaurea americana white and pink. A. celtis jeffermont Scott and M. Fisher: Cirsium arvense purple several; Cirsium vulgare rose-purple Janet Chu; Clematis ligusticifolia white 2x; Eriogonum flavum yellow; Helianthus pumilus yellow 3x; Holodiscus discolor whitish 2x; Jamesia americana white often; Monarda fistulosa rose-purple 2x; Solidago altissima “canadensis” yellow; Tilia americana yellowish-cream; honeydew of aphids proboscis repeatedly touching aphids on Cirsium vulgare seeking “aphid-honeydew” Janet Chu; berries Rubus deliciousus; rotting bananas-peaches 6x; sap of Acer negundo; sap of Robinia neomexicana Janet Chu; sap of Salix amygdaloides 29x; sap of Ulmus pumila 73x; mud 6x.

Asterocampa leitia (W. Edwards): Asteraceae shrub yellow.

Asterocampa clyton (Boisduval and LeConte) probed my red truck.

NYMPHALIDAE, NYMPHALINAE, NYMPHALINI

In late summer all the species (except Junonia) frequent Chrysothamnus nauseosus yellow bushes. Vanessa-Aglais-Nymphalides seldom visit red flowers, perhaps because Vanessa atalanta supposedly cannot see red (Zaccardi et al. 2006) (but it visits red flowers, see below). Polygonia seem to prefer yellow and white flowers.

Vanessa virginensis (Drury) visits flowers of all colors except red, and mud: Agoseris glauca yellow; Apocynum androsaemifolium pinkish-white 3x; Aster laevis var. geyeri blue; Aster Michaelmas Daisy purple (P. Allan Smith TV show); Asteraceae yellow several; Asteragalus drummondii white; Bidens cernua yellowish?; Buddleja davidii pink (This Old House TV show); Carduus nutans rose-purple; Centaurea diffusa white; Chrysothamnus nauseosus yellow 17x; Cirsium arvense purple 4x and var. incanum 1x; Erigeron speciosus blue; Eriogonum umbellatum yellow 2x; Fagopyrum esculentum (Polygonaceae) white (P. Allen Smith TV show); Helianthus tuberosus yellow; Lamiaceae blue; Lepidium campestre white; Liatris punctata purplish; Lobelia siphilitica violet- Lupinus argenteus blue; Monarda fistulosa rose-purple 2x; Oxytropis lambertii reddish-purple; Penstemon alpinus blue-purple; Raphanus sativus bluish-white 2x; Rudbeckia hirta yellow 5x; Rudbeckia laciniata ampla yellow 3x; Senecio yellow; sunflower big yellow; Taraxacum officinale yellow 2x; Trifolium pratense red-purple 2x; Trifolium repens white; Verbena purple; Verbena purpurea blue-purple 11x; white bushy flower; Zinnia grandiflora yellow-with-brown-red-center low 10 cm roadside sunflower; dung male near horse turds; mud 3x.

Vanessa cardui (Linnaeus) visits flowers of all colors even some red ones, plus fruit, sap, dung, and mud. It depends on Taraxacum officinale during spring northward migrations, and Chrysothamnus nauseosus in late summer (when southward migrants are rarely seen): Achillea millefolium “lanulosa” white 4x + one only ½ sec.; Ajuga reptans blue; Allium sibiricum violet; Alyssoides utriculata light-yellow; Alyssum saxatile yellow 4x; Anchusa azurea blue; Anemone canadensis white found dead with proboscis wrapped
around A. canadensis peduncle; Antirrhinum majus white 4x; Apocynum androsaemifolium pinkish-white 12x; Apocynum cannabinum whitish 10x; Arctostaphylos uva-ursi whithish; Arnica cordifolia yellow; Arnica mollis yellow 28x; Arnica rydbergii yellow; Asclepias incarnata pink 15x; Asclepias speciosa pink 2x; Aster ericoide white 9x; Aster nova-angiae purple 4x; Aster novi-belgii (purple 1x, white 10x); Aster “Pixie Park” purple 2x; Astragalus drummondii white 5x; Astragalus flexuosus purple 3x; Astragalus laxmannii “adsurgens” usually whitish 6x; Barbarea orthoceras yellow 3x; Berberis (Mahonia) repens yellow 2x; Berteroa incana white; Buddleja davidii color not stated 8x + purple 20x + violet 10x + white 61x; Calytridium umbellatum white; Cardaria (Lepidium) latifolium white; Carduus nutans rose-purple 42x; Ceanothus fendleri white; Centaurea diffusa (lavender 10x + white 67x); Centaurea maculosa lavender 6x; Centaurea scabiosa blue; Centranthus ruber red; Ceratostigma plumbaginoides violet 2x; Chrysanthemum Xsuperbum white 5x; Chrysanthemum “Corinne” white; Chrysanthemum “Megan” purple; Chrysanthemum “Melanie” ?white; Chrysanthemum (yellow 6x, yellow with orange center 1x, yellowish 2x); Chrysanthemus nauseosus yellow 106x2; Cirsium arvense purple 32x (+ var. incanum 10x); Cirsium discolor pinkish-violet 95x; Cirsium eatonii tweedyi; Cirsium parryi yellow; Cirsium prob. rose-purple; Cirsium scariosum lavender-white; Cirsium scopulorum yellowish-white; Cirsium undulatum rose-purple; Cirsium vulgare rose-purple 3x; Cleome (Peritoma) serrulata pinkish; Convolvulus olivaceus whitish 2x; Cosmos bipinnatus (orange 8x, white/pink 1x, white 1x, purple 3x, briefly 1x); Cryptantha minima white 2x; Cryptantha virgata white 2x; Delphinium ajacis violet 3x + 1/3 sec.; Descurainia pinnata yellow; Dianthus ~barbatus red; Dipsacus fullonum var. sylvestris violet-pink 15x; Dryas octopetala white 12x; Echinacea angustifolia purple 11x; Echinacea purpurea yellow 188x; Erigeron compostus white to rose-blue finely divided 3x; Erigeron speciosus blue 3x; Erigeron urinus blue-; 7x; Eriogonum jamei cream; Eriogonum lonchophyllum white; Eriogonum umbellatum yellow 4x; Erysimium asperum yellow 15x; Erysimum capitatum (orange 6x yellow 3x); Eupatorium perfoliatum white; Euphorbia esula yellow-green 3x; Euryops pectinatus “viridis” yellow; Gazania longiscapa yellow; Gomphrena globosa purple some; Grindelia squarrosa yellow; Gutierrezia sarothrae yellow (1x + another only 1 sec.); Haplopappus (Tonestus) pygmaeus yellow; Helianthus ~annuus spatulate leaf yellow; Helianthus nutallii yellow; Helianthus petiolaris yellow; Helianthus tuberosus yellow 8x; ~Helianthella uniflora yellow; Hesperis matronalis pink 4x; Heterotheca pumila yellow; Heterotheca villosa yellow 11x; Hymenoxys grandiflora yellow; Hymenoxys richardsoni yellow; Jamesia americana white 11x; Lavandula angustifolia light-purple 2x; Lesquerella montana yellow; Liatris punctata; 21x; Lobelia siphilitica violet-blue Lamiaceae 3x; Lonicera tatarica pink many; Machaeranthera pattersonii purple/4x; Medicago lupulina yellow Janet Chu; Medicago sativa violet 113; Mertensia lanceolata blue; Monarda fistulosa rose-purple 12x; Muscari botryoides deep-blue 32x; Nasturtium officinale white; Nepeta Xfaassenii violet; Onopordum acanthium rose-purple; Osteospermum near “Buttermilk” whitish petals lavender at base; Oxytropis lambertii reddish-purple 11x; Penstemon secundiflorus purple 6x; Penstemon virens blue 2x; Pericome caudata yellow 3x; Perovskia atriplicifolia blue; Petunia hybrida pink 1 sec.; Phacelia heterophylla ~pinkish; Phlox pilosa ~pinkish; Phlox subulata var. nelsonii pink; Physocarpus monogynus white 3x; Polygonum pensylvanicum pink; Prunus americana white 3x; Prunus cerasus white 24x; Prunus maackii white; Prunus pissardi rosea white 2x; Prunus virginiana white 17x; Pyrus malus white 2x; Pyrus crabapple (1x + pink 3x); Pyrus double-flowered crabapple pink 6x; Pyrus floribunda pinkish-white; Ranunculus yellow; Raphanus sativus blush-white common; Rorippa sinuata yellow 2x; Rubus deliciosus white; Rudbeckia hirta yellow 4x; Rudbeckia laciniata ampla yellow 4x; Salvia farinacea “Blue Bedder” violet-blue; Salvia nemorosa “Mainacht” purple 4x; Scabiosa columbaria lilac 6x; Sedum lanceolatum yellow 5x; Senecio atratus yellow 2x; Senecio canus yellow; Senecio crassulus yellow 34x; Senecio dimorphophyllus yellow; Senecio fendleri yellow 17x; Senecio integerrimus yellow gray-leafed 4x; Senecio triangularis yellow 4x; Senecio yellow many; Silene acaulis pink 19x; Solidago alissimma “canadensis” yellow 2x; Solidago rigid yellow; Solidago simplex var. nana=decumbens yellow; Sonchus uliginosus yellow; Spiraea japonica pink; Stachys olympica pinkish; Symphoricarpos albus pink; Symphoricarpos occidentalis pink 2x; Symphoricarpos rotundifolius pink; Syringa vulgaris pink-purple 49x (+ one only 1 sec.) white form alba 1x; Tagetes patula yellow-orange 13x; Taraxacum officinale yellow 182x; Thlaspi
Vanessa carye annabella (W. D. Field) visits all colors of flowers except perhaps pure red: Aesculus californica whitish; Apocynum androsaemifolium pinkish-white; Arnica molla yellow 2x; Aster ericoides white 2x; Aster lanceolatus hesperius bluish-white 7x; Calyptridium umbellatum white 2x; “Cirsium vulgare” probably Carduus nutans rose-purple; Chrysanthemum parthenium white (yellow center); Chrysanthemum yellow; Chrysanthanthus nauseosus yellow 33x; Cirsium arvense purple 2x; Dahlia X’Karma” rose 1 sec.; Dianthus “Pink Delight” pink; Echinacea purpurea purple; Machaeranthera bigelovii purple/violet; Medicago sativa violet 13x; Melilotus albus white; Perovskia atriplicifolia blue a long time; Raphanus sativus bluish-white 2x; Rudbeckia hirta yellow 2x; Salvia nemorosa “Mainacht” purple 2x; Scabiosa columbaria blue-lilac muc (a long time); Senecio crassulus yellow; Senecio triangularis yellow; Solidago (Euthamia) occidentalis yellow 2x; Solidago yellow; sunflower big yellow; sunflower yellow; Tagetes ~erecta orangeish large petaly marigold; Taraxacum officinale yellow; Trifolium pratense red-purple; Verbena purplish-blue; Zinnia elegans white (yellow center) 2x.

Vanessa atalanta (Linnaeus) visits flowers of all colors even red sometimes, and often visits sap and fruit bait and mud: Apocynum androsaemifolium pinkish-white 5x; Apocynum cannabinum whitish 6x; Arnica molla yellow 7x; Asclepias speciosa pink 2x; Asclepias syriaca pink male had pollinia on leg; Aster laevis var. geyeri blue 2x; Aster novae-angliae purple 2x; Aster porteri white; Berteroa incana white 2x; Buddleja davidi white; Centaurea diffusa white; Chrysanthanthus nauseosus yellow 35x; Cirsium arvense purple 26x + var. incanum 78x; Cirsium ochrocentrum rose-purple; Clematis liguistifolia white; Cornus sericea=stolonifera yellow 2x; Coronilla varia pink 3x; Echinacea purpurea purple; Erigeron speciosus blue; Eriogonum umbellatum yellow 2x; Geranium caespitosum pink; Gutierrezia sarothrae yellow; Helianthus tuberosus yellow; Hydrophyllum fendleri white; Jamesia americana white 4x; Machaeranthera patersonii purple/violet; Medicago sativa violet 4x; Monarda fistulosa rose-purple 4x; Nepeta cataria white; Phacelia heterophylla white probing with proboscis; Physocarpus monogynus white 14x; Prunus americana white; Prunus virginiana white 9x; Ratibida columnifera yellow; Rhus glabra green flowers 3x; Ribes cereum pinkish-white 3x; Rorippa sinuata yellow 2x; Rosa ~woodsii pink flower 5 cm wide; Rosa red giant with few petals; Rudbeckia hirta yellow; Rudbeckia laciniata ampla yellow 6x; Senecio crassulus yellow; Senecio ~sparioides yellow; Solidago altissima “canadensis” yellow 4x; Solidago missouriensis yellow; Stachys olympica pinkish; Symphoricarpos albus pink 26x; Symphoricarpos occidentalis pink; Symphoricarpos rotundifolius pink; Syringa vulgaris pink-purple 2x; Thlaspi (Noccaea) fendleri “montanum” white; Tilia americana yellowish-cream 6x; Tilia americana ochre; Trifolium pratense red-purple 47x; Vicia cracca bluish-purple; sucking diseased black small Cirsium ochrocentrum unexpanded flower head; Pinus edulis cones; sap of Populus tremula tremuloides; sap of Ulmus pumila 2x; sap of Salix amygdaloides 4x; rotten apple 2x; fruit bait 4x; mud 13x. Theis (2006) reports that it helps pollinate Cirsium arvense.

Inachis io Linnaeus (Europe): Taraxacum officinale yellow.

Aglais milberti (Godart) feeds on yellow or white flowers, seldom on blue-purple: Achillea millefolium “lanulosa” white; Allium sibiricum violet big clump of flowers; Anaphalis margaritacea whitish; Apocynum androsaemifolium pinkish-white; Arctostaphylos uva-ursi whitish 3x; Arnica cordifolia yellow; Arnica molla yellow 15x; Arnica rydbergii yellow 29x; Barbarea orthoceras yellow 9x; Ceanothus velutinus white; Chrysanthanthus nauseosus yellow 23x; Cirsium arvense purple 1x + var.
Polygonia \textit{incanum} 1x; \textit{Cirsium} ?rose-purple; \textit{Cirsium scariosum} lavender-white; \textit{Cryptantha virgata} white tall; \textit{Erigeron ursinus} blue-purplish 4x; \textit{Eriogonum lobbii} var. robustus cream; \textit{Erysimum asperum} yellow; \textit{Heterotheca villosa} yellow; \textit{Jamaica americana} white 3x; \textit{Medicago sativa} violet 2x; Lamiaceae ?\textit{Monarda} ~rose-purple; mustard? white tiny; \textit{Prunus americana} white 4x; \textit{Sedum lanceolatum} yellow 5x; \textit{Senecio canus} yellow 2x; \textit{Senecio crassulus} yellow; \textit{Senecio fendleri} yellow; \textit{Senecio integrerrimus} yellow 2x; \textit{Senecio triangularis} yellow 2x; \textit{Senecio yellow}; \textit{Solidago simplex} var. \textit{nana=decumbens} yellow; sunflower yellow 2x; \textit{Taraxacum officinale} yellow 4x; catkin \textit{Salix monticola} male catkin 5x; sap of \textit{Salix amygdaloides}; mud 10x.

\textit{Nymphalis californica} (Boisduval) prefers whitish, sometimes yellow, flowers: \textit{Calyptridium umbellatum} white; \textit{Ceanothus fendleri} white; \textit{Eriogonum umbellatum} yellow; \textit{Prunus americana} white 2x; \textit{Prunus virginiana} white; \textit{Rhus aromatica} trilobata yellowish; mud 8x.

\textit{Nymphalis antiopa} (Linnaeus) visits flowers less often than most butterflies; it visits whitish and yellow flowers, sometimes ochre, pink, and purple ones. It also visits catkins, and frequents tree sap and fruit and fruit bait, and visits mud. \textit{Arctostaphylos} (manzanita, Calif, photo); \textit{Asclepias speciosa} pink; \textit{Asclepias syriaca} pink; \textit{Chrysothamnus nauseosus} yellow 10x; \textit{Cirsium arvense} purple; mustard? tiny white; \textit{Physocarpus monogynus} white; \textit{Prunus americana} white 17x; \textit{Prunus domestica} white; \textit{Prunus virginiana} white 3x; \textit{Tilia americana} yellowish-cream; \textit{Tilia europaea} ochre 4x; yellow fungous stuff exuding from \textit{Salix irrorata} trunk base; \textit{Salix exigua} [catkin] 2x Anne U. White; \textit{Salix monticola} catkin 5x; sap of \textit{Populus angustifolia}; sap of \textit{Populus deltoides monilifera}; sap of \textit{Populus tremula tremuloides} 6x (at least one observed upside down there, thus approaching from above); sap of \textit{Salix amygdaloides} 6x; sap of \textit{Salix exigua} 3x (one aimed down, one sideways, one landed head-up then flew); sap of \textit{Ulmus pumila}; apples rotten and vineyard 2x; fruit bait of peach etc. 6x; mud 5x.

\textit{Polygonia interrogationis} (Fabricius): \textit{Chrysothamnus nauseosus} yellow; \textit{Monarda fistulosa} rose-purple; \textit{Nepeta cataria} white; \textit{Tilia americana} yellowish-cream; rotten \textit{Pyrus malus} crabapple; mud 4x. Internet photos show it on sap.

\textit{Polygonia comma} (T. Harris): \textit{Asclepias syriaca} pink; \textit{Chrysanthemum} hybrid ~white; \textit{Cirsium arvense} purple. Internet photos show it on sap.

\textit{Polygonia satyrus} (W. Edwards) visits yellow and white and sometimes purple flowers, frequents tree sap and fruit bait, and visits Salicaceae catkins and mud: \textit{Arctium minus} rose-purple 3x; \textit{Barbara orthoceras} yellow; \textit{Berberis} (\textit{Mahonia}) \textit{repens} yellow; \textit{Chrysothamnus nauseosus} yellow; \textit{Cirsium arvense} purple 1x + var. \textit{incanum} 1x; \textit{Crataegus} \textit{erythropa} white; mustard? white tiny; \textit{Physocarpus monogynus} white 2x; \textit{Prunus virginiana} white; \textit{Taraxacum officinale} yellow; catkin \textit{Salix monticola} 6x; sap of trees (of \textit{Salix amygdaloides} 2x, of \textit{Salix bebbiana} 1x, of \textit{Salix exigua} 2x, of \textit{Populus deltoides monilifera} 1x, of \textit{Ulmus pumila} 1x); fruit bait 208x; mud 7x.


\textit{Polygonia gracilis zephyrus} (W. Edwards) visits yellow and white flowers, sometimes blue and purple and pink, frequents fruit bait and sap (even dung and honeydew) and mud: \textit{Anaphalis margaritacea} whitish 4x; \textit{Antennaria parvifolia} whitish 4x; \textit{Apocynum androsaemifolium} pinkish-white 2x; \textit{Arctostaphylos uva-ursi} whitish; \textit{Arnica cordifolia} yellow 4x; \textit{Arnica mollis} yellow 2x; \textit{Aster ascendens} usually bluish; \textit{Aster glaucodes} white to violet; \textit{Aster laevis} var. \textit{geyeri} blue; \textit{Aster porteri} white; \textit{Asteraeae} yellow 2x; \textit{Barbara orthoceras} yellow 4x; \textit{Berberis} (\textit{Mahonia}) \textit{repens} yellow; \textit{Calyptridium umbellatum} white; \textit{Ceanothus fendleri} white 4x; \textit{Centaurea diffusa} white; \textit{Chrysothamnus nauseosus} yellow 194x; \textit{Cirsium arvense} purple 2x; \textit{Cirsium scopulorum} yellow-white; \textit{Erigeron compositus} white to rose-blue; \textit{Erigeron ursinus} blue-purplish; \textit{Eriogonum flavum} yellow; \textit{Eriogonum umbellatum} yellow; \textit{Erysimum ~capitatum} yellow; \textit{Geranium caespitosum} pink; \textit{?Heterotheca villosa} yellow \textit{Asteraeae}; \textit{Jamaica americana} white; mustard? white tiny; \textit{Physocarpus monogynus} white 2x; \textit{Prunus americana} white 7x; \textit{Ribes cereum} pinkish-white 10x incl. Janet Chu; \textit{Rubus idaeus melanolasius} white; \textit{Rudbeckia laciniata} amplus yellow 4x; \textit{Sedum lanceolatum} yellow; \textit{Senecio canus} yellow 12x (one male had yellow pollen on uns); \textit{Senecio integrerrimus} yellow “canus”; \textit{Senecio triangularis} yellow 2x; \textit{Senecio yellow} 3x; \textit{Solidago altissima}
“canadensis” yellow 3x; *Solidago* ~missouriensis yellow; *Solidago* simplex var. *nana=decumbens* yellow; sunflower yellow; *Taraxacum officinale* yellow 11x (one covered with dandelion pollen); *Thermopsis divaricata* yellow; *Thlaspi* (Noccaea) *fendleri* “montanum” white; *Wyethia* amplexicaulis yellow; *Salix monticola* catkin 4x; dung of dog; algae-water; aphid honeydew sucking on *Salix lemmonii* ~5x; berries ripe of *Rubus delicious* often; sap of *Salix amygdaloides* 2x; fruit bait 45x; mud 19x.

*Polygonia* *faunus* (W. Edwards) (mostly ssp. *faunus* [W. Edwards]) visits flowers of all colors except perhaps pure red, frequent tree sap and fruit tree bait and mud; *Achillea* *millefolium* “*lanulosa*” white; *Arctostaphylos uva-ursi* whitish; *Aster laevis* var. *geyeri* blue 3x; *Aster foliacaeus* purple [for form *silvius*]; *Aster* blue some; *Asteraceae* yellow many (preferred); *Barbara* *orthoceras* yellow; *Chrysothamnus nauseosus* yellow 10x [incl. *P. faunus* form *silvius*]; *Cirsium* *arvense* purple 2x; *Erigeron* *speciosus* blue; *Machaeranthera* *bigelovii* purple/violet 3x; *Ribes inermis* pinkish; *Rudbeckia* *hirta* yellow; *Rudbeckia laciniata* ampla yellow; *Solidago altissima* “*canadensis*” yellow; sunflower yellow 11x; *Taraxacum officinale* yellow 14x; catkin *Salix monticola* 9x; sap of *Populus tremula* *tremuloides* 5x; sap of *Salix bebbiana*; fruit bait 33x; mud 11x. Ssp. *cenveray* Scott visited: *Senecio triangularis* yellow; bait 50x.

*Junonia coenia* Hübner visits all colors of flowers (Scott 1975c studied this species but listed no specific flowers visited); *Achillea* *millefolium* “*lanulosa*” white 9x; *Aesculus californica* whitish 1x; *Asclepias incarnata* pink 2x; *Aster* ?*chilensis* bluish; *Aster ericoides* var. *falcatus* white; *Asteraceae* blue 1x; *Asteraceae* shrub yellow 3x; *Baccharis salicifolia* whitish 10x; *Brassica nigra* yellow 119x; *Brodiaea pulchella* blue zero visits; *Centranthus ruber* blue-red 25x; *Chrysothamnus nauseosus* yellow 2x; *Cirsium arvense* purple 48x; *Eriodictyon* white to lavender; *Eriogonum latifolium* white 16x; *Erodium ~cicutarium* violet 2x; *Eschscholzia californica* orange 1x; *Geranium ?carolinianum* red; *Grindelia stricta* yellow 2x; *Lamiaceae* violet 2x; *Lupinus* blue sp. 2x; *Lythrum salicaria* purple; *Medicago sativa* violet 7x; *Melilotus officinalis* yellow 10x; *Plantago lanceolata* white 4x; *Polygonum pensylvanicum* pink; *Pycnanthemum tenuifolium* white; *Ranunculus* yellow ~15x; *Raphanus sativus* bluish-white 3x; *Sisyrinchium bellum* blue-purple 2x; small primrose violet; sunflower big yellow; tall white flower 1x; *Taraxacum officinale* yellow 3x; *Trifolium repens* whitish 3x; *Wyethia helenoides* yellow 52x; *Zinnia ~elegans* small hybrids white; mud 3x.

*Junonia evarete nigrosuffusa* W. Barnes and McDunnough and hybrids: yellow *Lantana*-type flower with legume leaves; small primrose violet; *Ranunculus* yellow ~7x; *Zinnia grandiflora* 5-10 cm roadside yellow-with-orange-center sunflowers 10x.

**NYMPHALIDAE, NYMPHALINAE, MELITAEINI**

*Euphydryas* *colon* wallacensis Gunder: mud.

*Euphydryas chalcedona* (E. Doubleday) (Calif. area) mostly visits whitish flowers: *Aesculus californica* whitish 2x; *Carduus* ~purple several; *Cirsium canescens* whitish; *Eriodictyon* white to lavender; *Heracleum sphondylium montanum=lanatum*? white; *Lamiaceae* 2x; *Nasturtium officinale* white; sunflowers yellow; mud.

*Euphydryas chalcedona sierra* (W. Wright): *Calytridium umbellatum* white many; *Lamiaceae* purple many.

*Euphydryas anicia brucei* (W. Edwards) visits whitish and yellow, and less often blue and purplish flowers etc.; *Cirsium scariosum* lavender-white; *Dryas octopetala* white; *Erigeron pinnatifolius* blue; *Erigeron ursinus* blue-purple 2x; *Haplopappus* (*Toneatus*) *pygmaeus* yellow; *Hymenoxys* (*Tetranurus*) brevifolia yellow; *Hymenoxys grandiflora* yellow 7x (and male thorax uns covered with its pollen); *Ipomopsis globularis* purplish-white; *Mertensia alpina* blue 2x; *Senecio canus* yellow; *Senecio crassulus* yellow 2x; *Silene acaulis* pink/purplish 3x; *Thlaspi* (Noccaea) *fendleri* “*montanum*” white 2x; *Tragopogon dubius* major lemon-yellow.

*Euphydryas anicia* ssp. visit yellow and whitish flowers, sometimes orange or pink: *Achillea* *millefolium* “*lanulosa*” white 2x; *Anaphalis margaritacea* whitish 2x; *Antennaria parvifolia* whitish; *Apocynum androsaemifolium* pinkish-white 119x (12 were caught by proboscis stuck in stamen column slits, most dead); *Asclepias speciosa* pink (2 pollinia on leg); *Astragalus* yellow; *Ceanothus* *fendleri* white 17x; *Cerastium strictum* “*arvense*” white; *Crepis* (*Psilochoenia*) *atifaria* yellow; *Cystanthus virgata* white 9x; *Erigeron compositus* white to rose-blue dissected 2x; *Erigeron pumilus* usually white; *Eriogonum
flavum yellow 3x; Eriogonum umbellatum yellow 19x; Erysimum capitatum (yellow 2x, orange 5x); Euphorbia esula yellow-green 4x; Gaillardia aristata yellow with red-purple base 38x (6 had yellow thorax due to Gaillardia pollen); Galium septentrionale white; Geum aleppicum yellow; Harbouria trachypleura yellow 2x; Helianthus pumilus yellow 15x; Heterotheca villosa yellow 25x; Hymenoxys grandiflora yellow; Jamesia americana white 15x; Lesquerella montana yellow; Machaeranthera pinnatifida=Haplopappus spinulosus yellow; Physocarpus monogynus white 19x; Potentilla fissa yellow (and 1 briefly); Prunus virginiana white 10x; Raphanus deliciosus white 2x; Rudbeckia hirta yellow 4x; Sedum lanceolatum yellow 49x incl. one dead on flower; Senecio canus yellow 14x; Senecio fendleri yellow 63x; Senecio integrerrimus yellow 2x; Senecio yellow 2x; sunflower yellow; Symphoricarpus albus pink 3x; mud 84x.

Euphydryas bernadetta Leussler including ssp. rorina Scott and M. Fisher: small Arnica mollis yellow; Aster glaucodes ~white to yellow 2x; Eriogonum subalpinum [pinkish]-cream 2x; Eriogonum umbellatum yellow; Oxytropis sericea whitish; Senecio canus yellow 5x; Taraxacum officinale yellow 2x; mud 4x (3 flew down-valley apparently to seek mud).

Euphydryas editha (Boisduval) seems to prefer yellow and white flowers. Ssp. editha: Achillea millefolium "lanulosa" white; Eriodictyon californicum white to lavender 2x. Ssp. rubidunda: Asteraceae yellow, Mimulus ?guttatus yellow with red spots. Ssp. lehmani: Asteraceae (body covered with yellow Asteraceae pollen); Eriogonum subalpinum (pinkish)-cream. Ssp. hutchinsi: Lesquerella parvula yellow; Senecio fendleri yellow; sunflower yellow 4" (not Psilostrophe bakeri?).

Euphydryas gilletti (W. Barnes): Rosa ~pink sp.; mud.

Poladryas minuta near-minuta (W. Edwards) (NE New Mex.) visits yellow flowers: Asteraceae yellow 8x; Gaillardia ~aristata yellow with orange base; Gutierrezia sarothrae yellow none or maybe once; Heterotheca villosa yellow; Senecio spartioides yellow; Senecio-type yellow; ~Stephanomeria? yellow; Thelesperma megapotamicum yellowish.

Poladryas minuta arachne (W. Edwards): usually visits yellow flowers, sometimes white, orange, pink, blue, or purple flowers, and strangely NO records on mud! (Scott 1974a studied this species): Apocynum androsaemifolium pinkish-white 2x; Asclepias speciosa pink; Aster ascendens blue 6x; Asteraceae yellow; Ceanothus fendleri white 4x; Cirsium arvense purple; Clematis ligusticifolia white; Cryptantha jamesii white 4x; Erigeron pumilus 2x + white 3x + bluish-white 14x; ~Erigeron ursinus blue 2x; Erigeron ~blue; Eriogonum effusum white; Eriogonum umbellatum yellow 2x; Erysimum capitatum usually orange 1x + yellow 1x; Grindelia subalpina yellow; Harbouria trachypleura yellow; Heterotheca villosa yellow 91x; Hymenopappus filifolius yellow 4x; Hymenoxys (Tetranurus) acaulis yellow; Machaeranthera patersonii purple/violet 1 sec.; Mertensia ?lanceolata blue; Potentilla ~hippiana yellow 4x; Potentilla fissa yellow; Sedum lanceolatum yellow 15x; Senecio canus yellow 2x; Senecio fendleri yellow 16x; Senecio integrerrimus yellow; Senecio yellow small; Senecio? yellow 10x; Solidago (Euthamia) occidentalis yellow; Solidago simplex yellow 3x; Tagetes patula orange; yellow flowers 2x.

Poladryas minuta monacha (J. Comstock): Achillea millefolium “lanulosa” white 9x.

Microtia dymas (W. Edwards): Asteraceae shrub yellow; Baccharis whitish 20x; Polygonum ?pensylvanicum pink some; tiny white-yellow-flowered tiny-leaf “Cercocarpus” several; Valeriana ~white/rose some.

Microtia (Texola) elata (Hewitson): Baccharis whitish 30x; Polygonum ?pensylvanicum pink many; Senecio yellow; sunflower yellow; Valeriana ~white/rose some.

Chlosyne janaia (Drury): sunflower yellow several.

Chlosyne definita (E. Aaron): yellow Asteraceae.

Chlosyne endeis (Godman and Salvin): sunflower yellow several.

Chlosyne chinatiensis (Tinkham): Helianthus nuttallii yellow 2x.

Chlosyne leanira fulvia (W. Edwards) prefers yellow or white flowers: Allium textile white to light-rose 2x; Asteraceae white shrub many; Asteraceae yellow 6x; Ceanothus fendleri white; Heterotheca villosa yellow several; Nasturtium officinale white.

Chlosyne leanira alma (“Strecker”) =flavodorsalis (Austin and M. Smith): Leucelene ericoides=Aster arenosus white.
Chlosyne leanira leanira (C. Felder and R. Felder): Achillea millefolium “lanulosa” white 6x; Asteraceae yellow.

Chlosyne nycteis drusius (W. Edwards) visits whitish/yellow flowers especially of its hostplant Rudbeckia laciniata: Apocynum androsaemifolium pinkish-white 9x; Cirsium arvense purple; Eriogonum umbellatum yellow 2x; Gaillardia aristata yellow with red-purple base; Heracleum sphondylium montanum=lanatum white; Jamesia americana white 2x incl. Janet Chu; Melilotus officinalis yellow; Prunus virginiana white; Rudbeckia hirta yellow 9x; Rudbeckia laciniata ampla yellow 23x; Senecio triangularis yellow 10x; mud.

Chlosyne gorgone (Hübner) visits yellow and less often white flowers, seldom bluish or light reddish, and often visits mud: Agoseris glauca yellow (gray thistle-like leaf); Allium textile white to light-rose 10x; Antennaria parvifolia whitish; Apocynum androsaemifolium pinkish-white 2x; Arnica fulgens yellow; Aster lanceolatus hesperius bluish-white; Asteraceae yellow 2x; Astragalus parryi whitish; Barbarea orthoceras yellow 12x; Bidens cernua yellowish; Buddleja davidii pink-purple 5 min.; Ceanothus fendleri white; Cerastium strictum “arvense” white 5x; Chrysanthemum leucanthemum white; Cirsium arvense var. incanum purple; Cleome (Peritoma) serrulata pinkish; Crepis (Psilochnia) atriplicifolia yellow; Erigeron pumilus usually white 5x; Eriogonum effusum white; Eriogonum jamesii cream2x; Eriogonum umbellatum yellow 3x; Erysimum asperum yellow 2x; Gaillardia aristata yellow with red-purple base 3x; Helianthus annuus yellow 2x; Helianthus petiolaris yellow 5x; Helianthus pumilus yellow 5x; Heracleum sphondylium montanum=lanatum white; Heterotheca canescens yellow; Heterotheca villosa yellow 7x; Jamesia americana white; Lepidium montanum white; Lesquerella montana yellow 2x; Malva neglecta whitish; Medicago sativa violet 2x; Monarda fistulosa rose-purple; Phacelia heterophylla ~pinkish 2x; Physocarpus monogynus white 16x; Polygonum pensylvanicum pink 2x; Potentilla fissa yellow 6x; Prunus virginiana white 8x; Ranunculus acris yellow; Rhus aromatica trilobata yellowish 2x; Rubus delicious white an unpopular flower (one 1/3 sec, another hovered over 1 sec then flew); Rudbeckia hirta yellow 3x; Sedum lanceolatum yellow 4x; Senecio canus yellow 22x; Senecio fendleri yellow 51x; Senecio integerrimus yellow 5x; Senecio spartioides yellow; Senecio yellow 3x; Solidago altissima "canadensis" yellow 3x; Solidago missouriensis yellow 2x; Solidago (Euthamia) occidentalis yellow 2x; Taraxacum officinale yellow 7x; Thalictrum dasycarpum whitish; Thlaspi (Noccaea) fendleri "montanum" white; Verbesina encelioides golden-orange 7x; dund 11x (1-2 of human, 1 of horse, but usually of dog [3 males found dead on one dog dung that evidently killed them]); mud 115x.

Chlosyne whitneyi damoetas (Skinner) visits yellow, bluish, and sometimes pinkish or white flowers: Arnica rydbergii yellow 4x; Erigeron leioneris blue 5x; Erigeron pinnatisectus blue/purple; Erigeron pygmaeus blue/purple; Erigeron ~simplex usually white; Haplopappus (Tonestus) yallii yellow; Polygonum bistortoides whitish-pink landed on 1/3 sec. left quickly; Potentilla ~yellow; Senecio fremontii var. bitoides yellow 5x; Senecio yellow 4x; Silene acaulis pink/purplish 4x; sunflower yellow 1x.

Chlosyne whitneyi whitneyi (Behr): “Aster” sunflower with wavy leaves yellow; Erigeron compositus blue to pinkish or white; Wyethia ~angustifolia yellow.

Chlosyne sterope acastus(W. Edwards): mud 2x.

Chlosyne sterope arkanyon M. Fisher and Scott: Erysimum asperum yellow 4x; Prunus virginiana white; Schoenocrambe linifolia yellow 18x.

Chlosyne palla (Boisduval) ssp. visit yellow and white flowers, seldom bluish or pinkish: Ssp. calydon (W. Holland): Apocynum androsaemifolium pinkish-white; Ceanothus fendleri white; Erigeron speciosus blue; Helianthus pumilus yellow; Jamesia americana white; Rudbeckia hirta yellow 3x; Sedum lanceolatum yellow; Senecio fendleri yellow 2x; Senecio triangularis yellow several; mud 2x. Ssp. flavula: Erigeron speciosus blue; Eriogonum subalpimum [pinkish]-cream; Senecio triangularis yellow 4x. Ssp. palla: Allium sp. ?pale-pinkish; Ceanothus white; Eriodictyon white to lavender; Ranunculus yellow. Ssp. australomontana: Achillea millefolium “lanulosa” white some; Taraxacum officinale yellow; Trifolium ?whitish-pinkish some.

Chlosyne hoffmannii (Behr): Calytridium umbellatum white; Senecio yellow.

Phyciodes texana (W. Edwards): Asteraceae shrub yellow; ~Baccharis sarothroides whitish many.
**Phyciodes mylitta** (W. Edwards) visits whitish and yellow flowers at least: *Aesculus californica* whitish; *Baccharis salicifolia* whitish; *Cirsium canescens* whitish; *Gutierrezia sarothrae* yellow; sunflower yellow for *P. mylitta arizonensis* (like *Helianthus pumilus* but leaves hairless).

**Phyciodes pallida** (W. Edwards) mostly visits yellow flowers, seldom white/blue/violet, and visits mud: *Barbarea orthoceras* yellow 2x; *Ceanothus fendleri* white; *Erigeron flagellaris* white; *Eriogonum umbellatum* yellow; *Grindelia squarrosa* yellow; *Heterotheca villosa* yellow 2x; *Lupinus argenteus* blue 2 caught by crab spider on; *Medicago sativa* violet; *Mellilotus officinalis* yellow; *Potentilla hippiana* yellow; *Rudbeckia hirta* yellow 4x; *Rudbeckia laciniata ampla* yellow; *Sedum lanceolatum* yellow 2x; *Senecio canus* yellow; *Senecio fendleri* yellow; *Sisymbrium altissimum* yellow; *Solidago altissima* “canadensis” yellow 2x; *Taraxacum officinale* yellow; mud 4x.

**Phyciodes orseis** (W. Edwards); Ssp. *orseis* visited *Calytridium umbellatum* white; *Senecio* yellow. Ssp. *herlani* Bauer visited *Phacelia* violet.

**Phyciodes tharos orantain** Scott visits all colors except perhaps pure red: *Aster ericoides* white 12x; *Aster laevis* var. *geyeri* blue 2x; *Aster lanceolatus hesperius* bluish-white 6x; *Bidens cernua* yellowish 4x; *Cirsium arvense* var. *incanum* purple; *Euphorbia* “Agaloma” marginata green and white 2x; *Gaillardia aristata* yellow with red-purple base; *Heterotheca ~canescens* yellow; *Machaeranthera canescens* deep blue/purple; *Medicago sativa* violet 4x; *Senecio ~spartioides* yellow 2x; *Solidago altissima* “canadensis” yellow; *Solidago missouriensis* yellow; *Solidago (Euthamia) occidentalis* yellow 3x; *Taraxacum officinale* yellow; *Trifolium fragiferum* pink; *Verbena hastata* purplish-blue 2x.

**Phyciodes tharos tharos** (Drury) visits all colors of flowers except perhaps pure red, and mud: *Asclepias incarnata* pink; *Asclepias syriaca* pink (pollinia on leg); *Aster ericoides* white ~5x; *Aster simplex* whitish; ~*Astragalus gracilis* var. *parviflorus* purple 2x; *Cirsium arvense* purple; *Echinacea angustifolia* purple; *Helenium autumnale* yellow 4x; *Helianthus annuus* yellow 2x; *Helianthus tuberosus* yellow 31x; *Heterotheca canescens* yellow; *Medicago sativa* violet 9x; *Mellilotus officinalis* yellow; *Prunus virginiana* white; *Ranunculus* yellow; *Rudbeckia hirta* yellow 2x (This Old House TV show); *Solidago altissima* “canadensis” yellow; *Solidago yellow*; *Trifolium repens* whitish 9x; *Viola* ornamental blue briefly; *Valeriana ~white/rose*; mud 4x.

**Phyciodes cocytus selenis** (W. Kirby) visits nearly all colors especially yellow, and mud: *Apocynum androsaemifolium* (the favorite) pinkish-white 59x; *Arnica mollis* yellow 2x; *Aster ericoides* white 2x; *Aster laevis* var. *geyeri* blue; *Barbarea orthoceras* yellow 2x; *Bidens ~cernua* yellowish; *Bidens ~frondosa* yellowish; *Ceanothus fendleri* white 3x; *Cirsium arvense* purple; *Crepis (Psilochnenia) atribarba* yellow briefly; *Erigeron formosissimus* lavender; *Erigeron speciosus* blue (some violet-white) 4x; *Eriogonum umbellatum* yellow 3x; *Erysimum capitatum* orange; *Euphorbia esula* yellow-green 3x; *Gaillardia aristata* yellow with red-purple base 2x; *Grindelia squarrosa* yellow; *Hackelia floribunda* bluish-white; *Helianthus pumilus* yellow; *Heterotheca villosa* yellow 7x; *Monarda fistulosa* rose-purple 2x; *Rudbeckia hirta* yellow 41x; *Sedum lanceolatum* yellow 3x; *Senecio fendleri* yellow 5x; *Senecio pseudaureus* yellow; *Senecio triangulares* yellow 2x; *Solidago altissima* “canadensis” yellow; *Taraxacum officinale* yellow; *Verbena hastata* purplish-blue; mud 12x.

**Phyciodes diminutor diminutor** Scott (S. Minn.) visits yellow flowers (sometimes white), and carrion and mud: *Erigeron philadelphicus* white 14x; *Helianthus divaricatus* yellow; *Helianthus tuberosus* yellow; *Heliopsis helianthoides* yellow 47x; *Pastinaca sativa* yellow; *Senecio aureus* yellow; *Taraxacum officinale* yellow; *Trifolium repens* whitish; carrion (dead all-brown hawk 3x); mud 2x.

**Phyciodes batesii** (Reakirt); ssp. *apsaalooke* Scott and *anasazi* Scott visits most colors (yellow white blue purple and violet) of flowers, except perhaps red. Ssp. *apsaalooke* visited *Achillea millefolium* “lanulosa” white; *Aster glaucescens* white to violet; *Grindelia squarrosa* yellow; *Medicago sativa* violet 10x; mud. Ssp. *anasazi* visited *Aster glaucescens* white to violet 2x; *Cirsium arvense* purple 3x; *Erigeron speciosus* blue 2x; *Eriogonum umbellatum* yellow; *Machaeranthera grindelioides* yellow; *Medicago sativa* violet 2x; *Rudbeckia laciniata ampla* yellow 11x; *Viguiera (Heliomeris) multiflora* yellow; carrion (dead cow in shade); mud 2x.

**Phyciodes pulchella camillus** W. Edwards visits all colors including yellow, white, and blue-purple, except perhaps red, especially of its hostplant *Aster*, and frequents mud: *Achillea millefolium* “lanulosa” white.
Apodemia nais

Apodemia virgulti duryi

Apodemia

Emesis zela

Calephelis rawsoni arizonensis

Calephelis nemesis

Phyciodes picta

Phyciodes pulchella

Apocynum fendleri

var. whitish blue; eucosmus white. yellow; var. purple; Taraxacum officinale yellow 53x; Rudbeckia hirta 2x; 10x; p montana yellow 37x; septentrionale Eriogonum Eri

Cryptantha jamesii white 3x; Barbarea orthoceras

Aster porteri glaucodes 15x; pinkish 2x; gera
don pumilus Allium textile

lonchophyllum incanum

Musineon divaricatum

Eriogonum androsaemifolium vaguely like cream many;

Centaurea pink pea; sunflower yellow; sunflower yellow hispid

depth blue/purple blue 2x Clen

Helianthus ~petiolaris; mud 170x. white 68x + var. 

Eriogonum flavum

Eriogonum subalpinum [pinkish]-cream 6x;

eyrusimum capitatum orange 2x; Eupatorium maculatum blue; Galium septent
tionale white; Grindelia squarrosa yellow 4x; Gutierrezia sarothrae yellow; Harbournia

trachypeleura yellow 2x; Helianthus ~petiolaris yellow; Helianthus pumilus yellow; Heterotheca villosa yellow 37x; Hymenopappus filifolius yellow 2x; Hymenoxys (Tetraneuris) acaulis yellow; Lesquerella montana yellow; Liatris punctata purplish; Linum lewisi

ii blue 1x + one only ½ sec.; Machaeranthera canescens deep blue/purple 2x and var. rubrotinctus blue 2x; Machaeranthera pattersoni purple/violet 17x; Machaeranthera pinnatifida =Hoploppappus spinulosus yellow; Medicago sativa violet 10x; Musineon divaricatum yellow; Phyla=Lippia cuneifolia white 5x; Physocarpus monogynus white 2x; Potentilla yellow; Prunus virginiana white 2x; Ranunculus ~yellow; Rorippa sinuata yellow; Rudbeckia hirta yellow 3x; Sedum lanceolatum yellow 7x; Senecio canus yellow 19x; Senecio fendleri yellow 53x; Senecio integerrimus yellow 2x; Senecio spartioides yellow 2x; Senecio tridenticulatus yellow; Senecio yellow 2x; Solidago ~missouriensis yellow; Solidago (Euthamia) occidentalis yellow; Taraxacum officinale yellow 5x; Thlaspi (Noccaea) fendleri “montanum” white; Trifolium pratense red-purple; Trifolium repens whitish; mud 170x.

Phyciodes pulchella (Boisduval) ssp. Ssp. montana (Behr): Senecio yellow. Ssp. deltarufa Scott: Aster chilensis bluish some; purple flower. Ssp. pulchella: Asteraceae yellow; Cirsium arvense purple-blue. Phyciodes picta (W. Edwards) evidently visits all colors of flowers: Aster ericoides white; Cirsium arvense var. incanum purple; Heterotheca villosa yellow 4x; Medicago sativa violet 20x; Solidago ~missouriensis yellow; Valeriana ~white/rose.

LYCAENIDAE, RIODININAE

Calephelis nemesis (W. Edwards): Asclepias tuberosa orange; Baccharis sarothroides whitish; Clematis white.

Calephelis rawsoni arizonensis McAlpine: Asclepias red; aster white 2x; Baccharis whitish; ~Lathyrus eucosmus pink pea; sunflower yellow; sunflower yellow hispid-leaved.

Lasaia maria Clench: Acacia greggii yellow.

Emesis zela cleis (W. Edwards): Baccharis whitish 3x; ~Baccharis sarothroides white; Erigeron speciosus blue; Polygonum ?pensylvanicum pink; mud.

Emesis ares (W. Edwards): yellow sunflower (like Helianthus pumilus yellow but leaves hairless) 2x; mud.

Apodemia prefers white or yellow flowers.

Apodemia mormo (C. Felder and R. Felder) ssp.: A. mormo langei J. Comstock: Eriogonum latifolium whitish 22x. A. mormo mormo: Chrysothamnus nauseosus yellow; ~Eriogonum compositum cream “dense Eriogonum vaguely like effusum” 11x; Eriogonum white (bluish-gray plant with no or small leaves, bushy 1.5’ tall); Eriogonum corymbosum var. orbiculatum white 12x; Eriogonum longophyllum var. longophyllum cream many; Eriogonum wrighti white 18x. A. mormo pueblo Scott: Ceanothus fendleri white; Cryptantha fendleri white; Eriogonum jamesii cream ~49x; Heterotheca villosa yellow 2x; white flower.

Apodemia virgulti duryi (W. Edwards): Asteraceae yellow; Eriogonum wrighti white several.

Apodemia nais (W. Edwards) clearly prefers the white flowers of its caterpillar hostplant Ceanothus fendleri: Apocynum androsaemifolium pinkish-white 10x; Ceanothus fendleri white ~74x; Eriogonum jamesii.
yellow-cream; *Eriogonum flavum* yellow; *Heterotheca villosa* yellow several; *Holodiscus discolor* whitish; *Rudbeckia hirta* yellow; *Rudbeckia laciniata ampla* yellow; *Sedum lanceolatum* yellow; mud 10x.

**Apodemia palmerii** (W. Edwards): Baccharis? shrub white; *Eriogonum wrightii* white. *Lymnas cephise cephise* and many other butterfly species fed on rayless Asteraceae with long heads of flowers on bush.

**LYCAENIDAE, LYCAENINAE, LYCAENINI**


*Lycaena cupreus snowi* visits yellow flowers almost exclusively, rarely white or purple: *Arnica cordifolia* yellow; *Arnica molla* yellow; *Arnica rydbergii* yellow; Asteraceae yellow 2x; *Erigeron simplex* purple (rarely white); *Geum (Acomastylis) rossii* turbinatum 2x; *Haplopappus (Tonestus) hyllus* yellow; *Haplopappus (Tonestus) pygmaeus* yellow 3x; *Potentilla diversifolia* yellow; *Senecio dimorphophyllus* yellow; *Senecio fremontii* yellow 14x; *Senecio werneriaefolius* yellow; *Senecio yellow*; yellow flowers. *L. cupreus cupreus*: *Calytridium umbellatum* white.

*Lycaena mariposa* (Reakirt): *Senecio* yellow.

*Lycaena nivalis* (Boisduval) visits whitish and yellow flowers. Ssp. *browni*: *Anaphalis margaritacea* whitish; *Antennaria parvifolia* whitish; *Gallium* whitish; *Rudbeckia hirta* yellow; *Sedum lanceolatum* yellow; *Senecio yellow*. Ssp. *nivalis*: *Calytridium umbellatum* white some; mud.

*Lycaena helloides* (Boisduval) visits whitish and yellow, sometimes purple/violet and pink flowers: *Apocynum androsaemifolium* pinkish-white; *Aster “asters white”* Ore.; *Aster ericoides* white 10x; *Aster glauces* white to violet; *Aster lanceolatus hesperius* bluish-white 24x; *Baccharis salicifolia* whitish; *Bidens cernua* yellowish 5x; *Bidens frondosa* yellowish 35x; *Chrysothamnus nauseosus* yellow 3x; *Cirsium arvense* purple 3x + var. *incanum* 1x; *Croton texensis* whitish; *Eriogonum umbellatum* yellow; *Grindelia squarrosa* yellow; *Lepidium virginicum white* 6x; *Machaeranthera canescens* deep blue-purple 15x; *Machaeranthera pattersoni* purple/violet blue 9x; *Medicago sativa* violet 5x; *Melilotus officinalis* yellow; *Mentha arvensis* pink; *Polygonum amphibium coccineum* pink 85x; *Polygonum pensylvanicum* pink 6x; *Senecio spartioides* yellow 2x; *Solidago altissima “canadensis”* yellow; *Solidago (Euthamia) occidentalis* yellow 4x.

*Lycaena florae* (W. Edwards) visits yellow, bluish, whitish, sometimes purple etc. flowers (Scott 1978 studied this species): *Achillea millefolium “lanulosa”* white 26x (+ frequently, Scott 1978); *Anaphalis margaritacea* whitish 20x; *Antennaria parvifolia* whitish; *Antennaria rosea* rosy-whitish 7x; *Arnica parryi* (rayless) yellow 7x + 1 sec.; *Arnica rydbergii* yellow 2x; *Aster ascendens* usually bluish; *Aster foliaceus* var. *apricus* blue-violet sometimes purple 3x; *Aster laevis var. geyeri* blue common; *Asteraceae* yellow several; *Chrysothamnus nauseosus* yellow; *Cirsium arvense purple*; *Cirsium clavatum=centaurea* yellowish-white; *Erigeron ~blue*; *Erigeron elatior* pink-purple 8x; *Erigeron ~species* bluish 34x (+ frequently, Scott 1978); *Eriogonum ursinus* blue/violet 76x; *Eriogonum subalpinum* cream 9x; *Fragaria virginiana* glauca white; *Galium ~whitish*; *Haplopappus (Oreochrysum) parryi* yellow fls. dark stem 51x; *Heterotheca pumila* yellow 39x; *Heterotheca villosa* yellow; *Potentilla fruticosa* yellow 16x; *Potentilla gracilis* yellow 4x; *Potentilla pulcherrima* yellow 23x + 1/3 sec.; *Potentilla sp. yellow* 2x; *Pseudocymopterus montanus* yellow 1x + 1 sec.; *Rudbeckia hirta* yellow 15x; *Sedum lanceolatum* yellow; *Senecio atratus* yellow 21x; *Senecio tall yellow* 2x; *Solidago ~alissima “~canadensis”* yellow; *Solidago multiradiata* yellow 4x; *Solidago simplex* var. *nana=decumbens* yellow 5x + another only 1-2 sec.

*Lycaena hylas* (Cramer) =thoe Guérin Méneville visits yellow or whitish, sometimes purple/violet/blue or pink, flowers: *Apocynum androsaemifolium* pinkish-white several; *Apocynum cannabinum* whitish; *Asclepias speciosa* pink 9x (incl. pollinia on leg 4x); *Aster ericoides* white 3x; *Aster lanceolatus hesperius* bluish-white 2x; *Bidens frondosa* yellowish 8x; ~Carduus nutans rose-purple; *Cirsium arvense* purple 3x; *Helianthus nutallii* yellow; *Helianthus tuberosus* yellow 2x; *Heliopsis helianthoides* yellow; *Lamiaceae* small pale violet flowered; *Polygonum amphibia amphi coccineum* pink 11x; *Solidago altissima*
“canadensis” yellow; Solidago missouriensis yellow 2x; Solidago (Euthamia) occidentalis yellow 2x; Solidago (Oligoneuron) rigida yellow; Verbena hastata purplish-blue.

Lycaena gorgon (Boisduval): Achillea millefolium “lanulosa” white; Aesculus californica whitish 3x; Eriodictyon white to lavender.

Lycaena heteronea Boisduval visits yellow (esp. the hostplant) and whitish, sometimes blue/purple/violet or pink flowers, and often visits mud: Achillea millefolium “lanulosa” white 4x; Anaphalis margaritacea whitish 3x; Apocynum androsaemifolium pinkish-white 6x; Aster blue some; Aster porteri white; Ceanothus fendleri white 3x; Chrysothamnus nauseosus yellow 16x (a dozen had pollen on thorax uns); Cirsium arvense purple >102x; Conium maculatum white; Erigeron speciosus pink-blue 6x; Erigeron ursinus blue 19x; Eriogonum flavum yellow 29x; Eriogonum subalpinum [pinkish]-cream 25x; Eriogonum umbellatum yellow 60x [incl. Janet Chu] and var. porteri 1x; Haploppus (Oreocharysum) parryi yellow; Heterotheca pumila yellow; Heterotheca villosa yellow? 15x; Medicago sativa violet 2x; Melilotus alba white; Potentilla fruticosa yellow 4x; Rudbeckia laciniata ampla yellow; Senecio yellow; Senecio atratus yellow 9x; Solidago yellow; Solidago altissima “canadensis” yellow 17x; Solidago missouriensis yellow 13x; Solidago simplex var. nana=decumbens yellow; Tamarix chinensis=ramossissima rosy-white; Tetradyemia canescens yellow sunflower; sap of Salix amygdaloides; mud 14x incl. female.

Lycaena rubidus (Behr) visits yellow or whitish, sometimes bluish/violet/purple or pink, flowers: Achillea millefolium “lanulosa” white 8x; Anaphalis margaritacea whitish 4x; Apocynum androsaemifolium pinkish-white 4x; Apocynum cannabinum whitish; Asclepias speciosa pink 5x; Aster ascendens usually bluish; Aster foliaceus var. apricus purple; Aster glaucescens white to violet; Aster porteri white; Berteroa incana white 4x; Centaurea diffusa lavender; Chrysothamnus nauseosus yellow; Cirsium arvense purple 8x; Cirsium prob. rose-purple; Cleome (Peritoma) serrulata pinkish; Erigeron ~blue; Erigeron elatior pink-purple 8x; Erigeron speciosus blue 2x; Erigeron ursinus blue-purplish 11x; Eriogonum umbellatum yellow; Euphorbia esula yellow-green tiny yellow flowers many; Helianthus petiolaris yellow 4x; Heterotheca villosa yellow 9x; Medicago sativa violet; Melilotus alba white 2x; Melilotus officinalis yellow 3x; Potentilla fruticosa yellow 2x; Potentilla gracilis yellow 3x; Potentilla pulcherrima yellow 2x; Psoralea tenuiflora blue-purple; Rudbeckia hirta yellow; Sedum lanceolatum yellow; Senecio atratus yellow 2x; Senecio triangularis yellow 2x; Solidago missouriensis yellow; Solidago altissima yellow 2x; Solidago simplex var. nana=decumbens yellow; mud 2x.

Lycaena dione (Scudder) visits purple, blue/violet, pink, or whitish flowers, seldom yellow: Apocynum androsaemifolium pinkish-white 2x; Apocynum cannabinum whitish 3x; Asclepias incarnata pink; Asclepias speciosa pink 32x; Carduus nutans rose-purple 4x; Cirsium arvense purple 24x + var. incanum 1x; Cleantis ligusticfolia white; Medicago sativa violet 5x; Ratibida columnifera yellow; Symphoricarpus albus pink; Symphoricarpus occidentalis pink; Trifolium fragiferum pink; Verbena hastata purplish-blue.

Lycaena xanthoides (Boisduval) ssp. visit yellow, sometimes whitish/blue/red: Ssp. nigromaculata J. Emmel and Pratt (Scott and Opler 1975 studied this): Brassica nigra yellow 3x; Centranthus ruber bluish-red 6x; Dipsacus fulvum var. sylvestris blue-white 15x; Foeniculum vulgare yellow; Grindelia stricta yellow ~135x. Shapiro (2007) notes that it prefers Apocynum (esp. A. cannabinum) pinkish-white, Grindelia (only G. camporum) yellow. Marrubium vulgare cream, Lepidium latifolium white, and Oenanthe white or reddish, Tamarix pink. Ssp. xanthoides: Potentilla yellow.

Lycaena xanthoides edithea* xanthoides* “pseudonexa” J. Emmel and Pratt: Eriogonum umbellatum yellow.

Lycaena xanthoides “editha” varul. Kocak =montana W. Field visits yellow or whitish flowers, often blue and sometimes pink: Achillea millefolium “lanulosa” white 7x; Anaphalis margaritacea whitish 4x; Arnica mollis yellow; Chrysothamnus nauseosus yellow 4x; Cirsium clavatum=centaureae yellowish-white; Erigeron ursinus blue 8x; Geranium caespitosum pink 1 sec.; Heterotheca villosa yellow; Melilotus officinalis yellow 2x; Potentilla fruticosa yellow; Potentilla sp. yellow; Rudbeckia hirta yellow; Solidago ~altissima “~canadensis” yellow; Solidago ~multiradiata yellow.

Lycaena arota (Boisduval) prefers white and yellow flowers, and occasionally visits blue purple pink ones (Scott 1974b studied this species): Achillea millefolium “lanulosa” white; Allium textile white; Apocynum
androsaemifolium pinkish-white pinkish-white 21x; Arctium minus rose-purple; Asclepias speciosa pink 2x; Aster laevis var. geyeri blue 5x; Aster porteri white 9x; Chrysogonum nauseosum yellow 28x; Clematis ligusticifolia white cream-white 14x; Cryptantha jamesii white 2x; Erigeron elatior (not Aster novae-angliae purple) bluish-white (some lavender) 11x; Erigeron pumilus white; Erigeron speciosus blue common; Eriogonum jamesii cream 97x; Helianthus pumilus yellow 5x; Heterotheca villosa yellow 17x; Hymenoxys richardsonii yellow pollinating it covered with the pollen; Linaria vulgaris yellow with orange palate 3x (one probed flower base 1-2 min.); Melilotus alba white 20x; Nepeta cataria white; Pericome caudata yellow 130x; Ribes lepantanum pinkish-white; Rubus deliciosus white 2x; Rudbeckia laciniata ampla yellow 11x; Solidago ~altissima “~canadensis” yellow; Solidago (Euthamia) occidentalis yellow 395x; Symphoricarpus albus pink; Viguiera (Heliomeris) multiflora yellow; Rubus deliciosus juices of ripe purple berries 13x; mud 5x.

LYCAENIDAE, LYCAENINAE, THECLINI

Hypaurotis crysalus (W. Edwards) feeds on oak sap, raindrops, occasionally mud, never on flowers (Scott 1974c, Scott and Scott 1978): 18+ adults of both sexes sucking sap oozing from Quercus gambelii twigs (seeping knobs including one where a leaf fell off) and sap from new acorns, many on one 5m tree; some sucked raindrops on leaves; wet sand 8x. Habrodais grunus (Boisduval): mud.

LYCAENIDAE, LYCAENINAE, EUMAEINI

Some Eumaeini such as Callophrys and Strymon melinus seem to feed on Asteraceae flowers much less than other Eumaeini. Atlides halesus (Cramer) mostly visits whitish flowers: Aesculus californica whitish 1x; Baccharis salicifolia whitish 3x; Baccharis whitish; sunflower big yellow; white flowering plant abundant; mud (Scott 1973b). To confirm color choice I gathered records from Allen (1997), Bailowitz and Brock (1991), Bright and Ogard (2010), Brown et al. (1992) Clark and Clark ((1951), Ifter et al. (1992), Monroe and Monroe (2004), Opler and Krizek (1984), Orsak (1977), Shapiro (2007, and website), Tveten and Tveten (1996), and internet photos: Aesculus californica white; Apiaceae ~whitish/yellow; Apocynum whitish; Aralia spinosa whitish; Asclepias ~pink; Asclepias texana ~white; Asclepias white; Asteraceae rayless pink; Asteraceae rayless yellow; Baccharis sarothroides cream; Baccharis whitish; Bidens pilosa white to yellowish or purplish; Chrysogonum yellow; Clethra acuminata white; "Clethra alnifolia white (pink); Eriogonum whitish; resembles Eriophyllum jeppsonii Texas white; Eupatorium serotinum? white; Isocoma acradenia white-yellow; Lamiaceae white flowers on top; Lantana yellow; Lepidium latifolium white; Lepidospartum squamatum yellow; Leucelene? whitish with orangish disc; Melilotus alba white; Mikania scandens ?white; “Penstemon” yellow; Phoradendron flavescens inconspicuous greenish flowers; Pluchea sericea pink to rose; Polygonum (Bistorta) white; Prosopis yellowish and other leguminous shrubs; Prunus americana white; Senecio yellow 2x; Solidago yellow 5x; Verbesina virginica white; white flowers; Xanthoxylum clava-herculis greenish or whitish; Zinnia ~white. So they do prefer white but often visit yellow and occasionally visit pinkish or greenish flowers. Adults fly down-valley to seek flowers and mud (Scott 1973b).

Satyrium fuliginosum semiflava Klots visits yellow and sometimes whitish flowers: Arnica mollis yellow ~10x; Eriogonum subalpinum [pinkish]-cream 24x; Eriogonum umbellatum yellow 22x; Purshia tridentata yellow; Tetradygia canescens yellow sunflower 9x.

Satyrium behrii (W. Edwards) usually visits whitish flowers and yellow flowers, sometimes purple or pink, and occasionally visits mud: Achillea millefolium “lamulosa” white 3x; Apocynum androsaemifolium pinkish-white 18x; Arnica rydbergii yellow; Asclepias speciosa pink 8x; Aster glaucodes white to violet; Astragalus drummondii white; Berteroa incana white 3x; Ceanothus fendleri white 30x; Cirsium arvense purple 3x; Clematis ligusticifolia white; Conium maculatum white big umbel 2x; Eriogonum flavum yellow 8x; Eriogonum janesii cream; Eriogonum lobbii var. robustius cream several; Eriogonum lonchophyllum white 2x; Eriogonum umbellatum yellow 28x; Heterotheca villosa yellow 4x; Holodiscus discolor whitish 2x; Lamiaceae abundant; Medicago sativa violet; Melilotus alba white many; Monarda
Satyrium sylvinus
Satyrium saepium
Satyrium auretorum
Satyrium calanus godarti
Satyrium liparops aliparops

Satyrium liparops aliparops (LeConte) visits whitish flowers, sometimes purple and pink and yellow:
• Apocynum androsaemifolium pinkish-white 4x; Apocynum cannabinum whitish 4x; Asclepias speciosa pink pollinia on leg; Asclepias syriaca pink; Ceanothus fendleri white Janet Chu; Cirsim arvense purple 4x; Clematis ligusticifolia white 3x; Euphorbia esula yellow-green; Melilotus alba white; Monarda fistulosa rose-purple 3x; Solidago altissima ~canadensis” yellow 13x; Solidago missouriensis yellow 2x; Symphoricarpos albus pink; sap? female probing young 2 cm Prunus virginiana white leaf for ?aphid sap for a minute or two (a little black beetle was on leaf too) but no sap seen.

Satyrium calanus godarti (W. Field) visits yellow and whitish flowers, sometimes pink or purple: Apocynum androsaemifolium pinkish-white 7x; Asclepias incarnata pink; Asclepias syriaca pink pollinia on leg; Centaurea diffusa white; Cirsim arvense purple 2x; Heracleum sphondylium montanum=lanatum white; Melilotus alba white; Melilotus officinalis yellow many; Rudbeckia hirta yellow 2x; Rudbeckia laciniata ampla yellow 5x; Solidago altissima ~canadensis” yellow 10x; Solidago missouriensis yellow; sap of Quercus gambelii female sucking an acorn.

Satyrium edwardsii (Grote and Robinson): Asclepias syriaca pink ~7x.

Satyrium auretorum (Boisduval): Aesculus californica whitish 32x; Asclepias pink; Brassicaceae like Brassica yellow; mud.

Satyrium saepium (Boisduval) visits whitish and yellow flowers, occasionally whitish and pink and purple/blue: Achillea millefolium “lanulosa” white 3x; Aesculus californica whitish; Anaphalis margaritacea whitish; Apocynum androsaemifolium pinkish-white 17x; Asclepias pink; Asclepias speciosa pink 2x; Aster laevis var. geyeri blue 2x; Aster porteri white 6x; Baccharis salicifolia=viminea whitish many; Berteroa incana white 2x; Ceanothus fendleri white 7x; Cirsim arvense purple 5x + var. incanum 2x; Eriogonum flavum yellow 5x; Eriogonum umbellatum yellow 31x; Heterotheca villosa yellow 5x; Lamiaceae 5x; Monarda fistulosa rose-purple 2x + 3x only 1-2 sec. (proboscis too short); Potentilla fruticosa yellow 14x; Rhus glabra green flowers 2x; Rudbeckia laciniata ampla yellow 2x; Solidago altissima ~canadensis” yellow 25x; Solidago missouriensis yellow 12x; Solidago yellow; mud 3x. Adults fly down-valley to seek flowers and mud (Scott 1973b).

Satyrium tetra (W. Edwards) visits whitish and pink flowers at least: Aesculus californica whitish 203x; Asclepias speciosa pink 2x; Eriogonum californicum white to lavender 2x; Melilotus alba white; Lamiaceae.

Satyrium sylvinus (Boisduval) visits all colors of flowers (pink and white and yellow and purple/blue) except perhaps pure red, and mud: Aesculus californica whitish 2x; Allium sp. probably ~pink; Apocynum androsaemifolium pinkish-white 2x; Asclepias pink; Asclepias speciosa pink 25x incl. female captured by flower; aster blue; Asteraceae shrub; Brassica nigra yellow; Carduus nutans rose-purple; Centaurea diffusa lavender; Cirsim arvense purple 5x; Clematis ligusticifolia white 3x; Melilotus alba white; Melilotus officinalis yellow; Rosaceae shrub white; Rudbeckia hirta yellow; white uns Rudbeckia laciniata ampla yellow 4x; tiny white flowers; mud.

Satyrium californica (W. Edwards) visits whitish and yellow flowers, sometimes pink and purple, and mud: Achillea millefolium “lanulosa” white; Aesculus californica whitish 21x; Apocynum androsaemifolium pinkish-white 7x; Asclepias pink; Asclepias speciosa pink many; Ceanothus fendleri white 8x; Cirsim arvense purple 5x; Eriogonum flavum yellow; Eriogonum janesii cream; Eriogonum lobbi var. robustus cream; Eriogonum subalpinum [pinkish]-cream 48x; Euphorbia esula yellow-green tiny flowers 3x; Holodiscus discolor whitish 11x; Hymenopappus filifolius yellow; Lamiaceae; Marrubium vulgar cream; Melilotus alba white; Mentzelia ~yellow; Lamiaceae many; Potentilla fruticosa yellow; Rhus glabra greenish 5 min.; Rosaceae shrub white; Rudbeckia laciniata ampla yellow 6x; Sedum lanceolatum yellow; Solidago altissima “canadensis” yellow 14x; Solidago yellow 2x; Tetradyminia canescens yellow sunflower 13x; mud 7x.
Satyrium acadica (W. Edwards) visits pink, white, and less often purple-violet flowers: Apocynum androsaemifolium pinkish-white; Apocynum cannabinum whitish; Asclepias speciosa pink 27x; Asclepias syriaca pink 2x; Cirsium arvense purple 3x; Medicago sativa violet; Melilotus alba white 11x; Polygonum amphibium coccineum pink; Tamarix chinensis=ramossissima rosy-white.

Satyrium titus (Fabricius) visits yellow and white flowers, and less often purple, pink, blue, and orange, and sometimes mud: Apocynum androsaemifolium pinkish-white 4x; Asclepias speciosa pink 11x; Asclepias tuberosa orange; Aster laevis var. geyeri blue; Aster porteri white; Asteraceae yellow; Asteraceae shrub yellow; Ceanothus fendleri white 6x; Chrysanthemum nauseosus yellow 2x; Cirsium arvense purple 3x; Clematis ligusticifolia white 3x; Cleome (Peritoma) serrulata pinkish 2x; Cryptantha jamesii white 2x; Eriogonum flavum yellow-cream 16x; Eriogonum umbellatum yellow 9x; Geranium caespitosum pink 2x; Heterotheca villosa yellow 3x; Lamiaceae some; Lapinus argenteus blue; Melilotus alba white; Monarda fistulosa rose-purple 2x; Opuntia imbricata purplish; Prunus americana white; Rhus glabra green flowers 2x; Rudbeckia hirta yellow; Senecio spartioides yellow; Solidago altissima “canadensis” yellow 42x; Solidago ~missouriensis yellow 12x; Solidago (Oligoneuron) rigida yellow; Symphoricarpos albus pink; mud 2x.

Satyrium favonius autolycus (W. Edwards) =violae (Standal and Turner): white flowers 22x; Apocynum androsaemifolium pinkish-white; Trifolium 2x.

Satyrium favonius ilavia (Beutenmüller): abundant on white flowering plant.

Phaeostrymon alcestis (W. Edwards): Apocynum androsaemifolium pinkish-white; Salix ?amygdaloides catkins.

Callophrys dumetorum “affinis” homoperplexa W. Barnes and Benjamin generally visits yellow and white flowers: Aletes acaulis yellow 2x; Antennaria parvifolia whitish; Apocynum androsaemifolium pinkish-white 3x; Astragalus flexuosus purple 2x; Barbarea orthoceras yellow 3x; Berberis (Mahonia) repens yellow; Ceanothus fendleri white 9x; Comandra umbellata white 2x; Cryptantha jamesii white; Eriogonum flavum yellow; Eriogonum umbellatum yellow 5x; Habouria trachypleura yellow 6x; Heterotheca villosa yellow; Jamesia americana white; Lesquerella montana yellow 2x; Phacelia heterophylla white; Potentilla fissa yellow; Prunus americana white 4x; Ribes cereum pinkish-white; Rudbeckia hirta yellow; Senecio canus yellow 2x; Senecio fendleri yellow 4x; Senecio yellow; Thlaspi arvense white landed 2x but I didn’t see proboscis; mud 9x.


Callophrys sheridarni (W. Edwards) prefers yellow/white flowers. Ssp. sheridarnii: Berberis (Mahonia) repens yellow; Cerastium strictum “arvense” white 4x; Claytonia rosea pinkish-white 5x; Cymopterus acaulis white 2x; Eriogonum umbellatum yellow 2x; Lesquerella montana yellow; Lomatium orientale white; Mertensia lanceolata blue; Thlaspi arvense white 2x; Thlaspi (Noccaea) fendleri “montanum” white 4x. Ssp. paradoxa: Lesquerella yellow. Ssp. pseudodumetorum: Salix catkins ~whitish some; mud. Ssp. lernetii: Arcostaphylos uva-ursi whitish; Ranunculus ~yellow 2x.

Callophrys gryneus (Hübner) ssp. most often visit yellow/white flowers, and also visit pink etc. Ssp. gryneus: Asclepias syriaca pink. Ssp. chalcosiva Clench: Purshia tridentata yellow; mud. Ssp. nelsoni (Boisduval): Achillea millefolium “lanulosa” white ~18x; Cryptantha whitish; Gentian flower courting; Mimulus ?guttatus yellow with red spots; Potentilla yellow many; Rubus “blackberry” white; Senecio yellow. Ssp. siva (W. Edwards): Achillea millefolium “lanulosa” white 2x; Aletes acaulis yellow; Apocynum androsaemifolium pinkish-white 16x; Asclepias asperula occidentalis purple; Asclepias speciosa pink 3x; Astragalus drummondii white 3x; Baccharis whitish; Ceanothus fendleri 26x incl. Janet Chu; Chrysanthemum nauseosus yellow 14x; “Cirsium vulgar” probably Carduus nutans rose-purple; Cirsium arvense purple 4x; Cleome (Peritoma) srrulata pinkish; Comandra umbellata whitish; Conium maculatum white 4x; Cryptantha jamesii white 12x; Cryptantha virgata white tall; Eriogonum flavum yellow 2x; Eriogonum ovalifolium var. ovalifolium pinkish or white; Eriogonum umbellatum yellow 10x incl. Janet Chu; Erysimum asperum yellow; Euphorbia esula yellow-green 4x; Geranium caespitosum pink; Harbouria trachypleura yellow 3x; Heterotheca villosa yellow 4x; Hymenopappus filifolius yellow 3x; Jamesia americana white 8x; large shrub in stream with erect brown “catkins” Ariz.; Melilotus alba white; Melilotus officialis yellow commonly (Scott 1973a); Opuntia polyacantha yellow;
Phacelia heterophylla white 2x; Phlox hoodii canescens white with yellow centers; Physocarpus monogynus white; Prunus virginiana white 3x; Rhus aromatica trilobata yellowish old flowers; Rudbeckia hirta yellow; Salix flowers ~whitish 2x; Schoenocranbe linifolia yellow; Sedum lanceolatum yellow 2x; Senecio canus yellow 2x; Senecio fendleri yellow 9x; Solidago altissima “canadensis” yellow 4x; Solidago ~missouriensis yellow; Solidago yellow; Trifolium hybridum pinkish-white; Veronica ~catenata pale blue or white; white flowering shrub; white flowering mud 7x.

Callophrys johnsoni (Skinner): Ceanothus sp. whitish; Rhus aromatica trilobata yellowish several; Cercis occidentalis pink; mud. Adults fly down-valley to seek flowers and mud (Scott 1973b).

Callophrys spinetorum (Hewitson) mostly visits whitish and yellow flowers: Antennaria ?parvifolia whitish Janet Chu; Arctostaphylos uva-ursi whitish 2x incl. Janet Chu; Asclepias pink; dull whitish-cream flower; Eriogonum subalpinum [pinkish]-cream 3x; Fragaria ~vesca white; Melilotus alba white; on flower; Potentilla concinna yellow; Prunus americana white 2x; Pseudocymopterus montanus yellow Janet Chu; Sedum lanceolatum yellow 2x; Taraxacum officinale yellow; yellow flower; catkin Salix ?monticola ~whitish; mud 16x incl. female.

Callophrys mcfarlandi P. Ehrlich and Clench: Nolina greenei “texana” white to cream many.

Callophrys mossii schryveri (Cross): Cerastium strictum “arvense” white; Lesquerella montana yellow; Prunus americana white 2x; Taraxacum officinale yellow.

Callophrys mossii windi (Clench): Arctostaphylos (manzanita) pink/white; Cercis occidentalis pink; mud.

Callophrys augustinus iroides (Boisduval): Amelanchier white NM; Aletes acaulis yellow. Adults fly down-valley to seek flowers and mud (Scott 1973b).

Callophrys augustinus augustinus (Westwood) usually visits white/yellow flowers: Arctostaphylos uva-ursi (the hostplant) whitish 21x; Asclepias pink; Berberis (Mahonia) repens yellow; Calyptridium umbellatum white; Cerastium strictum “arvense” white; Cercis occidentalis pink; Prunus virginiana white; Rhamnus californica yellowish many; Rhus aromatica trilobata yellowish 2x; Senecio canus yellow; Thlaspi arvense white; mud 5x.

Callophrys polios (Cook and F. Watson) prefers the white flowers of its caterpillar hostplant: Arctostaphylos uva-ursi whitish 18x; Barbarea orthoceras yellow 2x; Penstemon secundiflorus purple rear of flower (male aimed toward peduncle); mud 2x incl. female.

Callophrys eryphon (Boisduval) mostly visits white/yellow flowers: Arctostaphylos uva-ursi whitish 5x; Asclepias subverticillata whitish; Barbarea orthoceras yellow 35x; Berberis (Mahonia) repens yellow 3x; Calyptridium umbellatum white; Conium maculatum white; Cryptantha jamesii white 2x; Eriogonum lobii var. robustius cream; Euphorbia esula yellow-green 2x; Harbouria trachypleura yellow 3x (one briefly); Hymenopappus filifolius yellow; Hymenoxys (Tetraneuris) acaulis yellow; Prunus americana white 5x (including Janet Chu); Prunus virginiana white 2x; Rhus aromatica trilobata yellowish 4x; Rosa ~pink; Rubus deliciosus white; Salix monticola catkin ~whitish 12x; Salix scouleriana catkin ~whitish several; Sedum lanceolatum yellow; Senecio canus yellow; Senecio yellow; Taraxacum officinale yellow; Thlaspi (Noccaea) fendleri “montanum” white; Townsendia grandiflora Bluish-white; mud 7x.

Strynnon melinus Hübner visits all colors of flowers, even red, and sometimes visits mud: Abronia fragrans whitish; Achillea millefolium cultivated variety white; Aesculus californica whitish; Agastache rupestris red; Allium textile white to light-rose; Apocynum androsaemifolium pinkish-white 6x; Arctium minus rose-purple; Asclepias pumila white; Asclepias syriaca pink; Asclepias tuberosa orange; (proboscis too short for Asclepias speciosa pink); Aster ericoides white 6x; Aster fendleri blue-violet; Aster laevis var. geyeri blue 5x incl. Janet Chu; Aster lanceolatus hesperius bluish-white; Aster porteri white 4x; Asteraceae yellow; Asteraceae shrub yellow 3x; Astragalus bisulcatus purple; Astragalus flexuosus purple 3x; Astragalus laxmannii “adsurgens” usually whitish 3x; Astragalus shortianus purple; ~Baccharis sarothroides whitish; Baccharis whitish; Berberis (Mahonia) repens yellow; Berteroa incana white; Bidens cernua yellowish 4x; Buddleja davidii purpure 2x; Carduus nutans rose-purple; Ceanothus fendleri white 4x; Centaurea diffusa white; ?Chaenactis douglasii white-flowered Asteraceae; Chrysanthemum Xsuperbum white (1x, + several times but flew after sipping for a few sec.); Chrysothamnus nauseosus yellow 39x; Cirsium arvense purple 18x; Clematis ligusticifolia white; Conyza canadensis whitish; Croton texensis whitish 3x; Dalea candida
white; *Dalea purpurea* pink-purple 2x incl. Anne U. White and Janet Chu; *Echinacea purpurea* purple 3x; *Erigeron pumilus* bluish-white; *Erigeron speciosus* blue; *Eriogonum alatum* yellowish (ovipositing?); *Eriogonum corymbosum* var. *velutinum* whitish; *Eriogonum effusum* white 17x; *Eriogonum flavum* yellow 9x + var. *chloranthum* cream 1x; *Eriogonum jamiessii* cream; *Eriogonum latifolium* whitish 6x; *Eriogonum lonchophyllum* whitish 2x; *Eriogonum umbellatum* yellow 9x; ~*Eupatorium purpureum* pink-purplish big 1 m "Liatris" with wide leaves; *Euphorbia* green sp. and palpated its flowers some for 2 min. then flew; *Euphorbia marginata* green and white; *Geranium caespitosum* pink; *Glycyrrhiza lepidota* yellowish-white; *Gutierrezia sarothrae* yellow 4x; *Helianthus nuttallii* yellow; *Hesperis matronalis* pink (+another 2 sec.); *Heterotheca canescens* yellow; *Heterotheca villosa* yellow 7x; *Lesquerella montana* yellow; *Liatris punctata* purplish 10x; *Linaria canadensis* var. *texana* blue; *Linaria vulgaris* yellow with orange palate 15x by feeding from holes made by bumblebees? in spur (most flowers have such holes and one had 5 holes, a bumblebee fed out of same holes); *Marrubium vulgare* cream 2x; *Medicago sativa* violet 45x; *Melilotus alba* white 5x; *Melilotus officinalis* yellow 5x; *Mentha arvensis* pink low Lamiaceae; *Oxytropis lambertii* reddish-purple; *Phacelia heterophylla* ~pinkish; *Phlox hoodii canescens* white with yellow centers; *Plantago lanceolata* white 2x; *Polygonum amphibium coccineum* pink 5x; *Pruunus americana* white; *Psoralea tenuiflora* 6x blue-purple; *Rhus aromatica trifolbata* yellowish; *Rudbeckia hirta* yellow; *Senecio canus* yellow 2x; *Solidago altissima* "canadensis" yellow; *Solidago missouriensis* yellow; *Solidago nana* yellow sprawling; *Solidago (Euthamia) occidentalis* yellow 2x; *Solidago rigida* yellow 2x; *Solidago simplex* whitish var. *nana* =decumbens yellow; *Solidago yellow; Sphaeralcea coccinea* orange; *Tarraxacum officinale* yellow; *Thelesperma megapotamicum* yellowish; *Trifolium fragiferum* pink; *Trifolium repens* whitish 8x; *Trifolium; Verbascum thapsus* yellow 2x; *Verbena hastata* purple 2x; *Verbena "Purple Top"* purplish-blue; *Verbena stricta* purplish-blue; *Verbena purplish-blue* Janet Chu; *Verbena officinalis* yellow; *Viguiera (Heliomeris) multiflora* yellow; big yellow sunflower; *Zinnia elegans* pink 2x; *catkin Salix*; mud 4x.

*Strymon cestri* (Reakirt): ~*Senecio spartioides* yellow.

*Strymon bazochii* (Godart): *Lantana camara* yellow-red common.

*Ministrymon leda* (W. Edwards) visits whitish, often yellow, sometimes pink flowers: *Apocynum androsaemifolium* pinkish-white; *Asteraceae* yellow shrub; ~*Baccharis sarothroides* whitish 7x; *Baccharis* whitish 2x; *Clematis* ~white; *Croton texensis* whitish; large shrub in stream with erect brown “catkins” Ariz.; *Polygonum ?pensylvanicum* pink many; *Senna hirsuta* var. *leptocarpa* yellow; tiny white-yellow-flowered tiny-leaf “*Cercocarpus*”; white-flowered shrub similar to *Amelanchier*.

*Erora laeta quaderna* (Hewitson): *Ceanothus fendleri* white; mud (Scott 1973b). Adults fly down-valley to seek flowers and mud (Scott 1973b).

**LYCENIADA, LYCAENIINA, POLYOMMATINI**

*Leptotes marina* (Reakirt) visits whitish, yellow, orange, pinkish, purple-violet flowers, and frequents mud: *Apocynum androsaemifolium* pinkish-white; *Asteraceae* yellow shrub; *Baccharis* whitish; *Chrysanthamnus nauseosus* yellow; *Cirsium arvense* purple; *Eriogonum umbellatum* yellow; *Geranium caespitosum* pink; *Medicago sativa* violet 16x; *Melilotus alba* white 4x; orange winged flower; *Phaseolus heterophyllus* flower with two orange hoods and yellow center with vine stem and tri-part leaves; *Polygonum ?pensylvanicum* pink; *Trifolium repens* whitish; white flowering plant; yellow-flowered low bush; mud 68x.

*Brephidium exilis* (Boisduval): *Aster fendleri* blue-violet; *Baccharis salicifolia* whitish; *Chrysanthamnus nauseosus* yellow 2x; *Medicago sativa* violet; *Melilotus alba* white.

*Cupido comynias* (Godart) visits yellow, white, bluish-purple, or pink flowers: *Asclepias incarnata* pink 2x; *Cirsium arvense* var. *incanum* purple; *Coreopsis verticillata* yellow; *Erigeron philadelphicus* white; *Lotus corniculatus* yellow 2x but proboscis maybe not inserted as flowers are long; *Medicago lupulina* yellow 4x; *Medicago sativa* white 2x; *Oxalis stricta* yellow 7x; *Trifolium fragiferum* pink; *Trifolium hybridum* pinkish-white 4x; *Trifolium pratense* red-purple 2x; *Trifolium repens* whitish 23x; *Vicia villosa* violet and white to rose; blood of chicken many fed on blood on ground; mud 13x.
Cupido amyntula valeriae (Clench) visits white, sometime yellow or purplish or pinkish flowers: Allium cernuum pink 2x; Apocynum androsaemifolium pinkish-white; Aster porteri white; Astragalus drummondii white; Astragalus flexuosus purple-blue 12x; Centaurea diffusa white; Cerastium strictum “arvense” white 2x; ~Draba yellow; Eriogonum effusum white; Eriogonum lobbii var. robustius cream; Lathyrus leucanthus white 3x; Potentilla ?pulcherrima tiny yellow flower 1 cm wide; Rhus aromatica trilobata yellowish; Sedum lanceolatum yellow 2x; Taraxacum officinale yellow; Thlaspi (Noccaea) fendleri “montanum” white; Trifolium pratense red-purple; Vicia americana purple; urine; manure horse; mud 105x.

Celastrina neglecta (W. Edwards) usually visits white flowers, sometimes yellow or purplish ones: Anemone canadensis white; Anethum graveolens yellow Lakewood, Jeff. Co. CO (evidently neglecta); Aster simplex whitish; Cornus sericea=stolonifera white 5x; Cryptotaenia canadensis white; Melilotus officinalis yellow 2x; Rhus glabra whitish or greenish-yellow bushes flowers a long time 3x; Sambucus canadensis white; Trifolium pratense red-purple; Trifolium repens whitish 65x; Verbena hastata purplish-blue; mud common.


Celastrina neglecta cinerea (W. Edwards) prefers white flowers: Ceanothus fendleri white; Holodiscus discolor whitish; Solidago white flowering plant; mud 19x.

Celastrina lucia sidara (Clench) feeds only on yellow and white flowers (biology was discussed by Scott and Wright 1998): Aletes acaulis white 2x; Antennaria parvifolia whitish 2x; Arctostaphylos uva-ursi whitish 10x; Barbarea orthoceras yellow 14x; Berberis (Mahonia) repens yellow Janet Chu; Ceanothus fendleri white; Cerastium strictum “arvense” white 3x; Clematis ligusticifolia white; Harbouria trachypleura yellow; Jamesia americana white 24x; Lesquerella montana yellow; “mustard” Janet Chu; Physocarpus monogynus white 3x; Potentilla fissa yellow; Prunus virginiana white 17x; Salix monticola catkin ~whitish 7x; Senecio canus yellow; Senecio fendleri yellow; Thlaspi (Noccaea) fendleri “montanum” white 3x; feeding on sugar? on leaves of ~Conium maculatum white umbel; wet rotting wood 2x; manure horse 2x; mud 182x (includes f. lucimargina 6x).

Celastrina lucia lunare (Scott): Ribes inerme pinkish.

Celastrina humulus (Scott and Wright (hop-ecotype) seldom feeds on flowers, but prefers whitish or yellow flowers, sometimes pink: Apocynum cannabinum whitish 4x; Barbarea orthoceras yellow 3x; Ceanothus fendleri white 4x incl. Janet Chu; Cerastium strictum “arvense” white landed on and flew; Geranium caespitosum pink; Jamesia americana white cream 6x; Phacelia heterophylla ~pinkish; Solidago altissima “canadensis” yellow; honeydew from cream-colored small Cicadellidae on ups of leaf bases of two Lactuca serriola plants; mud 13x incl. visit by female. It ignored Achillea millefolium “lanulosa” white and ignored Physocarpus monogynus white, and landed on Anemone canadensis white but flew.

Celastrina humulus Scott and Wright (lupine-ecotype) seldom visits flowers: Barbarea orthoceras yellow 4x; Ceanothus fendleri white; Claytonia rosea pinkish-white; Euphorbia esula yellow-green 2x; Geranium caespitosum pink 7x and white 6x; Linum lewisii blue landed below petals to ?feed once for ~10 sec.; Prunus virginiana white; (one landed on Clematis hirsutissima blue but left); mud 14x; dung of dog.

Hemiarthus isola (Reakirt) has a very small proboscis, so can visit only small flowers. It visits yellow and white and purplish-violet and pinkish and sometimes pink and reddish flowers (it frequents small Trifolium), and often visits mud: Achillea filipendula “Gold Plate” yellow; Aster ericoides white (6x + var. ericoides 4x + var. falcatus 1x); Aster laevis var. geyeri blue; Aster porteri white 4x; Astragalus drummondii white 2x; Astragalus flexuosus purple 2x; Astragalus gracilis + var. parviflorus purple; Berteroa incana white; Chrysanthemum nauseosus yellow 6x; Cirsium arvense purple 2x; Eriogonum corymbosum var. velutinum whitish; Eriogonum umbellatum yellow 2x; Glycyrrhiza lepidota yellowish-white 3x; Gutierrezia sarothrae? yellow; Helianthus petiolaris yellow 1 sec.; Helianthus pumilus yellow; Heterotheca canescens yellow; Heterotheca villosa yellow 2x; Humulus lupulus female flower; Hymenopappus filifolius yellow; Hymenoxys (Tetraneuris) acaulis yellow; Lavandula angustifolia light-purple 3x; Lesquerella montana yellow; Liatris punctata purplish; Limonium latifolium violet-blue 6x; Lupinus argenteus blue; Medicago lupulina yellow; Medicago sativa violet 23x; Melilotus alba white 6x;
Melilotus officinalis yellow 2x; Mertensia lanceolata blue flower that had lost its petals (intact flowers have petals too long for the short proboscis); Nepeta Xfaassenii violet 4x; Perovskia atriplicifolia blue (Michael S. Fisher); Polygonum ?pensylvanicum pink; Psoralea tenuiflora blue-purple 2x; Psoralea? thin blue legume; Rhus aromatica trilobata yellowish; Rorippa sinuata yellow; Sedum lanceolatum yellow 5x; Solidago missouriensis yellow 2x; Sphaerelcea coccinea orange; Tagetes patula orange; Thlaspi arvense white 10x; Trifolium fragiferum pink 23x popular; Trifolium pratense red-purple 2x; Trifolium repens whitish 45x; yellow-flowered low bush; mud 26x.


Euphilotes species visit mostly just the flowers of the local hostplant. Euphilotes bernardino martini (Mattoni): Erigoonum fasciculatum var. poliolium whitish many. Euphilotes batooides batooides (Behr): mud.

Euphilotes batooides comstocki (Shields): Erigoonum umbellatum var. furcosum yellow.

Euphilotes batooides intermedia (W. Barnes and McDunnough): Erigoonum ~nudum ~yellowish ½ m tall many; Erigoonum umbellatum yellow 2x; mud.

Euphilotes batooides (ellisii) basinensis Austin: Erigoonum hermannii var. humilius white 2x.

Euphilotes batooides (ellisii) ellisii Shields: Erigoonum corymbosum whitish many.

Euphilotes batooides (ellisii) anasazi Scott: Erigoonum corymbosum var. velutinum whitish many. Euphilotes glaucon glaucon (W. Edwards): Erigoonum umbellatum yellow; Erigoonum like E. shockleyi 1” cream balls with gray spoonlike leaves.

Euphilotes glaucon hadrocheilus Pratt and J. Emmel: Erigoonum umbellatum yellow.

Euphilotes glaucon centralis (W. Barnes and McDunnough): Erigoonum jamaesii cream 24x; Aster ?whitish; manure; mud 19x.

Euphilotes enoptes enoptes (Boisduval): Erigoonum nudum yellowish 12x; Erigoonum incaenum yellow; Erigoonum tiny white flowers.

Euphilotes enoptes bayensis (Langston): Erigoonum latifolium whitish abundant.

Euphilotes enoptes damerisi (J. Comstock and Henne): mud.

Euphilotes ancilla (W. Barnes and McDunnough) visits almost only yellow flowers esp. of its hostplant, and frequents mud: Ssp. ancilla: Chrysothamnus nauseosus yellow 4x; Erigoonum subalpinum cream 5x.

Ssp. barnesi Opler and Fisher: Erigoonum flavum yellow-cream 2x; Erigoonum subalpinum [pinkish]-cream 5x; Erigoonum umbellatum yellow 100x; Euphorbia esula yellow-green; Heterotheca villosa yellow 3x; Medicago lupulina yellow Janet Chu; mud 106x; Ssp. gilvutunica Austin: Erigoonum lobbi var. robustius cream.

Euphilotes ancilla stanfordorum Opler and Warren: Erigoonum ovalifolium var. ovalifolium pinkish or white 6x.

Euphilotes rita coloradensis (Mattoni): Erigoonum effusum white 30x; mud 5x.

Euphilotes rita rita (W. Barnes and McDunnough): Erigoonum wrighti white 3x.

Euphilotes rita emmeli (Shields): Erigoonum (bluish-gray with no or small leaves, bushy 1.5’ tall) white; Erigoonum leptocladon (var. leptoclodon yellow many, var. ramosissimum white several).

Euphilotes rita pallascens (Tilden and Downey): Erigoonum kearneyi var. kearneyi whitish.

Euphilotes spaldingi pinjuna Scott: Erigoonum jamaesii cream; Erigoonum racemosum cream; mud many.

Glaucopsyche piasus daunia (W. Edwards) visits white and yellow flowers, sometimes pink or purple, and often visits mud: Astragalus drummondii white; Astragalus flexuosus purple 3x; Astragalus laxmannii “adsturgens” usually whitish; Barbarea orthoceras yellow 5x; Brassicaceae white; Ceanothus fendleri white; Chrysothamnus nauseosus yellow 3x; Conium maculatum white 5 sec.; Cryptantha virgata white 2x; Erigeron pumilus white; Erigoonum umbellatum yellow 2x; Geranium caespitosum pink; Glycyrhiza lepidota yellowish-white; Jamesia americana white; Phacelia heterophylla white 3x; Sedum lanceolatum yellow; Senecio integerrimus yellow; mud 24x.

Glaucopsyche lygdamus oro (Scudder) visits most colors except perhaps red: Allium cepa lilac or white 17x; Astragalus alpinus (purple 1x, white with small purple areas 1x); Astragalus agrestis purple 2x; Astragalus drummondii white; Astragalus flexuosus purple 10x; Barbarea orthoceras yellow 9x; Berberis...
(Mahonia) repens yellow; Cerastium strictum “arvensis” white; Erigeron pumilus 5x (usually bluish-white, some white); Eriogonum umbellatum yellow; Erysimum asperum yellow; Hymenopappus filifolius yellow; Hymenoxys (Tetraneuris) acaulis yellow; Harbouria trachypleura yellow; Iris missouriensis pale-blue failed to probe petal; Lepidium campestre white; Lesquerella montana yellow 3x; Linum lewisii blue; Lonicer a involucrata yellow Janet Chu; Medicago sativa violet 5x; Melilotus alba white; Melilotus officinalis yellow; Mer tensia lanceolata blue 2x; Oxytropis lamberti reddish-purple 5x; Phacelia heterophylla -pinkish; Physaria -vitulifera yellow 2x; Senecio fendleri yellow; Thermopsis divaricarpa yellow 8x (5 of these noted to put proboscis between corolla and sepals); Thlaspi arvense white 17x; Thlaspi (Noccaea) fendleri “montanum” white 2x; tiny white and yellow mustard blossoms Janet Chu; Vicia americana purple; dung of ?dog; white bird dung; mud 35x.

Plebejus atrapraetextus longinus (Nabokov): mud 6x.

Plebejus melissa melissa (W. Edwards) visits whitish, yellow, and blue/purple colors but seldom pink or reddish, and often visits mud: Achillea millefolium “lanulosa” white; Allium textile white; Aster ascendens blue 3x; Aster ericoides white 22x + var. ericoides 1x + var. falcatus 5x; Aster laevis var. geyeri blue; Aster lanceolatus hesperius bluish-white 3x; Aster porteri white 5x; Astragalus agrestis purple 2x; Astragalus bisulcatus purple 3x; Astragalus drummondi white 3x; Astragalus flexuosus purple 8x; Astragalus laxmannii “adsurgens” usually whitish; Astragalus missouriensis rose-purple; Barbara e orthoceras yellow; Berteroa incana white 2x; Ceanothus fendleri white; Centaurea diffusa (white 8x, lavender 1x); Centaurea maculosa lavender; Chrysanthamnus nauseosus yellow 28x; Cirsium arvense var. incanum purple 3x; Croton texensis whitish 2x; Dalea candida white; Delphinium ajacis violet; Erigeron pumilus bluish-white 8x; Eriogonum brevicaule yellow; Eriogonum effusum white 5x; Eriogonum flavum yellow; Eriogonum subalpinum [pinkish]-cream; Eriogonum umbellatum yellow 5x; Erysimum asperum yellow; Grindelia squarrosa yellow 2x; Gutierrezia sarothrae yellow 5x; Heterotheca villosa yellow 14x; Hymenopappus filifolius yellow; Hymenoxys (Tetraneuris) acaulis yellow 2x; Kuhnia eupatoroides white; Lesquerella montana white; Lithospermum punctata purplish 3x; Linum lewisii blue; Lygodesmia juncea pink; Machaeranthera pinnatifida=Haplopappus spinulosus yellow; Medicago lupulina yellow 2x; Medicago sativa violet 25x; Melilotus alba white 5x; Melilotus white or yellow common; Melilotus officinalis yellow 5x; Oxytropis kentrophyta impexus blue; Barbarea orthoceras yellow; Ceanothus fendleri white; Cirsium scariosum cream 2x; Erigeron elatior pink-purple 2x; Erigeron pumilus bluish-white 5x; Erigeron speciosus blue; Erigeron ursinus blue-purplish 13x; Eriogonum subalpinum [pinkish] cream 2x; Fragaria virginiana glauca white 2x; Geum (Acomastylis) rossii purplish-yellow; Heterotheca pumila yellow 2x; Jamesia americana white; Limnorchis “Habenaria” dilatata white 2 sec.; Polygonum bistortoides whitish 2x; Potentilla pulcherrima yellow (1x + ½ sec. twice); Sedum rhodanthum pink; Senecio atratus yellow; Senecio canus yellow; Senecio crassulus yellow 6x; Senecio dimorphophyllus yellow; Senecio integerrimus yellow; Senecio triangularis yellow; Solidago simplex var. nanae-decumbens yellow; Taraxacum officinale yellow; Trifolium hybridum pinkish-white 11x; Trifolium pratense red-purple 2x; Trifolium repens whitish 7x; Veronica nutans blue; mud 14x.

Plebejus icarioides (Boisduval) (mostly ssp. lycea [W. Edwards]) visits whitish, yellow, and sometimes bluish/purple, rarely reddish, flowers, and often visits mud: Achillea millefolium “lanulosa” white; Aesculus californica whitish; Apocynum androsaemifolium pinkish-white; Astragalus flexuosus purple

66
Plebejus glandon

Plebejus alupini

Plebejus alupini

Plebejus alupini

Plebejus acmo

Plebejus shasta

reddish

International Commission of Zoological Nomenclature articles that require such misleading names to be

many;

chloranthum

subalpinum

strictum

“lanulosa

dandelion”;

canesce

32x;

cream;

Eriogonum corymbosum

yellow;

Astragalus flexuosus

many; Iridaceae white;

Eriodictyon

yellow 1x;

pink;

adults.

yet adults feed on many flowers, in contrast to

umbellatum

nana

Erigeron ursinus

Ssp.

female sucked it from tops of

yellow;

exigua

heterophylla

cataria

Melilotus alba

pumilus

umbellatum

Eriogonum lobbii

blue 3x;

4x;

Astragalus laxmannii

pitkinensis


Eriogonum umbellatum

female catkin;

Solidago

yellow 4x;

1x and white var. 1x;

Lupinus

sometimes bluish

2x; (near

Lupinus

fusco

fusco

(Ceanothus fendleri

yellow 11x;

Solidago furcosum

white;

Taraxacum officinale

yellow “landing on
dandelion”;

Thlesperma filifolium

yellow; white flowering plant; manure; mud 40x.

Plebejus alupini lutzi

dos Passos visits yellow and whitish flowers, and mud: Achillea millefolium

“lanulosa” whitish;

Berteroa incana white 2x; (near-lutzi) Ceanothus fendleri white 11x; Cerastium

strictum “arvense” white; Chrysothamnus nauseosus yellow 10x; Eriogonum flavum yellow;

Eriogonum subalpinum [pinkish]-cream 15x; Eriogonum umbellatum yellow 11x; Solidago simplex var.

nana=decumbens yellow; mud 4x.

Plebejus alupini cotundra

Scott and M. Fisher: Erigeron pinnatisectus blue/purple; Eriogonum flavum var.

chloranthum cream.

Plebejus alupini alupini

(Boisduval): Eriogonum marifolium yellow; Eriogonum ~nudum yellowish ½ m

many; Eriogonum umbellatum yellow 2x. Plebejus “lupini” was grossly misnamed because its larvae eat

Eriogonum and its adults have never been seen to visit Lupinus (I have no records), illustrating a defect in

International Commission of Zoological Nomenclature articles that require such misleading names to be

used in perpetuity with no possibility of correction, so Scott (2008) invoked the lapsus contrarius

principle to rename it P. alupini.

Plebejus chlorina monticola

(Clemence): Eriogonum umbellatum var. furcosum yellow.

Plebejus glandon rustica

(W. Edwards) visits yellow and whitish (sometimes bluish/purplish and rarely

reddish) flowers, and mud: Achillea millefolium “lanulosa” white 8x; Agoseris glauca yellow;
Antennaria parvifolia white 4x + 1 sec.; Arnica cordifolia yellow 3x; Arnica mollis yellow 2x; Aster foliaceus var. apricus blue-violet sometimes purple 10x; Astragalus laxmannii “adsurgens” usually whitish; Barabara orthoceras yellow; Cerastium strictum “arvense” white? tiny leaves; Chrysanthemum leucanthemum white; Erigeron compositus white filiform leaves 2x; Erigeron couteri whitish 2x; Erigeron eliator pink-purple 26x; Erigeron pinnatisectus blue/purple 2x; Erigeron pumilus white 1x; Erigeron simplex blue 2x; Erigeron speciosus blue 2x; Erigeron ursinus blue 93x; Erigeron -blue 2x; Eriogonum subalpinum [pinkish]-cream 4x; Eriogonum umbellatum yellow 10x; Fragaria virginiana gauca white 1x + 1 sec.; Geranium caespitosum pink 3x; Geum (Acomastylis) rossii turbinatum yellow; Haplopappus (Oreochrysum) parryi caespitosum 3x; Heterotheca villosa yellow; Hymenoxys grandiflora yellow; Machaeranthera patersonii purple/violet; Melilotus officinalis yellow 2x; Oxalis dillenii yellow; Oxytropis lambertii reddish-purple; Penstemon virens blue; Polygonum bistortoides whitish 3x; Potentilla diversifolia yellow 2x; Potentilla fissa yellow 2x; Potentilla fruticosa yellow 5x; Potentilla hippiana yellow; Potentilla pulcherrima yellow 7x; Prunus virginiana white; Rudbeckia hirta yellow 3x; Saxifraga (Micranthes) oregana white 2x; Sedum lanceolatum yellow 12x; Senecio atratus yellow 11x; Senecio crassulus yellow; Senecio fendleri yellow 2x; Senecio fremontii var. blitoides yellow; Senecio triangularis yellow 2x; Solidago multiradiata yellow 6x; Solidago simplex var. nana=decumbens yellow 20x; sunflower yellow; Taraxacum officinale yellow 3x; Tetradytnia canescens yellow; Haplopappus (Tonestis) pygmaeus yellow; Tragopogon dubius major lemon-yellow; mud 26x.

Part II. Flowering Plants Visited and not Visited by Butterflies, the Butterfly Species that Visit Them (or Visit Other Food Sources), and their Known Pollinators

In this section, the flower-feeding/food records are sorted by flower species and food types, not by butterfly species. This arrangement shows which butterfly species are attracted to that flower/food. Each paragraph in the records section below is a flower species (or food source such as sap or mud), with an alphabetical list of the butterflies visiting that flower/food and the number of their visits/records. Or the paragraph (in parentheses) explains that the flower is shunned by butterflies. Pollinators of the flowers are listed from information in published studies (the good studies are cited). Frequent visitors that might pollinate are listed if no good pollination studies are available. The flowers are arranged by phylogeny of plant families. After the identified flower species, is a list of flowers of unknown species and plant family. Other foods (mud, sap, fruit, honeydew, dung, etc.) are not sorted by plant family (even though sap and fruit comes from plants thus could be sorted by the sap-exuding or fruiting plant). Those other foods are listed after the section on sorted flowers, and the butterflies that visited them are listed.

Before listing the records, I now discuss them and provide relevant literature, in order to reach some conclusions.

The ultimate goal of a paper like this, is to determine which flowers are popular and visited often by butterflies, which flowers are pollinated by them, and why the butterflies visit them. There are two sides to such popularity. The following list of flowers visited, along with the butterfly visitors, helps determine which flowers have qualities that attract butterflies. I also list the plants that are commonly found in Colorado that butterfly adults never visit or seldom visit, to determine which plants are shunned or are unpopular and thus have qualities that repel or do not attract butterflies. One must ask several questions about butterflies and flowers. What attracts the butterflies to the flowers or repels them? Is it the visible colors of the flowers, their pattern of ultraviolet reflection, their size or shape or height in the habitat, their clustering into a big floral display or just small individual flowers, the odors emitted by the flowers, or (in rare cases such as Heliconius that feed on pollen) the pollen produced by the flower? Are the popular butterfly flowers being pollinated by butterflies?

In an attempt to help answer these questions, I also list the known pollinators of the flowers (as determined from published papers)—both the flowers popular with butterflies and the flowers shunned by
them—in order to help understand why the butterflies visit or ignore them. This information is the only modern compilation of pollinators of Colorado plants.

A full understanding of the reasons for a flower’s attractiveness for butterflies would involve quantifying the size and shape and clustering and height and colors and ultraviolet pattern of the flower, measuring the minimum length of a capillary tube (proboscis) that could tap the nectar, analyzing the nectar contents and concentration, using head-space gas chromatography techniques to determine the floral odors produced by the flower that might attract or repel butterflies, and would involve an analysis of the wind or animals that cross-pollinate or self-pollinate the flower.

A brief discussion is needed here about the factors affecting the number of records of visits that I recorded for a particular flower species. These factors seem important: 1) the abundance of the flower; 2) the basic attractiveness of the flower to most butterflies in general, determined by the factors just noted, mainly its colors and ultraviolet pattern and shape and size and scent; 3) whether the flower is too young or too old on the day of observation to have an attractive display and aroma; 4) the basic attraction of that butterfly species to that type of flower; 5) the height of the flower in relation to the preferred flight height of the butterfly (large Papilio that fly 3-5 m above ground seldom visit tiny low flowers, for instance, and Pholisora catullus skippers that fly just above the ground will seldom visit flowers on bushes or trees); 6) the abundance of the butterfly in the flower’s microhabitat on that day; 7) the amount of overlap of the flowering period of the flower and the flight period of the butterfly. That list of influential factors is long and complex. Of course all these influential factors were not measured here, and overall they are too complicated to be accurately measured except in a few high-intensity studies of one particular butterfly and one particular flower at one locality. This paper attempts to estimate the popularity of a flower to a butterfly by the inferences that can often be made when a large number of observations of visits to flowers are accumulated.

Using my knowledge of the factors listed above, I was sometimes able to make a better conclusion about the popularity of a species of flower than a mere inspection of the number of visits would suggest. Some rare flowers are popular where they occur, even though I do not list many visits for those. Likewise, some very common flowers are not popular, even though there are many visits listed for them. So in this paper I also add comments that estimate the popularity of a flower species by my rough understanding of these factors based on experience, as a supplement to a simple inspection of the number of visits listed below.

There are hundreds of flowers listed in the floras that are so uncommon or rare in Colorado that I did not encounter and identify them enough to make observations about them, so those plants cannot be discussed here. Some of those plants are expected to be popular, so perhaps elsewhere in the range of those plants where they are more common, someone will be able to determine whether butterflies often visit them.

This paper is a start on determining why some flowers are attractive and some are not. A complete survey of the ultraviolet reflection of Colorado flowers will be needed to understand the flowers’ popularity more fully. And good studies of their floral scents will be needed to understand differences in floral attraction.

Various “Butterfly gardening” books are not mentioned here, because most of those books are replete with errors; up to half of the flowers that they cite as popular with butterflies are actually not popular or are even shunned. The authors of those books are usually people who have very little knowledge of butterflies and have extremely poor ability to identify butterflies and wild plants. Most websites are also replete with such errors, including the websites of nurseries which mistakenly list numerous flowers as attractive to butterflies merely to boost their sales.

Before listing the detailed records, all those factors influencing the attractiveness of flowers are discussed, allowing some conclusions to be made from the records. The most popular flowers in Colorado. There are many popular flowers, as noted below. But the most popular may be Asclepias tuberosa, which has astonishing powers of attraction, and can attract butterfly species not seen elsewhere at the site that day (I planted seeds of it in the back yard, but unfortunately it is very difficult to grow). All Asclepias are very popular, as are Apocynum and thistles (Cirsium, Carduus,
Mega

Hesperiidae often fly visitors to red though the majority of the yellow and white flowers, especially when white flowers have ultraviolet (Dodson 1972), than with long corollas or open corollas. Interestingly, bees—like butterflies—mostly bypass red flowers and visit blue, yellow and white flowers, especially when white flowers have ultraviolet (Dodson and Dunmire 2007); but bees cannot see red well, whereas butterflies can. Some butterflies are attracted to red, for instance the white males of Neophasia terlootii are attracted to red cups because red is the color of their females. And an Asterocampa clyton probed my red truck, and a Lethe eurydice probed a red ribbon. And Heliconius erato are known to be attracted to the red patch on their wings (Swihart 1972). My results show that Hesperidae butterflies are often attracted to red flowers (I saw 43 species visit reddish flowers, though the majority were visits to reddish-purple yet many were to pure red) and are the majority of visitors to red Hedysarum boreale, and Poanes hobomok seems to prefer red-pink flowers. Actually Hesperidae often fly much faster than other butterflies (Hesperia miriamae and Paratrytone snowi and Megathymus ursus and some Agathymus fly so fast that they can be seen only when they slow down,
placing them among the fastest insects in the world), leading to the conclusion that their vision in general may be superior to that of Papilionoidea butterflies. Vision has been studied in only one Hesperiidae evidently, by Swihart (1969) who concluded that they have superposition eyes like moths and have only two optical pigments (of wide wavelength range), but if true the superposition eye may allow their brain to organize a fine image of the visual field that may permit their faster more precise flight.

Until recently it was thought that butterflies were at most trichromatic with three visual pigments (opsins) like bees that did not allow very good vision for pure red. However, new research shows that butterflies can see all the colors from very-near-ultraviolet to true red (300 to 700nm). Blackiston et al. (2011) studied Danaus plexippus and reviewed butterfly vision. Danaus plexippus has a time-compensated sun-compass navigation system and uses specialized ultraviolet-sensitive and polarization-sensitive receptors in the dorsal rim of the compound eye, just like the honeybee. They found that Danaus has the three expected opsin pigments with peak sensitivity at UV340, B435, and and Y545nm wavelengths, and the butterflies make use of dark-orange pigments distributed heterogeneously in the eye (in the pigment cells at the rhabdom) to enhance long-wavelength discrimination to let them see red colors (the dark-orange filtering pigments in some ommatidia result in orange and yellow eyeshine when the eye is struck with bright light, because the light reflects off the basal tracheoles and back out through the ommatidium to recapture more photons, like a cat’s eye [Stavenga and Arikawa 2006]). Blackiston et al. (2011) also concluded that Danaus has an additional (fourth) long-wavelength color receptor, based on the butterflies’ trainability to long-wavelength colors (they can learn to distinguish between two colors made by narrow-band filters transmitting 589 and 620nm wavelength for instance). Vanessa cardui has similar receptors at UV360, B470, G530 (Briscoe et al. 2003), like the presumed ancestor of Papilionoidea butterflies. Vanessa atalanta cannot see redder colors (590-640 nm) (but it visits red flowers, see Part I), while Heliconius erato has three similar peaks in reception and in addition has long-wavelength orange and red receptors at O590, R620, and R640 nm because of filtering pigments at the rhabdom that produce its orange and red eyeshine (Vanessa atalanta has only orange eyeshine) (Zaccardi et al. 2006). And Stavenga and Arikawa (2006) found that Pieris rapae butterflies have color vision from 300-700nm with ultraviolet, violet, blue, green, pale-red, and red receptors, because pale-red and deep-red screening pigments at the rhabdom modify the peak sensitivity of the opsin pigments to create the redder receptors. And Ogawa et al. (2013) found that Colias erate butterflies have four color receptors (ultraviolet, blue, green, red), but males have 11 and females have 8 different receptor classes when the effects of pigments etc. are included, and the blue and red receptor classes differ between males and females, and the butterflies can even see a little out to 725nm (almost to the infrared at 750nm). The pierid butterfly Phoebis sennae clearly sees red, as the records in Part I prove. And Kinoshita et al. (1999) found that Papilio xuthus butterflies are tetrachromatic (including red) with five opsins expressed in the eye, and they have eight varieties of photoreceptors when the filter pigments are considered along with the opsin pigments. Papilio aegeus has visual receptors peaking at UV360, V390, B440, G540, and R610 (Kelber, 1999), and Battus philenor can be trained to distinguish red from yellow or blue colors (Weiss and Papaj 2003). And Lycaena hestorema and L. rubidus (Lycaenidae) have tetrachromatic eyes with the four optical pigments peaking at UV360, B437, G500, and Y568nm, the latter useful for detecting reddish hostplants (with the same peak wavelength as human red cone detectors) and longer than the G530 wavelength pigment of most insects; some detectors differ between those two species and between sexes to function better in mating and oviposition.

Flower preferences of Phoebis sennae (Pieridae, Coliadinae), a tropical butterfly that prefers long tubular red flowers. The pollination books (Proctor 1996, Willmer 2011) seem to overemphasize that butterflies prefer red tubular flowers, I think because existing literature publications studied many large tropical species, so their preferences have come to dominate popular opinions. During my research I did find one of those species that prefers red long-tube flowers, so I researched it fully to serve as a comparison to the flower preferences of Colorado butterflies. That butterfly is Phoebis sennae, which ranges throughout Latin America from Argentina to Mexico, and in southern U.S. it migrates north each year then migrates back to Florida and Mexico in the fall. I have a few records for the species, and some records are from published literature, but most records I got from internet photos of P. sennae butterflies on flowers, by
laboriously identifying the flowers with books, internet photos of identified flowers (google “genus species photo”), and trips to nurseries (see the records above in Part I). *Phoebis sennae* has a very long proboscis, and it does visit a large variety of flowers, of all colors, but it seems to prefer red and orange, and the flowers it visits mostly have long tubular corollas. It often sticks its whole body and the base of its wings into a flower to suck nectar from the far end of flowers that can reach 5 cm in length. Evidently tropical butterflies, especially large ones, have different flower preferences than temperate climate butterflies (and the literature also suggests that subalpine-alpine flowers are pollinated much more often by flies, as noted below).

Considering all this research, the conclusion is that butterfly vision covers a spectrum that is among the widest known in the animal kingdom (Briscoe and Chittka 2001), as they can see all the colors humans can, plus ultraviolet.

**Ultraviolet reflection of flowers.** So, we should investigate the ultraviolet reflection of flowers. Apparently all butterflies see ultraviolet (as do bees and other insects and birds), which humans cannot see, and many flowers are known to have ultraviolet patterns that are used by insects at least to find some flowers and help locate the nectar and pollen. The ultraviolet reflection is generally caused by specialized epidermal structures on the flower surface, while numerous kinds of flavonoids in the flower absorb ultraviolet evidently to protect the flower from damage caused by too much sunlight. In particular, many flowers are known to have the center of the flower non-reflective (absorbing) of ultraviolet, while the outer part of the petals reflects ultraviolet (an ultraviolet bullseye). Examples are many Asteraceae including *Rudbeckia hirta* yellow, *R. laciniata* yellow, *Helianthus petiolaris* yellow, *Viguiera multiflora* yellow (see photos in Fig. 40 of Scott 1986a), while other flowers do not reflect ultraviolet (*Aster laevis* var. *geyeri* blue, *Geranium caespitosum* pink, *Heterotheca foliosa* = *fulcrata* yellow, *Aster porteri* white, *Heterotheca villosa* “horrida” yellow on those Fig. 40 photos). Bauer (1983) found an ultraviolet pattern in *Delphinium bicolor*, but none in *Castilleja pulchella*, *Lupinus monticola*, *Mertensia ciliata*, *Oxypotis campestris*, *Penstemon procerus*, and *Trifolium dasysphyllum*. Of these flowers, *Rudbeckia*, *Viguiera*, *Aster*, and *Heterotheca* are popular with butterflies, and among Bauer’s flowers only *Oxytropis campestris* and *Penstemon procerus* might be fairly popular, while *Geranium* is only moderately popular (except some tiny skippers love it) and *Osteospermum* is not common enough in Denver for me to determine its popularity. *Brassica rapa* is fairly popular and has an ultraviolet bullseye (Omura et al. 1999a). The popularity of the flowers does not seem to correlate very well with ultraviolet pattern in this sample, which is too small to be conclusive. Luckily the internet has hundreds more images of flowers that compare regular photos to uv-reflecting photos (Rorslett 2006; Primack 1982; etc.). Only about a quarter or fewer of all flower species have ultraviolet patterns different from the visual ones. Guldberg and Atsatt (1975) photographed flowers of 300 species of 61 families and found that yellow and violet flowers seem to have the highest probability of reflecting ultraviolet, while greenish and white flowers seldom reflect; pollination guides on flowers generally do not reflect uv; larger flowers are more likely to reflect uv (probably to help pollinators locate the flower center). Chittka et al. (1994) studied the flower reflection spectra of 573 species and found uv reflection to be less common and less intense than reflections of other colors. Among all those photos on the internet, by far the most common ultraviolet pattern—when it exists—shows the inner part of the flower absorbing ultraviolet, and the outer part of the flower reflecting ultraviolet. This uv “bullseye” pattern does not vary much between flowers, although the width of the uv-absorbing center varies somewhat (20-60% of the diameter of the flower, maybe averaging ~40%), while the most extreme flowers have the dark center of the bullseye much larger such as *Magnolia* and *Sonchus* and *Arnica angustifolia* and *Caltha palustris* and some *Rudbeckia hirta* that have just the petal tips uv-reflecting. So the insect may home in on the dark center of the ultraviolet-reflecting bullseye on those flowers, to help it find the middle of the flower where the nectar occurs (untrained bees probe the uv-absorbing end of the petal to seek nectar). Omura et al. (1999a) suggested the uv bullseye in *Brassica rapa* flowers is a nectar guide for *Pieris rapae* butterflies. *Cornus florida* and *Hibiscus trionum* and the sundew *Drosera longifolia* have the opposite pattern (uv reflects only in the center), and *Nuphar lutea* *Xpumila* has uv reflection only in a ring between center and outer non-reflecting parts, but that reversed uv pattern is rare and butterflies evidently shun those flowers. One would think
that the appearance of an ultraviolet ring with a dark center would enable flower visitors to easily locate those flowers, but many of those flowers are unpopular with butterflies. When I compare the popularity of the flowers to whether or not they have an ultraviolet-reflecting pattern, I am not able to find any correlation. Many popular and unpopular flowers have the bullseye ultraviolet pattern, but many popular flowers have no ultraviolet pattern at all because the flower is completely non-reflective. And some closely-related flowers have different uv reflection but similar popularity: for instance the regular *Potentilla* species have the uv bullseye pattern while *Potentilla (Dasiphora =Pentaphylloides) fruticosa* is completely non-reflective, but both kinds are equally (moderately) popular with butterflies; and *Viola tricolor* has the bullseye pattern while *Viola arvensis*tricolor has the upper petals absorbing and the lower parts reflective yet both flowers are probably unpopular. Kevan et al. (2001) note that bees perform poorly in identifying pure ultraviolet patterns when lighting changes (dim light etc.), which explains why there are few if any totally-uv-reflecting flowers in nature (only 3% of sunlight at sea level is uv, but the proportion rises in twilight due to greater scattering through a longer atmospheric trip that favors the passage of shorter-wavelength photons—however nocturnal sphingid moths refuse to visit flowers with uv reflection [White et al. 1994]). Most white flowers do not reflect ultraviolet, and would look blue and green to a bee and blue and yellow and reddish to a butterfly thus are still attractive to them. Kevan et al. (2001) note that uv reflection is no more important than the normal colors of reflection from flowers in a bee’s choice of flowers. And non-ultraviolet color changes in flowers are definitely known to affect the popularity of flowers: at least 214 genera of plants have flowers that change colors with age, as *Lantana camara* does when popular nectar-rich yellow flowers are pollinated and then change into nectar-poor red ones that are not visited (Barrows 1976). So perhaps the ultraviolet reflection patterns in flowers are mostly just an aid in helping bees and other insects to place their mouthparts on the uv-absorbing center of those flowers in nature, and they can use other colors and scent to locate the flowers (bees are the most important pollinators of flowers, so the evolution of flowers is surely driven mostly by bees, and most bees and most Hymenoptera have trichromatic vision with ultraviolet, blue, and green receptors [Chittka et al. 1994], and they evidently don’t see red very well, so most butterflies can see red better than bees). This conclusion is supported by reports that irregular (zygomorphic) flowers are more likely to have ultraviolet reflection patterns than regular (radially symmetrical) flowers; pollinators could use the help of uv bullseyes in locating the sweet spot on irregular flowers. So, ultraviolet reflection is evidently not the key to understanding the popularity or repulsion of flowers to butterflies.

If ultraviolet is not the key to understanding why flowers are popular or unpopular to butterflies, and the colors humans can see aren’t key either, then there is only one last possibility: the nectar and odor of the flowers.

**Flower nectar.** Flowers need sugary nectar to keep most pollinators (including pollinating butterflies sometimes) visiting. Some animals such as sunbirds and honeyeaters and new world bats and short-tongued bees and flies imbibe nectars that have double or more the amounts of glucose and fructose compared to sucrose, but most animals including long-tongued bees and butterflies visit flowers with more (or mostly) sucrose, and those flowers tend to have longer distances to the nectararies (Baker and Baker 1991, Proctor et al. 1996). Longer corollas usually have more sugary nectar (May 1988). *Battus philenor* (Erhardt 1991) and *Vanessa indica* (Omura and Honda 2003) preferred sucrose to fructose to glucose. This ratio seems unimportant for butterflies though, because glucose and fructose are more abundant in Asteraceae flowers than sucrose yet those are generally very popular for butterflies. And sucrose is dominant in Fabaceae yet those flowers are not as popular as Asteraceae. And female *Lysandra bellargus* preferred glucose while males preferred sucrose (Rusterholz and Erhardt 2000). And the butterfly-pollinated *Gladiolus* species have nectar that is either sucrose-rich or hexose [=glucose and fructose]-rich (Goldblatt and Manning 2002). And the preferences of *Ornithoptera priamus* differ by sex (Erhardt, 1992). Willmer (2011) summarizes nectar preferences in butterflies and other flower visitors and concludes that the sucrose/(glucose + fructose) ratio is very variable and does not matter much (butterflies don’t seem to care, table 8.2), though some visitors may prefer more concentrated nectar whatever the ratio.
The nectar of flowers attractive to butterflies (and birds and bats) is generally reported to be dilute enough (15-25%) to not plug the narrow proboscis. However Pivnick and McNeil (1985) reported that *Thymelicus lineola* preferred thick nectar and their sucrose intake was highest at about 40%, and they prefer flowers of *Trifolium pratense, Medicago sativa* and *Vicia cracca* which have 40-65% nectar. They used an engineering equation of laminar flow through pipes while assuming the Lepidoptera proboscis exerts constant sucking pressure, to calculate that the optimum nectar concentration is 35% (Boggs 1988, Hainsworth et al. 1991, May 1985, 1988, 1992; Willmer 2011 table 8.4 lists 35-45%). Kim et al. (2011) refined the engineering analysis and calculated that the optimal sugar concentration is 30-40% for animals that use active suction (Lepidoptera) and capillary suction (hummingbirds and sunbirds), but 50-60% for viscous dipping (used by most bees and ants). Those methods of feeding seem to be responsible for most differences in sugar concentration that have been reported (such as Willmer 2011 fig. 8.12). So butterflies can sip most of the nectar available in flowers, as the records seem to suggest (has anyone ever seen a butterfly reject a flower because the nectar is too thick?--butterflies whip out their proboscis on thick immobile sap on tree trunks and suck it up, evidently because they exude a little saliva to thin it).

Gardener and Gillman (2002) studied the amino acid profiles in nectar of 65 diverse plant species, and found a wide range of mixtures, with most plant species having their own amino acid “taste” values. Nectar of butterfly flowers was reported to contain small amounts of some or all of the biologically important amino acids, averaging more amino acid concentration than the nectar of flowers preferred by bees and other pollinators (except for flowers that mimic dung or carrion to attract flies, which have large amounts of amino acids) (Baker and Baker 1983, and Willmer 2011 table 8.3 in which average amino acid concentration of butterfly flowers is 50-300% more than flowers visited by other insects, except for carrion and dung flies). However methodological considerations suggest that most visitors care little about amino acid concentration (Willmer 2011), although some butterflies may truly prefer more. If pollen falls into the nectar, amino acids diffuse into the nectar over time (Ehrhardt and Baker 1990). *Heliconius* collect pollen on their proboscis tip with tiny spikes, roll it up, spit protease-containing saliva into the ball, and absorb amino acids and proteins from the pollen, enabling them to live six months (Gilbert 1972); females do this more often than males. Because of the proteases in *Heliconius melpomene* saliva, the more pollen they gather with their proboscis the more eggs they produce (Eberhard et al. 2007). And *Araschnia levana* females laid more eggs when fed amino acids, except if their larval food was enriched with nitrogen so they didn’t need more nitrogen (Mevi-Schütz and Erhardt 2005). Female *Coenonympha pamphilus* preferred nectar with more amino acids, while males had no preference, and butterflies raised on low-nitrogen leaves desired more amino acids (Mevi-Schütz et al. 2003) to compensate for larval deprivation. Long-lived (but not short-lived) tropical Borneo butterflies did live longer when fed amino acids (Beck 2007). *Pieris rapae* females (and honeybees) but not males prefer nectar that contains amino acids (Alm et al. 1990), as they visit those flowers more often and suck more nectar. However *Ornthoptera priamus* visited amino-acid-containing nectar no more than sugar solution (Erhardt 1992). And *Battus philenor* males preferred plain sugar over sugar and amino acids, while females showed no preference (Erhardt 1991). *Lysandra bellargus* females but not males preferred flowers with more amino acids in spring, while males preferred higher-sucrose nectar and more sugar than females who preferred more glucose (Rusterholz and Erhardt 2000). Although female (but not male) *Inachis io* preferred nectar mixed with amino acids (Erhardt and Rusterholz 1998), they evidently cannot detect amino acids well and greatly prefer sugar. *Euphydryas editha* requires sugar in nectar for an optimum production of eggs but amino acids increase egg production very little and an excess is harmful (Murphy et al. 1983). *Colias* visit flowers with significant [but not high] amounts of nitrogen-rich amino acids and a high proportion of monosaccharide sugars in their nectar (Watt et al. 1974). The consensus seems to be that most butterflies care little about the amino acid concentration of nectar, and only some females and some long-lived species really desire more amino acids. Some female butterflies desire amino acids to grow their eggs, especially if their larval food was deficient in nitrogen due to bad soil, while males desire sodium more.
These components of nectar such as sugars and amino acids evidently are not volatile, so they do not contribute to floral scents, and thus do not influence the butterflies’ choice of flowers before they land; a butterfly must evidently lower his proboscis into the nectar to determine if the nectar is good.

**Floral scents.** It seems likely that most undesirable flowers lack a floral scent that is attractive to butterflies. But butterfly flowers generally have a weak—not a powerful—scent. Proctor et al. (1996) state that flowers adapted to pollination by butterflies usually have sweet and sometimes heavy scents, and they cite five flowers from England that have powerful scents (Lonicer periclymenum, Hyacinthus orientalis, Syringa vulgaris, Erysimum cheiri, and Dianthus caryophyllus). Syringa vulgaris does have a powerful scent, but it is not very popular with butterflies in Colorado, where the cultivated Lonicer and Dianthus are not popular either, although Colorado Erysimum are popular (it does not have a strong scent). Cultivated Salvia sclarea and Iris germanica have a very powerful scent, but are not visited by butterflies. Unfortunately humans have a poor sense of smell, as most of the 1000 genes that rodents and bears and wolves use to power their tremendous olfactory capabilities (bears can smell food many kilometers away) have been lost in the evolution of humans, as apes have only 700 and humans only 400 of those olfactory genes. Perhaps that is the reason that I have not noticed a medium or strong scent in most of the flowers that are popular with butterflies. It is now thought that butterfly flowers smell mildly sweet, but not as sweet as those visited by sphingid moths which are very sweet (Dobson 2006; Willmer 2011). Butterflies evidently have a much better sense of smell than humans (like bees, which can detect odors at 1% the concentration noticeable by humans). Butterflies can perceive most floral scent chemicals, except the highly-volatile monoterpenes (pinene, carene, 1,8-cineole, sabine, p-cymene, limonene) (Andersson 2003b). Butterflies are probably just as good at detecting odors as bumblebees, and Marden (1984) found that bumblebees detect the odor of flowers while flying to decide whether to land. Butterflies are known to be good chemists, as their antennae and labial palpi and leg tips detect scents, including the pheromones wafted by males and females to facilitate courtship and mating, and the scents of caterpillar hostplants. Some butterflies love sap for instance, as noted below in the records, and they find it by smell as the sap is generally very inconspicuous on a tree (typically the butterfly approaches the sap by smell, and lands above the sap and walks down to it, to avoid getting stuck and fossilized in amber). Also, males and females choose conspecific individuals for mating primarily based on detecting the odors of pheromones in both sexes, because the courtship movements of butterflies are generally the same within genera or tribes so are not specific enough to provide enough information for reproductive isolation (Scott 1973e) (most western North American species of Argynnis for instance are so similar in appearance that only experts can distinguish them by wing pattern, and their courtship dances are identical, and they produce offspring butterflies when males and females are forcibly paired in the lab [Steve Spomer research], yet they seldom interbreed in nature, obviously because pheromones produced by both sexes produce reproductive isolation). Most flowers evidently have a scent that attracts visitors in order to promote pollination. More than 1,700 compounds have been isolated so far, from 990 taxa of 90 plant families (Knudsen and Gershenzon [2006], Dudareva and Pichersky [2006]). Flower scents are small volatile organic compounds, including aliphatic compounds (fatty acid derivatives, including hydrocarbons such as pentadecane, esters such as ethyl acetate, alcohols such as hexanol, and ketones such as jasmine), benzenoids (and phenylpropanoids) with a benzene ring (such as vanillin, methyl salicylate, eugenol, methyl cinnamate, benzaldehyde, and phenylacetaldehyde), terpenoids (including monoterpenes such as linalool, limonene, alpha-pinene, verbenone, geraniol and citronellol, sesquiterpenes such as alpha-farnesene, caryophyllene, and ionone; and irregular terpenes such as ooxisporphorene), plus some compounds containing nitrogen (such as indole and skatole) and sulfur (such as dimethyl disulfide), etc. Dudareva and Pichersky (2000, 2006) reviewed floral scents and noted that they are almost always a complex mixture of small (30-300 amu) volatile molecules of the above compounds, that are generally emitted by the flower petals, and no two closely-related plant species emit the same volatiles; evidently all plants contain the gene for making linalool (which is also used by corn and soybeans as a defense against herbivores).

There are now some good studies that show that some compounds are frequently used by flowers to attract butterflies: their scents have abundant benzenoids (including phenylacetaldehyde and 2-
phenylethanol, often benzaldehyde, benzyl alcohol), certain terpenoids (especially linalool, often oxoisophorone, trans-beta-ocimene, cis-3-hexenyl acetate); some have fatty-acid derivatives (such as cis-3-hexenyl acetate), seldom with nitrogen compounds in small amounts (Dobson, 2006). Andersson et al. (2002) studied the scent compounds of 22 butterfly flowers in Europe and America (including butterfly-pollinated Buddleja davidii, Centranthus ruber, Phlox paniculata, and Warszewiczia coccinea), and identified 217 compounds (8 to 65 per plant); they reported that the following compounds are probably a signal to attract pollinating butterflies to flowers: the benzenoids phenylacetaldehyde and 2-phenylethanol, the monoterpenes linalool and linalool oxide (furanoid I and II), and the irregular terpene oxoisophorone. *Buddleja davidii* emits oxoisophorone (the most common, and related oxoisophorone oxide and dihydrooxoisophorone), phenylacetaldehyde, and linalool (and 2-phenylethanol) to attract butterflies (Andersson et al. 2002), while *Cirsium arvense* emits the same basic mixture with phenylacetaldehyde the most common (Andersson 2003b). Theis (2006) found 10 chemicals in the flowers of *Cirsium arvense* (Asteraceae) that attract insect pollinators (benzaldehyde and phenylacetaldehyde dominate, with 2-phenylethanol, methyl salicylate, p-anisaldehyde, benzyl alcohol, linalool, furanoid linalool oxides [E and Z], and dimethyl salicylate also present) and found that the two dominant ones attracted both the pollinators and insects that ate the flowers (the pollinators are mostly bees, and some flies, and even the butterflies *Vanessa atalanta* and *Pieris rapae*). Oxoisophorone is also the most common in *Centranthus*. Andersson (2003b) further found that the compounds phenylacetaldehyde, linalool, and oxoisophorone are exclusively of floral scent origin (found in *Cirsium* and *Buddleja* etc.) and elicit the greatest antennal response in three nymphalid and pierid butterflies (compared to 39 synthetic compounds, Andersson 2003a,b), so are likely to be important compounds for attracting butterflies to flowers in nature. *Pieris rapae* is attracted to floral scents of *Brassica rapa* flowers (phenylacetaldehyde especially, and benzaldehyde, benzyl alcohol, and 2-phenylethanol, phenyl acetonitrile), which are used for close-range flower location and recognition in Japan (Omura et al. 1999a); *P. rapae* is repelled by gamma-decalactone in *Osmanthus fragrans* flowers (Omura et al. 2000a) (and is also repelled by indole). Three of those compounds are the same as the five in *Ligustrum japonicum* that attract *Pieris rapae* (phenylacetaldehyde, 2-phenylethanol, 6-methyl-5-hepten-2-one, benzaldehyde, and methyl phenylacetate—these compounds are more attractive together than separately) (Honda et al. 1998); benzyl acetate also attracts *P. rapae* (Raguso 2004). These compounds attractive to *Pieris rapae* are similar to those Andersson (2002) considered important, and similar mixtures attract honeybees and are emitted by rust fungi that attract diverse flies and bees (Raguso 2004), which suggests that many butterflies are attracted to floral scents that are very common among flowers, and butterflies are mostly generalists regarding their choice of flowers (which is evidently why the common butterfly species have such large lists of flowers visited in my records). More butterfly flowers with benzenoids: *Prunus yedoensis* flowers attract *Luehdorfia japonica* butterflies with phenylacetaldehyde, and a little less by benzaldehyde, benzyl alcohol, and 2-phenylethanol (Omura et al. 1999b). Butterfly-pollinated European orchids *Gymnadenia* [Nigritella] nigra, *Gymnadenia densiflora*, and *Anacamptis pyramidalis* also have high benzenoid emissions (Andersson 2006; *G. nigra* emits mostly benzyl alcohol and phenylethanol, plus some terpenes and aldehydes including vanillin, Tava et al. 2012, Kaiser 1993). *G. [“conopsea”] densiflora* emits the benzenoids benzylacetate [especially], mixed with benzyl benzoate, eugenol, methyl eugenol, and benzyl alcohol, but the nocturnal scent has less benzyl alcohol and methyl eugenol, suggesting those two might be more important for butterfly attraction) (Huber et al. 2005); the moth-pollinated *G. conopsea conopsea* has high fatty-acid-dominated and indole emission typical of moth flowers (Andersson 2006; indole repels *Pieris rapae* butterflies, Omura et al. 1999a). *A. pyramidalis* has a simple blend of phenylacetaldehyde, 2-phenylethanol, linalool, verbenone, alpha-pinene, and oxoisophorone which varies greatly between individuals yet attracts butterflies anyway (Andersson 2006), so butterflies evidently do not rely on a single compound for attraction. Omura and Honda (2005) found that benzaldehyde, acetophenone, and (E and Z)-nerolidol, isolated from *Taraxacum officinale* and *Cirsium japonicum* flowers, caused *Vanessa indica* to extend its proboscis to feed. The Japanese butterfly-pollinated *Cimicifuga simplex* type II emits the benzenoid isoeugenol plus methylantranilate that each attract fritillary butterflies but together are more attractive (Pellmyr 1986); these compounds are
absent in bumblebee-pollinated types I and III. Andersson suggests that benzenoids are more predominant in temperate zone European and American flowers, while the terpenoid linalool and derivatives are more predominant in warmer American areas. For instance the originally-tropical-American Lantana camara is dominated by terpenoids such as trans-beta-ocimene, cis-3-hexenyl acetate and low in benzenoids (the main benzenoid is benzaldehyde) (Dobson 2006, Andersson and Dobson 2003b). And the tropical Heliconius melpomene much prefers the terpenoid compounds in Lantana camara flowers to the fatty acid derivatives in Philadelphus coronarius (Andersson and Dobson 2003a, b). But some temperate zone flowers emit more terpenoids. The originally-Chinese Buddleja davidii emits more terpenoids as noted above. And the European butterfly-pollinated Dianthus carthusianorum scent is dominated by terpenoids such as trans-beta-ocimene and some cis-e-hexenyl acetate, and is low in benzenoids such as benzaldehyde (Dobson 2006) (the sphingid-pollinated D. gratianopolitanus attracts the moth with methylbenzoate and less methyl salicylate). Originally-Texas Phlox drummondii flowers produce linalool and beta-caryophyllene, while eastern U.S. Phlox paniculata produces mainly trans-beta-ocimene, followed by phenylacetaldehyde and 2-phenylethanol (Andersson et al. 2002).

These floral scents are evidently much smaller compounds than the large compounds such as alkaloids etc. that are “tasted” by butterfly females drumming their forelegs onto potential hostplants to determine suitability for egg-laying, so their small molecular weights may provide some hope that floral scents can be more easily studied with head-space gas chromatograph technology to soon enable us to understand why butterflies find certain flowers popular and reject most flowers.

Flowers visited and pollinated by moths also have complex mixtures and great variation in floral scents. They are predominantly terpenoids (including some monoterprenes) or benzenoids (often including aldehydes) (Dobson 2006). The floral scents attractive to “settling moths” (moths than land on the flower, including Noctuidae, Geometridae, Pyralidae, Tortricidae, etc.) tend to be intermediate to the scents chosen by the hovering Sphingidae moths; typical benzenoids tend to have more phenylacetaldehyde and benzaldehyde and esters, terpenoids include linalool and beta-ocimene and lilac compounds, and they sometimes have fatty-acid-derived esters and nitrogen compounds. Hovering sphingid-attracting scents tend to be dominated by terpenoids (especially oxygenated ones, and linalool), benzenoid esters especially methyl benzoate, and more-abundant nitrogenous compounds (even indole). Moth flowers tend to be pale, long (with narrow tubes or spurs), and strongly-scented to attract nocturnal moths.

Bee-pollinated plants also produce numerous floral volatiles, but their scents tend to be dominated by terpenoids and generally have low amounts of benzenoids and fatty acid derivatives (Dobson 2006) (butterfly flowers tend to have more benzenoids and less terpenoids than bee flowers).

Every plant emits a different composition of floral scents (Knudsen et al. 1993). Borg-Karlson et al. (1993) studied floral scents of six genera of Apiaceae (including Aegopodium podagraria, Heracleum, and Pastinaca sativa) and found that the various mixes of terpenes and nitrogen compounds and esters and linalool etc. differed in every species. Levin et al. (2001) studied floral scents of Nyctaginaceae (Mirabilis, Acleisanthes, Selinocarpus, pollinated by sphingid moths), and found that every plant had a unique blend of mono- and sesquiterpenoids, aromatics (both benzenoids and phenylpropanoids), aliphatic compounds, lactones, and nitrogen-bearing compounds. So the popular compounds above may enable a butterfly to determine that the flower probably has nectar, then the butterfly can learn the scent composition of rewarding flowers and prefer those. At short range, some butterflies still use the colors etc. on the flowers as much or more than their scents to choose them (Hirota et al. 2012; Omura and Honda 2005), and Heliconius melpomene uses color to approach flowers but needs floral scents to feed and forage (Andersson and Dobson 2003a,b). But butterflies in general use both color and floral scents to choose flowers (Andersson 2006).

Inflorescence shape and height. Flowers shaped with a “landing platform” are traditionally claimed to be important for butterflies, but this does not seem to be very important when we consider the shapes of the popular flowers in the list above, as many popular flowers/ inflorescences have irregular shapes (such as legumes, Delphinium, Liatris, Asclepias, Buddleja, Lobelia, etc.), and butterflies have claws on the tips of their legs that grasp irregular flowers very well, so an odd flower shape is no impediment to a landing
butterfly (note the way *Papilio multicaudata* harvests nectar from *Delphinium ajacis* flowers described below). Irregular flowers are actually safer for a butterfly to land on, because landing on a flat area (wet sand for instance) would cause wing tip damage as the wing tips knock against sharp things (sand grains on wet sand, or the flowers at the edge of an *Achillea* inflorescence) when the butterfly flies away. The really flat inflorescences on Apiaceae are not very attractive to butterflies (although the flat *Eupatorium* in Asteraceae are attractive), and the flat-inflorescence *Achillea* is not the most popular Asteraceae flower. Very long flowers are not visited by most butterflies because the corolla is too long for the proboscis, and this is evidently why Hesperiinae (which have longer proboscis) visit some flowers with longer corollas (such as *Opuntia, Convolvulus sepium, Hedysarum, and Penstemon* as noted below) more often than other butterflies visit them, and is why small butterflies such as most Lycaenidae only visit small flowers that fit their small proboscis. Nectar spurs are not typical of butterfly flowers either, as often claimed; few flowers have such nectar spurs in Colorado; *Aquilegia* has long spurs but is not popular, though *Delphinium geyeri* is popular with long-proboscis *Papilio*. And butterflies generally visit the flowers that are about at the height that they fly, because of the coincidence of that level being the height that they fly for mate-location (for males, especially fleeing = “patrolling to seek females” males rather than raiting = “perching to await females” males; see Scott 2010 for these definitions) or oviposition (for females), although butterflies that fly very high, such as *Neophasia* that fly around *Pinus* trees to seek females, tend to come down near the ground to find flowers. 

Butterflies use minimal standards to select their flowers. Now we have to consider all this information regarding the colors of flowers and their ultraviolet reflection and their nectars and floral scents and their size and heights above ground, and apply a little logic. If floral scents are the key to understanding butterfly attraction to flowers, but nearly every flower species has a different mix of floral scents, how could a butterfly deal with the numerous flower species in its environment, every one different in scent? This paper shows that most butterflies visit very many flower species, as the list of flowers visited grows longer and longer and even longer the more you watch them. So the scents that attract most butterflies must be of numerous kinds or must be rather general—encompassing entire classes of volatile compounds—to allow them to visit so many flowers. There is evidence above that butterflies have a good sense of smell and are attracted to multiple floral scent compounds, which lets them visit many different kinds of flowers. The same logic applies to colors, ultraviolet reflections, and shapes/sizes and heights. 

Butterflies visit so many flowers, of so many fragrances, of so many colors, of so many types of ultraviolet reflections, of so many different heights and sizes and amounts of clustering, that it would take a giant brain to analyze all that if they dealt with every aspect of every flower. The butterfly brain is simply not powerful enough to analyze every one of the thousands of chemical combinations or the thousands of combinations of color and uv and size and shape that exist in flowers, so there has to be just one basic conclusion about what butterflies are thinking: When a flying butterfly is thirsty and something appears in its view or olfactory neighborhood that is remotely adequate (that isn’t brown or green and has any kind of hopeful color and scent or at least isn’t repulsive), it will approach near and look and smell again and then stop and see if it provides accessible nectar with an adequate taste. Then it will learn and rapidly reduce its handling time on rewarding flowers, and farther on it will be more likely to choose that type of flower (demonstrated in the butterflies *Thymelicus flavus, Battus philenor, Pieris rapae, Pieris napi, Euphydryas editha*, and *Lycaena virgaureae*, which all learn to exploit good flowers and visit them more often [Kandori and Ohsaki 1996, McNeely and Singer 2001, Goulson et al. 1997, Goulson and Cory 1993, Lewis 1986, 1989, Weiss and Papaj 2003, and references in Andersson 2006 p. 208]), while naive untrained young butterflies have a genetic preference for some floral scents that are prevalent in butterfly flowers (Andersson 2003a, Andersson and Dobson 2003a). Different localities and different seasons have different flowers, so the species visited will differ with locality and time, so a viewer like me who studies hundreds of localities at all seasons will eventually record a list of flowers visited that is long with numerous types of flowers. Maybe the main conclusion of this paper is that butterflies are not very restrictive in their choice of flowers; most of them visit very many different flower species and flower colors and shapes and sizes if those are available and if they satisfy minimal standards of color and scent and nectar availability and quality and size and height.
Yet from the records presented below it is obvious that most flowers fail those minimal standards, as most flower species in nature—even beautiful ones—are shunned by butterflies.

So, what are the minimal standards butterflies use to choose flowers? I do not know why butterflies are attracted to most of their flowers. Surely they require some of the floral scents discussed above, and usually require reasonably bright colors, and after landing they require adequate nectar. It would seem that weak/mild floral odor is attractive to most butterflies, and a colorful or bright white appearance (even without uv reflection) is attractive. The big unknown in understanding this seems to be floral scents, about which we know the least.

The shunned flowers evidently have unpopular scents (such as the unpopular fatty-acid-derivative and sesquiterpene scents of Philadelphus coronarius and Achillea millefolium [Andersson 2003a], and the “aminoid” odor of amino acid derivatives such as valine methyl ester, isoleucine-related imines, and 1-pyrrole in the white-umbel plants Daucus, Heracleum, Sambucus, Sorbus, Viburnum, and Cornus [Raguso 2006] that evidently make them unpopular for butterflies) and rely on other insects for pollination, usually bees, sometimes wasps, flies (Bombyliidae, Syrphidae, etc.), beetles, Sphingidae moths, hummingbirds (which especially visit red flowers), or bats (pollinating Agave or Saguaro cacti in the American desert etc., and especially in the tropics), rarely thrips or ants etc. Many plants have beautiful flowers yet are seldom visited by butterflies and are pollinated by bees etc. Some flowers such as Oenothera bloom at night and are pollinated by moths. But some flowering plants have flowers that are truly adapted to attract insects such as butterflies.

Pollination of flowers by butterflies. Pollinators helped create the diversity of life still surviving on earth today. About 80% of flowering plants are pollinated by animals, as flowering plants and their pollinators coevolved together in the late Cretaceous and Tertiary. Without pollinators, there would be many fewer plants on earth because they would have to be common enough so that wind could blow pollen between them (or they would have to self-pollinate). An efficient animal pollinator allows the plant to become rarer because the pollinator can carry the pollen the longer distance between individuals of rarer plants. So as pollination efficiency increased, rarer plants could survive, specialization of both plants and pollinators could continue, and the average plant became rarer as the number of species increased. This has culminated in the Orchidaceae with a huge number (20,000 species) of rare orchids that are efficiently pollinated by bizarre complex pollination systems. 40,000 or more species of bees worldwide evolved to pollinate plants, and some flies and wasps and other insects and birds and bats etc. also evolved as pollinators. Without pollinators, many plants would become extinct, and the fewer number of plant species would mean that the number of plant-feeding insects such as Lepidoptera would be greatly reduced. Now, why did the plants become rare and need pollinators? Willmer (2011 fig. 4.9) shows four current arguments about the evolution of floral-pollinator specialization, none of which seem entirely correct. I think this is a search-process game. We can divide the players here into three: the plants, the munchers, and the pollinators. The “munchers” are various animals that consume plants and can drive them into extinction, so as the plants become rare from the munchers they are saved from extinction only if there is a pollinator that can pollinate them at that low density (numerous plants without such pollinators surely went extinct due to lack of pollinators or due to too much selfing-induced inbreeding), and then the munchers and pollinators and plants can coexist, at a low-enough density that the munchers cannot easily find and exterminate the plants and destroy the system. Of course, to be realistic we could throw in all the parasitoids and predators and parasites and herbivores and fungi and bacteria and viruses etc. that make the density of all three players low as well, but they don’t disturb the basic logic, because the value of low density for all the players in this game is the lesser susceptibility to being killed due to the greater difficulty of being found by munchers. The diversity of plant (and animal) species and the diversity of their repellent chemicals and muncher-avoidance devices and immune systems, all serve to make the density of creatures that are killable by the munchers low enough to make it difficult for the munchers to find them. That low density then requires effective pollinators and effective mate-location systems that succeed at low density for all these players in the search-process game. Selfing is rare because it contributes less to the diversity of plants’ anti-muncher repertoire.
In this section, it helps to know that many plants, especially trees, weeds, and grasses/sedges, have tiny ugly flowers which are wind-pollinated. Of course the least popular flowers for butterflies are wind-pollinated flowers, because they lack nectar and their pollen is unusable by butterflies. In temperate zone Colorado, wind-pollinated plants include most trees, many weeds, grasses/sedges/rushes, and the primitive plants mosses/liverworts/ferns/horsetails. Trees are mostly wind-pollinated in cold temperate climates because most insects fly lower to the ground and the wind speed is faster higher up, because temperate zone trees are generally common so the distance between conspecific trees is small enough for wind to bring pollen, and because trees generally have too many flowers for insect populations to pollinate them efficiently (there are too many flowers per insect, and the insect is likely to visit another flower on the same tree rather than travel to another tree) (grasses/sedges and weeds also have too many flowers). Thus trees such as Cupressaceae, Pinaceae, Celtis, Morus, Ulmus, Fagus, Quercus, Populus, Salix, Juglans, Alnus, Betula, Acer, Fraxinus, Ginkgo, etc. are wind-pollinated (all of those are found in Colorado in nature or in towns, except Fagus). (Many trees native to the deciduous forest in eastern U.S. are not wind-pollinated, such as Catalpa trees with large white flowers [which are not visited by butterflies], Castanea, Tilia (partially wind-pollinated), etc. And tropical rain forest trees tend to be rare [with hundreds of species in a small area] so animal pollinators are useful to bring pollen from the flowers of one to a distant other.) That wind-pollination reduces floral display is shown in Eupatorium: wind-pollinated Eupatorium flowers tend to have smaller floral heads, larger stigmas that are more exposed to the wind, and weaker inflorescence branches, while insect-pollinated Eupatorium flowers tend to have reduced stigma size and exposure and stiffly upright inflorescences and showy heads (Sullivan 1975).

Pollination involves more than just transfer of pollen from stamen to stigma. Many plants are obligate outcrossers and their flowers may be receptive only at certain times of day. Many plants produce pollen on different days than the stigma is receptive, in order to avoid self-pollination, so pollen transfer on a single day between synchronized flowers will not pollinate. Some plants have flowers that set seed without pollen transfer. An effective pollinator is one that transfers pollen in the correct manner according to the plants’s beeding system. So to prove actual pollination, experimental studies of seed set of the flower may be needed. Thus it is important to note that mere visits to a flower do not prove that the butterfly is pollinating it.

Butterflies are often claimed to be pollinators of flowers. However, the butterfly proboscis tends to be very smooth and pollen appears not to stick to it very well (except Heliconius are known to gather pollen of Anguria flowers etc. with their proboscis which has scales sticking out near the tip to capture the pollen, then they roll up the pollen in their curled proboscis and exude saliva onto the drop to dissolve amino acids and proteins from the pollen that they then suck up [Gilbert 1972]). The butterfly proboscis is operated like a crane, lifted up by the more rigid basal part and then only the tip inserted into the flower, so the opportunity for the proboscis to contact pollen or stigma is limited. And butterfly legs are rather smooth, though they may be covered with scales and setae that might catch pollen. The butterfly body is covered with more scales that can catch pollen, but the long stiltilike legs generally keep the butterfly’s body above the pollen-bearing anthers and stigmas of the flower. To pollinate a flower, the butterfly must visit one flower and get pollen stuck onto its proboscis or legs or body or wings, and then visit another plant of that species and deposit the pollen on the stigma, where the pollen must successfully fertilize the plant.

This chain of events requires a lot of time and effort to prove. To prove pollination by a butterfly species, detailed studies are needed to determine where it lands on the flower and whether pollen is transferred to which parts of the butterfly, etc. It is desirable also to determine why a butterfly is attracted to a particular flower and not others, whether the attraction is based on colors visible to humans or ultraviolet or scent or whatever, to see if the butterfly is attracted enough to that species of flower to visit many of them to transfer pollen. In the best studies, a palynologist examines the butterfly to search for the microscopic grains of pollen and uses powerful microscopes to identify the pollen to plant species (great care is needed in catching and preserving that butterfly in order to avoid contamination from pollen present in the net capturing the butterfly or present in preservation boxes or on tweezers etc.). The process is easier for pollen-gathering bees, because the mass of pollen that the bee gathers in its pollen
Solidago generalist flowers that are adequately common, such as flowers become unreliable pollinator ones their larvae can thrive eating. I without doing much pollination pollen to kill generation coinciding with those flowers)

...the flower base to steal the nectar; bumblebees are the usual culprits in making these holes that they chew and eggplants actually shake pollen out of the flower Bumblebees and so weak butterflies could never hope to open. swee... locate good food. good foods the hive using movements and keep bees in the hive (the round dance for nearby trips and the tremble dance to keep bees in the hive for housekeeping duty to receive and process nectar--they perform those dances in the hive using movements and buzzing sounds and four different scents to communicate the location of good foods to other bees) that all make them great pollinators. Honeybees even have scout bees to help locate good food. Other bees also pack and store pollen in those hairlike “scopae” (on hind legs in bumblebees, on legs and sometimes on sides of thorax and abdomen in Andrenidae, in various places on the hind legs in many bees such as Halictidae and Melittidae and Anthophoridae, on hind legs and underside and front of abdomen in Lasio...Lasioglossum, on thick hair on underside of abdomen in Megachilidae, while Hylaeus bees carry pollen in their crop mixed with nectar). Bees attack flowers like brutes, sweeping them to gather pollen, and forcing open recalcitrant flowers such as legume (pea) flowers that weak butterflies could never hope to open. Bumblebees are incredibly strong compared to butterflies. Bumblebees and some other bees can even grab the flower and vibrate their thorax (“buzz pollination”) to actually shake pollen out of the flower that other bees can’t get (out of a hole in the anthers of tomatoes and eggplants for instance). But sometimes even the herculean bumblebees get lazy and chew a hole in the flower base to steal the nectar; bumblebees are the usual culprits in making these holes that they chew in Linaria, Aquilegia, Lupinus, garden Narcissus, etc. Bees vary in the number of flower species that they visit: those that visit only the flowers of one species or genus or family of plants are called specialist (oligolectic) bees (if the bee visits just one plant it is called monolectic), while those non-specialists that visit numerous flowers of many plant taxa are called polylectic. Specialist bees generally collect the pollen and store it in their nest and use it to grow their larvae, which are adapted to feed on that plant’s pollen and often die eating other flowers’ pollen (Praz et al. 2008) (they typically have just one yearly generation coinciding with those flowers). Evidently many or most plants place toxic chemicals in their pollen to kill the larvae of promiscuous bees that visit many kinds of flowers and would steal their pollen without doing much pollination, and this process causes bees to evolve specialization on few flowers, the ones their larvae can thrive eating. In fact it is now thought that the original bee was a specialist pollinator. However, a specialist bee will be forced to evolve into a promiscuous polylectic bee if its flowers become unreliable, which seems to be why most specialist (oligolectic) bees get pollen from generalist flowers that are adequately common, such as Salix catkins and Helianthus and Aster and Solidago flowers. There are 4,000 species of bees in North America (1,000 of them Andrena), so there are plenty of bees to pollinate the flowers. Butterfly collectors usually pay little attention to bees and flies, so they should carry a cyanide jar and net into the field and collect bees etc. that visit flowers, so the
bees and pollen loads can be identified to bee species and flower species (pollen can be identified using powerful microscopy at least to plant genus usually, though similar species may have identical pollen).

In comparison, butterflies are built like nectar robbers and not pollen transporters, so are not expected to be efficient pollinators. Butterfly bodies are poorly adapted for pollination. The butterfly proboscis is a long straw that serves to neatly suck nectar from a distance away from the mess of the flower so the butterfly will not become bothered and weighted down with pollen, and the stiltilike legs keep the body away from the floral mess, and whatever pollen sticks to the proboscis or legs is partly shaken off as the proboscis rolls up and the legs retract for flight, and much of the pollen that was on the proboscis gets brushed off and stuck in the proboscis chamber between the labial palpi (Venables and Barrows 1985), and the air rushing past during flight knocks off more pollen.

For example, Lazri and Barrows (1984) observed the butterfly *Pieris rapae* visit 38 flower species in Washington D.C. (nearly all exotic plants) and found that each butterfly carried an average of 1 to 9 pollen grains of seven flower species on their proboscis and from 0 to 2 grains of four flower species on their legs, and transported much more of *Raphanus sativus* (especially) and *Lythrum* flowers than the others; but they concluded that the butterflies function primarily as nectar thieves. Wiklund et al. (1979) found that the proboscis of Swedish *Leptidea sinapis* butterflies made little contact with *Viola canina*, *V. riviniana*, and *Lathyrus montanus* flowers as it sucked nectar and there were only an average of three pollen grains on each adult, so they are mostly nectar thieves and poor pollinators (*Viola* was shunned when *Lathyrus* became common, but *Lathyrus* is probably not preferred by *Leptidea* either). Venables and Barrows (1985) studied pollination of mostly garden flowers by two hesperiid butterflies, and found that *Atalopedes campestris* visited 23 flower species and had an average of 68 pollen grains per butterfly, and *Epargyreus clarus* visited 27 flowers and had an average of 45 pollen grains; these grains were mostly on the proboscis cavity and on the body, fewer on legs and abdomen tip; they concluded that few pollinations occurred and these Hesperiidae are mostly nectar thieves, because their most popular flowers were Asteraceae and they visited mostly protandrous disc flowers when the pollen was available and not later when stigmas were receptive, and they estimated that the pollen loads were small enough that it would take an average of four trips to transfer one pollen grain. They noted that spiny pollen does not stick to the proboscis as well as spineless pollen. Bees pollinate *Lotus* flowers, while butterflies steal the nectar (Proctor et al. 1996, table 4.3). Courtney et al. (1982) wrote that *Anthocaris cardamines* and other Pieridae and *Aglais urticae* butterflies carried pollen for days on head and body so could pollinate, but later critics doubted that there was much pollen transfer. I prove in this paper that most butterflies visit numerous flower species, so when they do this locally few pollen grains will stick to con specific flowers. Hawkswood (1985) found 11 butterfly species visiting *Acacia bidwillii* in Australia, and found pollen on 26 of 58 butterflies (most on underside of abdomen), but considered that the short visit times and small numbers of pollen carried made the butterflies unimportant pollinators compared to other insects. Butterfly/moth flowers last an average of six days before wilting, longer than any other flowers except Australian bird flowers (Willmer 2011 Table 21.2), which suggests that they need to stay fresh longer because they are being pollinated rather slowly by the butterflies.

However, butterflies may be better pollinators than we think, because electrostatic pollen transfer is evidently important in nature: plants tend to be negatively charged in warm still air, especially at narrow protrusions, and flying insects accumulate a positive charge as they fly, so when a butterfly lands on a flower the pollen can leap across and adhere due to electrostatic attraction (Vaknin et al. 2000). This phenomenon evidently does occur (especially for tiny pollen “buzz-pollinated” out of anthers by bees) but was thought to need more study (Willmer 2011 pp. 171, 175). However Clarke et al. (2013) apparently confirmed the phenomenon and even demonstrated that bumblebees can learn the electric fields of flowers to help discriminate between flower species during foraging. Could electrostatic attraction transfer pollen between butterfly and flower to partially overcome the morphological deficiencies that limit butterfly pollination?

Overall, it would seem that butterflies are not very good pollinators in Colorado. And Shapiro (2007) notes that in California “butterflies—at least in our area—are rarely if ever critically important as pollinators.”
But my records presented below suggest that some butterflies may pollinate flowers. *Hesperia leonardus* in central North America visits *Liatris punctata* (purple) flowers almost exclusively, and surely pollinates them often as the pollen and stigma extend outward to contact the body sometimes. *Notamblyscirtes simius* crawls among the stamens of *Opuntia* and surely pollinates the flowers. *Papilio multicaudata* were found covered with *Hemerocallis fulva* (orange flowers) pollen and surely pollinate this yard plant, and other authors including Hirota et al. (2012) confirm that *Papilio* spp. do pollinate it. Some butterflies visiting Asteraceae do end up with pollen among the scales on the lower part of their thorax, which suggests they do pollinate those flowers sometimes. Examples of butterflies observed covered with Asteraceae [mostly-yellow flowers] found are *Parnassius phoebus smintheus* (seen repeatedly covered with *Senecio fendleri* pollen), *Oeneis calais ivalida*, *Erebia callias* (*Hymenoxys grandiflora* pollen), *Polygonia gracilis zephyrus* (*Senecio canus* and *Taraxacum officinale* pollen), *Argynnis (Speyeria) calippe* (*Senecio fendleri* pollen), *Euphydryas anicia* (6 adults covered with *Gaillardia aristata* pollen), *Euphydryas editha*, *Lycaena heteroea* (*Chrysothemmus nauseosus* pollen), *Lycaena arota* (*Hymenoxys richardsoni* pollen). (Likewise, a photo of *Lycaena philaeas* on protandrous *Verbesina virginica* [white] in Bright and Ogard [2010, p. 122] shows pollen shed from protruding anthers on legs and body, ready to fall off onto another stigma-ready flower.) I found many butterflies with *Asclepias* pollinia stuck on their legs, which suggests they could pollinate pink *Asclepias*. However, Morse (1982) found that Lepidoptera are not important pollen carriers of *Asclepias syriaca*, because bumblebees are several times more common than all other visitors combined and they carry a heavy pollen load. And Waddington (1976) found that 25% of Lepidoptera visitors had *Apocynum* pollen on their proboscis tip, but actual pollinations by Lepidoptera were “infrequent”. *Euphydryas editha* adults carry pollen but are poor pollinators, although they may pollinate some flowers especially *Lasthenia*, *Layia*, and *Linanthus* (Murphy 1984). *Piruna pirus* visits *Geranium caespitosum* frequently and perhaps can pollinate it occasionally, but they are too small to often contact the stigmas and there is no proof of pollen transfer. Of course experimental studies of seed set in flowers is needed to actually confirm pollination by butterflies and pollination by insects or other mechanisms.

But some flowers are reported to be butterfly pollinated based on better evidence. Butterflies are the primary pollinators of *Caesalpinia pulcherrima* flowers which have a yellow “target” on a reddish background and have protruding stigmas to catch the pollen (Cruden and Hermann-Parker, 1979); papilionid butterflies are the most important pollinators, as they approach the flowers from above and in front and transfer pollen due to fluttering of their wings while feeding, and the pollen is carried on the wings, held together by viscid threads which clump the pollen on the wings. *Dianthus* species are reported to be pollinated by butterflies (Erhardt, 1990). *Dianthus carthusianorum* (pink) is pollinated in Switzerland mostly by the Satyrinae butterflies *Satyrus ferula* and *Melanargia galathea* that contact the extended stamens and stigma, the former because it transferred 10 pollen grains to a stigma on average and visited the flowers frequently, while the latter transferred 13 grains but visited less frequently (the butterflies *Papilio machaon*, *Thymelicus sylvestris*, and the sphingid moth *Macroglossum stellatarum* visited seldom) (Bloch et al. 2006, Bloch and Erhardt 2008); the proboscis of the two pollinators and the hesperiid *Ochloes venatus* fits the *Dianthus*, so they prefer *Dianthus carthusianorum* and seldom visit the longer-corolla *Dianthus sylvestris*. Jennersten (1984) found that butterfly pollination is important in *Dianthus deltoides* [pink] and *Viscaria vulgaris* [pink](and they might pollinate *Knautia arvensis* [violetey-pink] when butterflies are common because the sexual organs protrude in *Knautia*) based on pollen found on the bodies, but they concluded that butterflies are of minor importance in pollination of the majority of northern European plants, and lycaeids such as *Plebejus amanda* visit Fabaceae regularly but are nectar robbers as they rarely transport pollen. Suzuki et al. (1987) showed that *Papilio helenus* and *P. proteror* butterflies are the main pollinators of *Clerodendron trichotomum* (white) in Japan (sphingid moths are less important), as they feed on nectar with a >24 mm proboscis the length of the flower tube, and the styles and stigmas contacted the thorax so most butterflies became loaded with pollen (1,776 and 2,817 grains average on the two species), and the flowers are protandrous and asynchronous so pollination was efficient (the *Papilio* also visited *Zanthoxylum ailanthoides*, but evidently did not pollinate it well). *Phlox pilosa* [pink] and *P. glaberrima* [pink] have a weak fragrance and are visited and
pollinated by butterflies (Colias, Pieris, Danaus, Polites in nature) (Levin and Berube 1972, Levin and Kerster 1967); in greenhouses Colias eurytheme picked up 1942 and 1,053 pollen grains of the two Phlox (which have about 15,000 per floret), but coiling the proboscis shed 15%-52% of the pollen, then one visit delivered 320 and 100 grains to another flower; but in the field they deduced that less than 1% of pollen from a flower would be transferred by Colias to another plant; yet butterflies must be occasional pollinators. Phlox paniculata [pink-purple etc.] and P. drummondii [red, pink, purple etc.] are pollinated by butterflies and moths (Grant and Grant 1965; Levin 1985). Aesculus californica [white or pale-pink] is reportedly pollinated by butterflies (Moldenke 1976), and I observed numerous butterfly visits to it. Butterflies produce more gene dispersal of pollen between Senecio [yellow] flowers than do bumblebees (Schmitt, 1980). Three of the 165 Gladiolus species in South Africa are pollinated by the Satyrinae butterfly Aeropetes tulbaghia (Goldblatt and Manning 2002), and six are pollinated by nocturnal moths, while most are pollinated by bees, birds, flies, or beetles. Butterfly-pollinated Gladiolus flowers are mostly bright crimson to scarlet, open by day, usually have prominent white patches on lower tepals, and are large with long tube and produce quantities of relatively dilute nectar (either sucrose-rich or hexose-rich) (Goldblatt and Manning 2002) (moth-pollinated Gladiolus are equally large with long tube, but open at night and are pale or mottled dull purple to brown, and are richly scented, with concentrated sucrose-rich nectar). (The current paper finds that most temperate zone Colorado area butterflies do not prefer red flowers, but most of those butterflies are probably ineffective pollinators.) Reddi and Bai (1984) found that the Indian Cadaba fruiticosa [greenish-white] is pollinated by butterflies (Colotis eucharis, C. danae, and Anapheae aurota) whose abdomen and wings contact the stamens and gynaeicum. Herrera (1987) found that a dozen species of bees (Anthidium, Bombus, and Megachile) were more effective pollinators of Lavandula latifolia [blue-violet or lilac] in Spain than flies (6 species) and a sphecid wasp and ten species of butterflies, as the bees made pollen transfers in 2 of every 3 trips on average, while most butterflies pollinated only once in 20 trips; however the Nymphalidae butterflies (Satyrinae, Argynnis paphia, Pandoriana pandora, and Fabriciana adippe) pollinated once in about every 3 or 4 trips, and they produced more cross-pollination than the bees. The lowland sunny type II of Cimicifuga simplex [white] in Japan is pollinated by fritillary butterflies (Argynnis paphia, Argyronome ruslana, and Damora sagana, that are common and carry pollen on legs and thoraxes) and some syrphid flies, while 14 families of Lepidoptera and 7 of Diptera and Vespa wasps and a few beetles and halictid bees merely visit but do not pollinate; a highland type I and a lowland shady type III are both pollinated by bumblebees (Pellmyr 1986). Andersson (2006) reported butterflies are major pollinators of Silene acaulis [pink] in arctic Sweden (I saw visits to it on Colorado tundra) as it has stamens and stigmas that stick out and she found pollen on the underside of butterfly bodies (although bumblebees and flies also pollinate it across the arctic). Butterflies are the main pollinators of Lantana camara [yellow {turning orange} or orange](7 references in Andersson 2006, Dronamraju 1960, Thakur and Mattu 2010). In Costa Rica large butterflies predominate as pollinators of Lantana camara which has yellow flowers that turn orange and red as they lose nectar and senesce, while small butterflies pollinate the smaller lavender-with-yellow-ring Lantana trifolia that loses the ring (Schemske 1976). Additionally, numerous published studies cited below with the records report that various flowers are pollinated by butterflies, and some of those studies have good evidence of actual pollen transfer.

Some butterflies even pollinate orchids. In Panama, three species of Epidendrum orchids including E. ibaguersce lack nectar and resemble Lantana and Asclepias to fool Danaus plexippus butterflies into pollinating them (Boyden 1980; Bierzychudek 1981); each places pollinia in a different place on the butterflies. The European orchids Gymnadenia (Nigritella) nigra [dark-red] and G. “conopsea” densiflora [pink] and Anacamptis pyramidalis [pink] are discussed by Proctor et al. (1996) and Andersson (2006) (and Fritz and Nilsson 1994 for Anacamptis) as pollinated by Argynnis and other butterflies (and zygaenid and nocturnal noctuid moths for Anacamptis); Proctor et al. (1996) provide a photo of a Melitaea cinxia butterfly with a pair of Anacamptis pyramidalis pollinia glued to its proboscis. Gymnadenia densiflora is actually a separate species from G. conopsea (Stark et al. 2011, Marhod et al. 2005, Jersakova et al. 2010) and is pollinated by butterflies in Sweden and pollinaria were found on their proboscis (L. Nilsson, in Andersson 2006); it is evidently pollinated by butterflies in central Europe
as her table 11.1 lists butterfly pollinated (Proctor et al. 1996; Andersson 2006). Previous authors (Proctor et al. 1996, Centranthus ruber stamens and stigma extend outward to contact the narrow floral tube to increase the probability that the head or proboscis will contact pollen, and the flava noctuid moths, leucophaea pollinated by 14 e (integrilabia (visitors were 4 Sphingidae spp. (Epargyreus clarus, Satyrium liparops, and the sphingid moth Hyles lineata in Illinois (Hilty 2013; Satyrium is probably too small to pollinate). Platanthera cristata yellow to orange is pollinated by butterflies and the bumblebees Bombus pensylvanica. Most Platanthera glue the pollinaria onto the head, but several other spp. (P. leucophaeum, P. psycodes, and P. huronensis) glue their two-part “hemipollinaria” on the proboscis while the insect rests on the lip, then it rotates down in front of the head in position to brush against the next stigma to transfer pollen. Platanthera huronensis whitish-green is pollinated in Colorado by butterflies (Erebia episepodea, Vanessa virginiensis) and bumblebees (Bombus appositus, B. flavifrons, B. occidentalis) and other bees (Psithyrus suckleyi, P. insularis) all in daytime, and by three noctuid moths just after dusk (Tichodestra dodii, Aletia oxyzyla, Cucullia intermedia); all of those insects had pollinia attached to the proboscis, while Syrphidae only visited and did not pollinate (Catling and Catling 1989); it can self pollinate. Platanthera dilatata white is pollinated by butterflies (Papilio glauca canadensis, P. zelicaon, Vanessa cardui, and by noctuids (including Discestra oregonica and Autographa californica) that had pollinaria, plus several other noctuids that probably pollinate. Platanthera psycodes lilac pink to deep rose-purple is pollinated in daytime by smaller butterflies (A. Moldenke; visits include Papilio polyxenes and Polites mystic, plus nocturnal moths and sphingids including Hemaris). Platanthera blephariglottis white to cream is pollinated mostly by nocturnal moths attracted by scent (Sphingidae 4 spp., and a noctuid) and often in daytime by bumblebees (Bombus vagans and B. fervidus), and sometimes by honeybees and butterflies (Papilio troilus, Danaus plexippus [those two had pollinaria], Argynnis (Speyeria) atlantis, Epargyreus clarus, Colias philodice, Pieris rapae, Polites mystic, P. peckius, and Euphyes vestris); the pollinaria was glued onto head or eyes of the butterflies. Platanthera grandiflora pale lilac to roseate or white is evidently pollinated by both moths (sphingids and the noctuid Artophaga ampla) and butterflies (Papilio troilus, P. glaucus, P. polyxenes); pollinaria glued to eyes. Platanthera peramoena rose-purple to purple-violet is primarily pollinated by the sphingid moth Hemaris thyse and probably by Hemaris diffinis and large butterflies (visitors were 4 Sphingidae spp. and the butterflies Papilio glaucus, P. troilus, Danaus plexippus, Argynnis (Speyeria) cybele, Epargyreus clarus); the sphingid Hyles lineata is a nectar thief. Platanthera integrilabia white to cream is pollinated by nocturnal sphingids 10 sp., occasionally by diurnal butterflies (Papilio glaucus, P. troilus, Epargyreus clarus); pollinaria glued to eyes. Platanthera stricta greenish is pollinated by 14 empidid flies, several bumblebees, and several moths. (The whitish species Platanthera leucophaea, P. praeclosara, P. orbiculata are pollinated by sphingid moths, greenish P. hyperborea by noctuid moths, greenish-white P. obtusata by many Aedes mosquitoes and several moths, greenish P. flavus by mosquitoes and a pyralid and seldom by butterflies, and P. chorisia by an oedemerid beetle.)

In general those flowers that are definitely pollinated by butterflies have bright or white colors, a narrow floral tube to increase the probability that the head or proboscis will contact pollen, and the stamens and stigma extend outward to contact the butterfly’s body, like the flowers of Diascia spp., Centranthus ruber [red], Lantana camara, and Buddleja davidii [purple], which are reported to be butterfly pollinated (Proctor et al. 1996; Andersson 2006). Previous authors (Proctor et al. 1996 etc.) overemphasized that butterfly-pollinated flowers are mostly reddish. Willmer (2011) emphasized it less, as her table 11.1 lists red, orange, yellow, mauve [=violet to purple], although p. 118 says “butterflies in general like white, yellow, orange, pink, and red”. Based on the above butterfly-pollinated flowers, they are frequently pink or yellow, often white, sometimes red, and least often are orange, purple, violet or
blue. Colorado butterflies visit blue/violet and purple flowers often (and of course yellow and white often), with a shortage of visits to red and orange, so the colors of any flowers pollinated by Colorado butterflies may differ somewhat. (It is notable that Ipomopsis aggregata is frequently studied as pollinated by long-tongued bumblebees and hummingbirds; it has red flowers over most of its range, but in central Colorado [where most of my records were gathered] it often has white flowers.) But Willmer notes that red flowers are more common in the tropics, while blue flowers are more common in high-altitude habitats such as this study (most of my records in Colorado are ~1300-4300 m=4000-13000 feet and I live at 5400 feet). German butterflies have color choices similar to large bees (Willmer 2011 fig. 5.12), which may be similar in Colorado. Previous authors overemphasized that they have sweet scents (often not powerful) with much nectar reached only through a slender tube or spur; more recent studies suggest that butterfly flowers are weakly scented (to humans) or fairly strongly scented, and few have spurs. Willmer notes that butterfly flowers tend to have a small, long floral tube, and often occur en masse; this is true mostly because Asteraceae are very popular and fit that description.

So, what is the verdict: do butterflies pollinate flowers? The good studies cited above and those cited below prove that some butterflies are the main pollinators of some flowers. But most flowers claimed to be “butterfly pollinated” (nearly all the flowers claimed in those awful “butterfly gardening” books or on the websites of nurseries) are expected to be pollinated primarily by other insects, usually bumblebees or other bees (usually by uncharismatic flies if you are in cold arctic/alpine places), as noted below in the studies cited of the pollinators of the plants. Evidently anything that travels between flowers of different individuals of a plant species will sometimes pollinate that species (if the flower reproductive system permits it), so butterflies fit in that category. Butterflies in general seem to be common occasional pollinators of flowers, and in a few cases they are main pollinators, but are usually just nectar thieves.

The ultimate question regarding pollination by butterflies is this: how many plant species would become extinct if butterflies became extinct? Comparing the popular flowers listed below with their pollinators as determined by literature reports summarized below, the answer appears to be—none or almost none. The plants most popular with butterflies also have alternative pollinators. Buddleja davidii and Lantana camara also have honeybees and thrips etc. The flowers most popular with butterflies, such as Asteraceae, generally have numerous additional pollinators. So, basically, butterflies are mostly nectar thieves, and they pollinate flowers only occasionally.

The records of visitation to flowers presented herein may assist future studies of pollination.

I searched the literature to determine which animals pollinated the plants listed below--both the plants popular with butterflies and the plants shunned--and found many good studies that demonstrate pollination by various insects and animals or wind or self-pollination etc. that are cited below, plus other studies with less evidence which are mentioned (readers can google “[plant species] pollination” to find the lower quality sources of this information or perhaps find something better). The good plant classification book of Judd et al. (2008) contains general information regarding pollination of the flowers of most plant families, and the relevant information is cited below. Most statements of pollination on the internet are just superficial observations of visits to flowers, which are of no greater use than this paper to determine the likelihood of pollination. (A bright spot on the internet is the vast records of flower visitation in Illinois based on C. Robertson [1929], presented at http://illinoiswildflowers.info and edited by Hilty [2013] [Tooker et al. 2002 lists those Illinois butterfly records]) There are now more than a million photos on the internet of butterflies on flowers, and most of those butterflies are identified properly but almost none of the flowers are identified even to family, and most of the key identification traits of the flowers are missing on macro photos of butterfly-on-flower, so only a minority can be identified to plant species although most can be partially identified; to identify most of those would require many experts familiar with exact details of the appearance of native and cultivated flowers. Laborious comparison of those photos with photos of identified flowers (from books, and google “[flower genus] [flower species] photo”) does produce useful results, with gratifyingly-accelerating results as the viewer learns the details of known flowers.

The numerous published studies on plant pollination do help to explain why some flowers are not popular with butterflies. Tiny flowers, especially tiny ugly ones, are generally wind-pollinated. Tiny
pretty flowers such as those of *Medicago lupulina*, *Portulaca oleracea*, *Polygonum viviparum*, *Capsella bursa-pastoris*, *Lepidium campestrae*, many *Cardaria*, *Polygonum viviparum*, and small *Gayophytum* are very often self-pollinated (although many tiny pretty flowers such as *Eriogonum* and *Limonium latifolium* are insect pollinated). Many beautiful flowers that are unattractive to butterflies are pollinated by bees. Bumblebees evidently are the best pollinators, as they gather nectar and pollen and are strong enough to get into almost any flower, and they can “buzz pollinate” (vibrate their thorax and legs) to shake the pollen out of crannies on the flower. Bumblebees often pollinate up to 50% of all the flowers in an area. Other bees are excellent pollinators. Flies are evidently major pollinators in alpine/arctic habitats where bees are few (Kevan, 1971; Pont 1993; Philipp et al. 1990). Flowers that open toward evening are mostly pollinated by moths, but can be pollinated by bees the next morning. Specialized flowers such as orchids have just one or a few pollinating animals that are highly adapted to each orchid species, but there are few orchids in Colorado and they are rare and there evidently aren’t many of those extreme cases of coevolution of flower and pollinator in Colorado.

**Sap and Fruit Feeding.** Some butterflies prefer sap to flower nectar. These butterflies belong to taxonomic groups that are basically the same worldwide. Sap feeding is most frequent in some groups of Nymphalidae, notably Satyrinae (in western North America sap feeding is frequent only in *Cerconis pegala*, and is occasional in *Cyllopsis* and some others, whereas there are many examples worldwide, and many in eastern U.S. including *Lethe, Cyllopsis gemma, Hermeuphytia, Megisto cymela*, in most tropical Morphinae (including Morphini and Brasolini), all Charaxinae (*Anaea* etc.), many Nymphalinae (*Limenitidini* [*Limenitis, Adelpha*], tropical Coeini and Biblidini, Apaturini [*Asterocampa* etc.], many Nymphalini [*Nymphalis, Polygonia, Vanessa atalanta*, less by other *Vanessa*, occasionally *Aglais*]). In other families only the small group of Theclini-Theclina (*Hypaurotis*) in Lycænidae/Lycæninae frequents sap. Among other butterflies, I observed sap-feeding only occasionally: in Hesperididae (Polites orygenes), Papilionidae (*Parnassius phoebe smintheus*), Nymphalinae/Heliconini (*Argynnis cybele, A. aphrodite, A. hesperis*), Lycænidae/Lycæninae (*Lycæna heteroea, Satyrium behrii, S. calanus*). Visits to sap seem to be very rare in Pieridae and the blues (lycænid tribe Polyommatini). Some of these sap feeders are long-lived as they hibernate as adults (*Anaea, Polygonia, Nymphalis*); however *Aglais milberti* adults aestivate in the mountains a long time and hibernate, yet they mostly feed on flowers.

Sap feeders are also the butterflies that most often feed on rotten fruit, so the chemicals attracting the butterflies must be similar.

Sap feeders generally approach the sap by odor (the sap is usually difficult to find visually), and they land just above the sap and walk down to it so they rest head downward as they feed. The obvious reason for this is the sap is sticky and gets thicker as it dribbles downward and evaporates, so if they climbed up to it they might get stuck and die and become fossilized in amber. I observed this downward posture often, and there are many photos on the internet of butterflies head downward sucking sap (for *Lethe anthedon* [Satyrinae], *Nymphalis antiopa, Vanessa atalanta, Polygonia interrogationis* and *P. comma* etc.). Sap-feeding butterflies can have a short proboscis, and some do, such as *Morpho* and *Hypaurotis* (but most such as *Asterocampa* and *Polygonia* have a normal longer proboscis), evidently because a short proboscis is less likely to become plugged by the thick sap, although certainly butterflies thin it with saliva before sucking it in, because it flows very slowly when stuck on the side of a tree. *Morpho peleides* evidently has a specialized short proboscis to feed on rotten fruit (it apparently never visits flowers and cannot feed on *Lantana* in greenhouses), because its proboscis is wide with a row of oblique transverse fissures on the posterior side of the distal part (which rests in the rotting fruit, posterior side up) that let the proboscis roll up and supposedly lead into the feeding tube (plus a row of large mid-posterior sensillae), that let it suck up fluid at a faster rate than the flower-feeding *Vanessa cardui* (Knopf and Krenn 2003). Sap-fruit feeders have a proboscis that is adapted to suck liquids from moist surfaces (Krenn 2010).

*Nymphalis antiopa* has been seen to imbibe sap from tree trunks, then raise the abdomen greatly and squirt clear fluid out into space (internet photos); evidently the butterfly found a spot where the sap was dilute so it passed much sap through the digestive tract to extract nitrogen, then voided the rest, as aphids do with their cornicles.
The chemicals in sap and fruit that attract butterflies seem to be different from those of floral nectar. Tree sap has sugars, and rotting fruit and some sap has those sugars plus fermentation chemicals. Omura and Honda (2003) studied the attractiveness (proboscis extension and feeding) of various sugars and amino acids in tree sap and rotting fruit, and of ethanol and acetic acid (which are most common in rotting fruit), to Nymphalis xanthomelas, Kaniska canace, and Vanessa indica, and found that they like sucrose more than fructose, and prefer glucose the least, but the most popular mix includes sucrose plus ethanol and acetic acid (both produced by bacterial fermentation of sugar); the butterflies were not attracted to the 15 amino acids that occur in sap and fruit. Tolerance of the fermentation products ethanol and acetic acid (even attractiveness when mixed with sugar) is evidently a required characteristic of sap feeding butterflies: Omura et al. (2008) found that the flower/sap/rotten fruit feeder Vanessa indica was not inhibited much by acetic acid from feeding, and 5-20% ethanol actually stimulated its feeding, whereas the strictly-flower-visiting Argyreus hyperbius was inhibited by ethanol and especially by acetic acid. (Also, Arum palaestinum emits an odor of rotting fruit to attract pollinating Drosophila, a scent almost entirely of ethyl acetate, with lesser amounts of ethanol and acetic acid [Kite et al. 1998]). Omura et al. (2000b) studied the odoriferous chemicals in Quercus sap that attract Vanessa indica and Kaniska canace, and found that Vanessa lowered its proboscis for five aliphatic acids (acetic, propionic, butyric, isobutyric, and isovaleric) and for 2-methylpropan-1-ol and 3-hydroxybutan-2-one, while Kaniska lowered its proboscis for those seven and also for ethanol, 3-methylbutan-1-ol and 1-hydroxypropan-2-one. Sourakov et al. (2012) studied the attraction of the fermenting-banana-feeding Morpho and Caligo to chemicals in rotting fruit, and found that they are attracted (based on electroantennogram response) to 14 aliphatic esters (the commonest being 3-methylbutyrate); sense organs on forelegs, middle legs, proboscis, and antennae respond to 10 of them, and interestingly the labial palpi respond to seven including four that the other organs did not respond to. They thought that fruit-feeding butterflies are not attracted to unripe fruit because they need to smell volatile compounds from both the fruit and from its fermentation; my googling the smell of those 14 chemicals reveals that essentially all of them (plus a hundred more variants) are all sold as fragrances in the chemical industry and their odors are described as sweet with banana (usually) or apple or pineapple odors, so those chemicals are natural products of fruit ripening even prior to obvious fermenting (ethanol and acetic acid are the final endpoints of fermentation, creating the wine and vinegar-pickles that humans love). They found that the strict fruit-feeding Morpho and Caligo were attracted only by odor and not by color, while flower-feeding butterflies used color as well as scent to choose test foods.

Amino acids in sap and fruit (or flowers) are not very attractive to butterflies. They did not extend the lifespan of Bicyclus anynana butterflies (Molleman et al. 2008), while fruit sugars etc. did extend its lifespan, which can reach 100 days. And the various fruit-feeding butterflies in Uganda that prefer different fruits, do not choose those preferred fruits based on their nutrient content or their visual attractiveness (Molleman et al. 2005).

I have few records of adults feeding on honeydew (from Homoptera), but honeydew has sugars like sap and most of the butterflies feeding on it also visit fruit at least occasionally, so the attractive chemicals are evidently similar to those of sap.

There are a few records of butterflies visiting decaying fungi (my records of Vanessa and Nymphalis, a record in E. U.S. of Cercomyis pegala on puffball), which may have attractive chemicals similar to those of sap.

**Dung and Carrion Feeders.** Dung and carrion are occasionally fed upon by butterflies, and some butterflies frequently visit them. Many butterflies in tropical America feed on dung. The butterflies that feed on them are mostly different than those that like sap and rotting fruit. Butterflies that seldom visit rotting fruit, such as Hesperidae, Papilionidae, Pieridae, Ithomiini, Melitaeini, Heliconini, and all groups of Lycaenidae, feed on dung, though not as frequently as the taxa that visit sap/fruit (various groups of Nymphalidae etc.). Many dung feeders are listed below, Payne and King (1969) list visitors to pig carrion, and the internet has photos of many dozen more species.

Carrion feeding butterflies in Borneo are very diverse (many kinds of butterflies visit carrion) compared to the few fruit feeders, and there is little similarity between the lists of carrion and fruit.
feeding species (Hamer et al. 2006); they suggested that butterflies may get nitrogen from the carrion. I have few records of carrion feeding, but many more photos are available on the internet, and my perusal of those suggests that carrion feeders are also more diverse than fruit feeders (Hesperidae and Papilionidae and Melitaeini and Lycaenidae [Feniseca, Theclini and Polyommatini] also visit carrion), although again they visit carrion less often than butterflies that like sap/fruit (various Nymphalidae groups).

Because the butterflies eating these foods are much more diverse than fruit feeders, it is expected that the chemicals involved in attraction must be very different. Boggs and Dau (2004) found that Pieris ‘napi’ marginalis butterflies tested on mud and dung preferred the samples that merely provided the most sodium; however that is a flower-feeding butterfly that visits mud and seldom or never feeds on dung in nature. Amino acids are not volatile enough to be attractive, and cannot be detected well, but ammonium ions may be attractive components of dung: Inachis io preferred ammonium ions in the lab but showed no response to urea (Erhardt and Rusterholz 1998), and related nymphaalids were not attracted to amino acids (Omura and Honda 2003). (The nitrogen in ammonium chloride is used by Papilio polytes to produce sperm and reproductive fluids and muscle, and transferred to females during mating, then is incorporated into eggs [Honda et al. 2012]). It appears that little work has been done on determining the compounds of dung and carrion that are attractive to butterflies.

However, there is good evidence from flies and beetles. The stable fly Stomoxys calcitrans (Muscidae) is attracted to horse and cow dung, primarily by carboxylic acids (butanoic acid), alcohols (oct-1-en-3-ol), aldehydes (decanal), ketones (octan-3-one), phenols (p-cresol), indoles (skatole), terpenes (beta-caryophyllene) and sulfides (dimethyl trisulphide), and the higher CO₂ concentration near horse dung may cause it to be preferred (Jeanbourquin and Guerin 2007). The European dung beetle was studied by Dormont et al. (2010), who found 64 compounds emitted by cattle sheep horse and boar dung that attracted thousands of beetles, but only nine were emitted by all (p-cresol [abundant in all four kinds of dung], alpha-pinene, dihydrolimonene, limonene, terpinolene, indole, tridecane, alpha-copaene, skatole, and beta-caryophyllene). Cattle dung is the most popular (maybe because butyl propanoate, methyl hexanoate, and p-cymene were commonest in it?). They surmised that dung beetles are attracted to dung mostly by p-cresol, indole and skatole (the same compounds the dung-mimic flower Arum maculatum uses to attract flies, see below). And they note that indole and skatole (emitted by dung of humans dogs and pigs) is so potent that it can be detected by people and recognized as dung at only 1 ppm. Dung beetles reportedly prefer the dung of omnivorous animals, because it is smellier.

To determine the smallest mixture of compounds that is attractive to dung insects, the best clues may come from orchids and fungi and Araceae that mimic dung, because they have had millions of years to perfect their simple-and-efficient attraction recipe.

Arun species that have dung odors for pollination by dung-feeding flies and beetles have scents dominated by fatty-acid hydrocarbons, 2-heptanone, methyl(iso)butyrate, ethanol, p-cresol, indole, skatole, 2-nitro-p-cresol, and sesquiterpenoids (Kite et al. 1998). Arum maculatum attracts pollinating Psychoda phalaenoides flies whose larvae breed in cow dung, with a dung odor consisting of 95 compounds of which 2-heptanone, indole, and some p-cresol mostly produce the odor (other compounds are ammonia, ethylamine, diethylamine, putrescine, and skatole), while p-cresol is the key chemical of cow dung and is the floral scent that attracts the flies (Kite 1995).

Carrion beetles are also attracted to sulfur-containing gases (methanethiol, dimethyl sulphide, dimethyl disulphide, and dimethyl trisulphide). Carrion-burying beetles (Nicrophorus) are also attracted to sulfur-containing compounds (Kalinova et al. 2009): When they begin to decay, mouse carcasses emit sulfur-containing compounds (methanethiol, methyl thiocetate, dimethyl sulphide, dimethyl disulphide, dimethyl trisulphide); the beetles’ antennal olfactory sensillae respond to all those chemicals and live beetles are attracted to the latter three dimethyl sulphides. The orchid Satyrium pumilum is dull-maroon-brown and is visited by calliphorid, muscid, and sarcophagid flies that are attracted to oligosulfides (mostly dimethyl sulfide), 2-heptanone, p-cresol and indole (all are compounds that dominate the scent of carrion). Only Sarcophaga females pollinate the orchid because it emits small amounts of those attractants to mimic the small animals such as mice that Sarcophaga places its larvae on, while large
amounts of the same compounds attract numerous Calliphora flies that lay many eggs on large carcasses. Some Araceae flowers mimic decaying carrion: Helicodiceos muscivorus flowers smell like dead horse to lure carrion-fly pollinators, and emit mainly dimethyl mono- di- and trisulfides which also occur in rotting horses and attract the flies (Stensmyr et al. 2002). Araceae species that smell “gaseous” or like carrion (Amorphophallus and Pseudodracontium) produce a simple mixture of mainly oligosulfides (Kite and Hetterscheid 1997); flowers that attract carrion feeding insects have odors with dimethyl oligosulfides (such as dimethyl di- and trisulfides in A. rivieri). Some Arum spp. also produce oligosulfides that attract calliphorid flies (Kite et al. 1998).

Araceae that smell like fish (Amorphophallus sp.) have amines such as trimethylamine (Kite and Hetterscheid 1997).

In general, flowers that produce p-cresol, indole and 2-heptanone mimic dung to attract flies, while flowers that produce mostly oligosulfides mimic carrion to attract them. But the stinkhorn fungus Clathrus archeri is a black-striped red elongated mass that has fetid odors that attract flies that eat it and spread its spores on feet and excreta, and the stinkhorn and seven fly-pollinated angiosperm flowers (Stapelia spp., Orbea spp., Huernia, Ferraria, Aristolochia cymbifera) convergently produce the same chemicals to attract flies: they produce oligosulfides that dominate in carrion, as well as phenol, indole and p-cresol that dominate in dung (Johnson and Jürgens 2010). [Ironically, at low concentration indole and skatole smell flowery and are used in perfumes.] Jürgens et al (2006) studied 11 genera of Stapeliad flowers (Apocynaceae relatives) that attract fly pollinators and found they fit into several groups: flowers with high p-cresol content but low amounts of polysulfides mimic herbivore feces; while flowers emitting mainly polysulfides and low amounts of p-cresol, or high amounts of heptanal and octanal, mimic carnivore/omnivore feces or carrion.

What is the conclusion? Clearly p-cresol and indole and skatole attract insects to dung, and oligosulfides attract them to carrion. Dimethyl sulfide is an oligosulfide, p-cresol is a phenol, and skatole is an indole. So, the ideal minimum mixture that collectors can formulate for attracting carrion and dung butterflies evidently should be mostly dimethyl sulfide, and less p-cresol and indole or skatole.

Bird Dung Feeders. Most of my observations of bird-dung feeding involve fluid-recycling skippers with a long proboscis (such as Epargyreus, Piruna, Euphyes, Poanes, and Amblyscirtes) that sometimes get nutrients from bird droppings by exuding clear fluid from the end of the abdomen onto the dropping, then extending the proboscis back under the body to the drop and sucking up part of the liquefied dropping. This is an efficient way of liquefying the dried food enough to be sucked. In the neotropics, antbirds travel along with army ant swarms (Eciton burchelli) and eat insects stirred up by the ants, and some Ithomini butterflies (Mechanitis and Melinaea, mostly females) congregate there and feed on the bird droppings (Ray and Andrews, 1980).

The compounds attracting butterflies to bird dung have not been studied. Bird dung differs somewhat from that of mammals. Birds secrete uric acid instead of urea, and place it in their dung, so the dung of many birds is white due to white uric acid crystals and does not look very nutritious. Yet butterflies do visit it sometimes, at least for sodium and nitrogen. Guano contains ammonium oxalate, nitrates (mostly urate), phosphates, some earth salts (sodium, potassium and potash, etc.), and phosphoric acid. Penguin rookeries emit acetic acid, acetaldehyde, acetone, ammonia, and formic acid. The bird-dung crab spiders in SE Asia Phrynarachne look like dung to attract flies to eat, and some even spin a white patch around them to further the camouflage, and P. ceylonica even emits a dung/urine scent (Takafumi et al. 1999), but those chemicals have not been determined either. Aldehydes in chicken dung attract Culex mosquitoes (Cooperband et al. 2008). Robacker et al. (2000) found that a synthetic mixture of ammonia, methylamine, dimethylamine, trimethylamine, 1-pyrrine, phenol, and 2-ethylhexanol was 96% as attractive as duck dung in attracting Mexican fruit flies.

Urine and Perspiration Feeding. I have few observations on urine, but those few observations and internet reports suggest that a wide range of butterflies occasionally feed on it, unlike sap and rotten-fruit feeders that are mostly taxa within Nymphalidae. Thus Hesperiidae, Papilionidae, Pieridae, Lycaenidae, and Melitaeini (Nymphalidae) also visit urine, as well as the Satyrinae and Nymphalinae sap feeders. Urine is a complex mixture of ~95% water, and solutes including urea, creatinene, uric acid, trace enzymes,
carbohydrates, hormones, fatty acids, pigments, mucins, and inorganic ions (sodium, potassium, chlorine, magnesium, calcium, ammonium, sulfates, and phosphates). The sodium and ammonium in urine are definitely attractive to butterflies. Shen et al. (2009) studied the grasshopper *Ceracris kiangsu*, which eats filter paper soaked in urine (which becomes most attractive after 3-6 days of warmth). The grasshoppers are stimulated to eat by NaCl, NaH2PO4, Na2SO4, KCl, NH4Cl, NH4HCO3, and are repelled by CO(NH2)2; the most powerful feeding stimulant was sodium salt NaCl. But Stapeliad flowers that emit hexanoic acid mimic urine (Jürgens et al 2006). Evidently butterflies feed on urine mostly to get sodium, as most reports of butterflies feeding on it assume, with the additional benefit of gaining some nitrogen.

**Mud Feeding (“Puddling”).** All butterflies have a proboscis, long or short, and evidently all butterflies feed on water at least when they become dehydrated (including the carnivorous-larva butterfly *Feniseca tarquiniius*). Butterflies—mostly males—are often found imbibing water at mud puddles or wet sand etc., often in groups evidently because most butterflies assume that if other butterflies are present, predators must be absent and nutrients must be good. The usual explanation (Arms et al. 1974) is that males are seeking sodium in the mud, which males (such as *Thymelicus lineola*, Pivnick and McNeil 1987) incorporate into their spermatophores that are transferred to females during mating, and the females use the sodium for their eggs. Thus Japanese *Papilio* butterflies detect Na+ using contact chemosensillae in the proboscis that fire for NaCl but not for CaCl2 or MgCl2 (Inoue et al. 2012), and they prefer Na+ over K+, Ca2+, and Mg2+ even if the concentration of the latter three ions is higher than that of Na+. So Lepidopterists today generally think that only males visit mud and think they are always seeking sodium. The *Thymelicus* mud feeders were all males, as were nearly all the *Pieris rapae* mud visitors studied by Adler and Pearson (1982). However, I have often seen females of many species visiting mud (although most mud feeders are males), so it is obvious that butterflies also visit mud simply to rehydrate. In hot summers at Arizona waterholes, hundreds of butterflies come to the mud to rehydrate. Boggs and Jackson (1991) found that young male *Argynnis* (*Speyeria*) *mormonia* spent more time at mud than older males, while young females almost never visited mud, yet older females visited just as often as older males (35% were older females, 38% were older males); perhaps the young males were often seeking sodium, and maybe older females want sodium also for their growing eggs, and evidently both sexes sometimes get dehydrated.

*Apyrrothrix araxes* has a unique method of sipping water. It lands with wings spread flat on the water, floats in that position, simply unrolls its proboscis, then when finished imbibing it flaps its wings and instantly blasts upward into space.

**The Flowering Plants and Other Foods, and the Butterflies that use them**

Plant classification has improved greatly recently. Plant morphology is less complex compared to animals and is very plastic, resulting in fewer useful characters to study, and there is frequent convergence in most plant traits; these difficulties cause great difficulty in determining phylogeny. The recent use of DNA bypasses some of those problems and has greatly improved the natural phylogenetic classification of plants. Below I arrange the plant families using the “consensus” Angiosperm phylogeny reported by Stevens (2012) (one of the authors of the Judd et al. [2008] book cited above), which was constructed using DNA and plant morphology etc. in an attempt to deduce phylogeny; the Stevens (2012) website has phylogenetic trees, a sequential printed classification, and a poster and chart of the phylogeny. ( Older floras such as Harrington [1964] and Flora of the Great Plains [McGregor 1986] arranged the plants in attempted-phylogenetic sequence, but many recent floras such as Hickman et al. [1993] and Weber and Wittman [1996-2012] arrange the families alphabetically and do not try to keep up with recent DNA advances in plant phylogeny.) Plant genera and species are arranged alphabetically within each plant family in the records below. The local floras listed in Literature Cited were used for
identification purposes and also to attempt to use the most correct names for plants that have different names in almost every flora.

Paragraphs in parentheses below concern flower genera and species that have no records of butterfly visitation; those serve as comparison to often-visited flowers.

MOSSES/LIVERWORTS/FERNS/HORSETAILS
Butterfly adults do not feed on these wind-pollinated plants in North America.

CUPRESSACEAE/PINACEAE
Butterfly adults do not feed on these wind-pollinated junipers and conifers. Primitive plants such as these and Ginkgo are mostly wind-pollinated, but Zamiaceae cycads are pollinated by beetles (Judd et al. 2008) and weevils and thrips (Terry et al. 2005).

EPHEDRACEAE
(Ephedra has no apparent “flowers”, and no records. Most species are wind pollinated, except for some such as E. aphylla and E. campylopoda that are sometimes pollinated by ants that get sugary nectar.)

NYMPHAEAECES
(Nuphar polysepala has pretty yellow flowers and occurs on subalpine Colorado ponds but I have made no observations involving it. Nuphar is pollinated by flies, bees, and Donacia beetles [Chrysomelidae] that evidently specialize on Nuphar [Lippok et al. 2000]. Three bee species (Hylaeus nelumbonis, Lasioglossum nelumbonis, and Lasioglossum nymphaearum) are specialists on Nuphar and the closely-related Nymphaea and Nelumbo.)

ALISMATACEAE
Alismataceae in general are pollinated by insects, often bees and flies (Judd et al. 2008).
Alisma subcordatum whitish is too uncommon to assess its popularity: Ancyloxypha numitor. Flowers of Alisma underwater self-pollinate, and those above water are pollinated by flies.
(Sagittaria are common and have beautiful white flowers, but I have seen no butterflies on them, though in E U.S. visits are recorded by Ancyloxypha numitor and Lycaena helloides. Sagittaria guyanensis is pollinated by a wide variety of insects in China.)

JUNCAGINACEAE
(Triglochin has small ugly flowers that are evidently wind-pollinated.)

POTAMOGETONACEAE
(Potamogeton has small inconspicuous flowers that are not visited by butterflies. Some Potamogeton have flowers above water that are wind-pollinated, and others such as P. pectinatus have pollen carried to the surface in air bubbles where they float and move by wind or waves etc.; seed set is only 4% submerged, but up to 40% emerged [Zhang et al. 2010].)

MELANTHIACEAE (formerly in Liliaceae)
(Veratrum californicum is common but has tiny greenish flowers that are reportedly pollinated by flies.)
(Zigadenus white is ignored by butterflies. Zigadenus venenosus is pollinated by bees, but is toxic to honeybees. Zigadenus [Anticlea] elegans is visited by muscid flies. Zigadenus paniculatus is visited most often by syrphid flies [Eristalis hirtus], by the solitary bee Andrena astragali [which is a Zigadenus specialist], and by stratiomyid flies [Stratiomys barbata, S. nevadae] which become covered with pollen [Tepedino 1981].)

LILIACEAE
In general these flowers are unpopular, but giant *Hemerocallis* and *Lilium* flowers are actually pollinated by large papilionid butterflies. Elsewhere, Liliaceae with bell-shaped flowers are often pollinated by bees, while *Lilium martagon* is pollinated by the sphingid moth *Macroglossum stellatarum* (Proctor et al. 1996).

*Calochortus* yellow-orange: *Colias occidentalis*. *Calochortus macrocarpus* pink is pollinated by bees including two specialist pollinators of *Calochortus* (the halictid *Dufourea calochorti* and the andrenid *Perdita calochorti*), and by anthophorid bees, while flies visit but often get trapped in hairs within the blooms (Gary Ott, Internet). California *Calochortus* are visited by bees that collect pollen and by beetles that feed at glands on the petals. Other *Calochortus* are reportedly visited by various generalist insects including honeybees and beetles.

*Calochortus gunnisonii* white: *Oarisma garita.*

*Calochortus nuttallii* violet-white: *Hesperia uncas tomichi.*

(Convalaria white flowers in my yard are shunned by butterflies. *Convalaria majalis* is reportedly pollinated by bees, honeybees, flies, and selfing. *C. keiskei* is reportedly visited by beetles and flies.)

(*Erythronium grandiflorum* yellow has no records. It is pollinated by bumblebees, *Apis*, and *Andrena* bees [Thomson 1986; Thomson and Thomson 1989; Motten 1986].)

*Hemerocallis fulva* orange (with some red) is pollinated by *Papilio* at least frequently: *Papilio multicaudata* 7x + another only 3 sec. (a very popular flower this butterfly seems to pollinate, as a male had orange-yellow pollen behind ventral forewing costa ~2 cm from middle of body that looks like *Hemerocallis* pollen; another had orange pollen on ventral forewing yellow area just behind costa 1.5 cm from body; and a 3rd had pollen on ventral forewing just behind costa 1.5 cm from body; a 4th male on var. “Magnificence” was deep into flower [half visible]), *Papilio polyxenes*. *Papilio* obviously pollinates *H. fulva*, which is confirmed by Hirota et al. (2012), who observed numerous visits of *Papilio xuthus*, *P. memnon*, and *P. helens* to the flowers in Japan (along with a few visits of the nymphalid *Argyreus hyperbius* and many visits of the hesperiid *Parnara guttata* and many visits of the bee *Xylocopa appendiculata* during field tests of attraction); *Hemerocallis citrina* is yellowish with a sweet fragrance and opens in the evening and is pollinated by nocturnal sphingids *Theretra* *olderlandiae* and *T. silhetensis*. Hummingbirds pollinate other *Hemerocallis*.

*Leucocrinum montanum* white: *Erebia epipsodea*. This is pollinated by a nocturnal moth.

(*Kniphofia caulescens* has beautiful orange-red flowers but I have seen no butterflies on the few local plants. *Kniphofia* are reportedly pollinated by hummingbirds and insects in North America, bees in Britain, and sunbirds and sugar birds in their native south Africa [Brown et al. 2010; they note that *Kniphofia* is pollinated by the butterfly *Aeropetes tulbaghia* at two locales, but primary pollinators are sunbirds and to a lesser extent bees].)


*Lilium philadelphicum* orange is rare in Colo.: *Papilio eurymedon*. I saw no other butterflies on several dozen flowers SW of Denver. It is pollinated by large papilionid butterflies (*Papilio eurymedon* [Shapiro 2007 notes *Lilium* are visited by *Papilio eurymedon* that become covered with pollen] and *P. glaucus rutulus* in western U.S., *P. glaucus glaucus* in E U.S. including New England), while hummingbirds occasionally visit but the flower morphology causes the Papilionidae forewings to contact the reproductive structures and causes bird beaks to avoid contact (Flora of North America 26:180, www.efloras.org). Several *Lilium* species are pollinated by hummingbirds (Grant 1994), and some are reportedly pollinated by butterflies.

lily with yellow flower: *Hesperia linseyi*.

*Muscari botryoides* deep-blue is very common in my yard but has few records: *Vanessa cardui* 32x mostly during superabundant migrations. It is pollinated by “insects” such as bombyliid flies but in gardens generally spreads vegetatively.

(*Polygonatum* white flowers in my yard are shunned by butterflies. *Polygonatum odoratum* is pollinated largely by bumblebees *Bombus terrestris* and *B. hortorum* in Spain [Guitian et al. 2001]. *Polygonatum multiflorum* and *P. biflorum* are pollinated by bees and self-pollination. *P. bistorta* is “buzz-pollinated” by bumblebees. In Illinois *P. commutatum* attracts various long-tongued bees including bumblebees,
Anthophorinae bees, and Little Carpenter bees, while short-tongued halictid bees visit for pollen but are not effective pollinators, and hummingbirds visit sometimes [Hilty 2013].

Allium (Maianthemum) stellata white lilies are mostly ignored by butterflies: Pieris marginalis mcdunnoughii. Allium cepa is reportedly pollinated by small bees flies and beetles. S. (Maianthemum) canadense is pollinated by bumblebees at least.

**ORCHIDACEAE**

These are usually pretty but are not visited by butterflies, as most orchids are highly specialized for pollination by various bees or flies or other animals. Orchids are rare in Colorado. Corallorhiza maculata purplish-spotted white is pollinated by small flies, bees, and beetles (Dodson and Dunmire 2007). (Calypso bulbosa rose is rare in Colorado so I have no records. It is pollinated by bumblebees that are tricked as it has no nectar [Dodson and Dunmire 2007].)

Limnorchis “Habenaria” dilatata white: Plebejus saepiolus 2 sec.

(Spiranthes diluvialis white is locally common in Wheat Ridge Colo. but I saw no visits on it. Bumblebees are principal pollinators of most North American Spiranes, with megachilid bees minor pollinators [Catling 1983]. Eight butterfly spp. were seen as visitors on eight Spiranes spp. flowers in the Illinois wildflower survey [Hilty 2013], while bumblebees and other bees visited them all.)

**IRIDACEAE**

These are not popular with butterflies. Iridaceae in general are pollinated mainly by insects, esp. beetles, bees, and flies (Judd et al. 2008). Iridaceae produce floral oils as a reward.

(Crocus [cultivated] have many bright colors but are shunned, and in Denver they bloom in early winter too early for nearly all butterflies. They are pollinated by bees [Proctor et al. 1996].)

(Gladiolus is rare in Denver, and I have seen no butterflies on them. Several South African species are pollinated by the Satyrinae butterfly Aeropetes [Goldblatt and Manning 2002].)

Iridaceae white: Plebejus acmon.

Iris is rarely visited, though there are recorded visits by Carterocephalus “palaemon” skada in California, and visits on Iris versicolor by Poanes hombomok and Euphyes bimacula in eastern U.S.

Iris germanica blue: Papilio multicaudata 1x (another 1 sec.), Papilio zelicaon. In Louisiana bumblebees are the most common visitors to Iris at some sites, hummingbirds most common at another site.

Iris missouriensis pale blue is fairly common but seldom visited: Epargyreus clarus, Glaucopsyche lygdamus (failed to probe petal, so got no nectar), Papilio multicaudata (South Dakota, Gary Marrone), Polites draco (crawled down and turned and put proboscis between petal bases). Iris is pollinated by bumblebees in western North America (Dodson and Dunmire 2007). Elsewhere, Iris pseudacoris is pollinated by Bombus hortorum bumblebees and long-tongued flies that crawl inside (Proctor et al. 1996).

(Sisyrischium has pretty little flowers but is seldom visited.)

Sisyrinchium bellum blue-violet (Calif.): Euchloe auronides ausonides 2x, Junonia coenia 2x. In Brazil Sisyrinchium vaginatum has pollen but no nectar and is pollinated by syrphid flies, and in some places by bees (Freitas and Sazima 2003).

Sisyrinchium montanum deep violet: Colias philodice.

**AMARYLLIDACEAE** (includes Alliaceae)

The plants formerly placed in Alliaceae are pollinated in general by various insects, esp. bees and wasps (Judd et al. 2008). Brodiaea is popular.

Allium (formerly in Liliaceae) is not very popular, but there are some records. Allium (including onion) is reportedly pollinated by bees, solitary bees, and syrphid and calliphorid (Lucilia and Calliphora) flies. Allium cepa: Glaucopsyche lygdamus 17x.

Allium cernuum pink or pinkish-white (the inflorescence is nodding and flowers face downward, yet there are three records anyway): Cupido amyntula valeriae 2x, Erynnis horatius.

Allium geyeri pink: Erebia epipsodea, Paratrytone snowi.
Allium sibiricum violet: Aglais milberti, Vanessa cardui.
Allium textile white: Erynnis afranus, Lycaena arota, Oarisma garita (another did not land after inspecting two white flowers), Plebejus melissa.
Allium textile white to light-rose: Argyris (Spereya) callippe, Atrytonopsis hianna hianna 4x, Chlosyne gorgone 10x, Chlosyne leania fulvia 2x, Colias philodice, Erynnis persius 3x, Euchloe olympia 9x, Euptoieta claudia 2x, Hesperia juba, Oeneis chryxus, Phyciodes pulchella camillus 6x, Polites (Yverture) rhesus 2x, Pontia protodice, Pyrgus communis 2x, Strymon melinus.
Allium sp. violet: Erynnis telema.chus.
Allium sp. ?pale-pinkish: Chlosyne palla palla.
Allium sp. probably ~pink: Satyrium sylvinus sylvinus.
Brodiaea pulchella blue seems moderately popular in Calif.: Battus philenor hirsuta 2x, Colias occidentalis, Euchloe ausonides ausonides 7x, (Junonia coenia did not visit it). This is reported to be pollinated by bees and butterflies. Brodiaea ida-maia and B. venusta are pollinated by hummingbirds (Grant 1994).
Brodiaea blue: Hesperia lindseyi, Ochloides agricola, Papilio zelicaon [on Brodiaea?].
(Narcissus pseudonarcissus yellow is common in gardens but is shunned by butterflies. It is pollinated by long-tongued bees and flies [bumblebees including Bombus terrestris and the bee Anthophora plumipes and the fly Eristalis] [Proctor et al. 1996].)

ASPARAGACEAE (includes Agavaceae which formerly contained Yucca and Nolina)
Asparagaceae in general are pollinated by bees and beetles (Judd et al. 2008). Most genera are not visited, although Nolina is popular.
(Asparagus officinalis has tiny greenish flowers that produce nectar and pollen but are ignored by butterflies. It is pollinated by bees, primarily honeybees that make good honey from it.)
Nolina greenei “texana” white to cream: Callipryrs mcfarlandi many visits (the hostplant, whose flowers are almost the only ones visited by this butterfly). Nolina is visited by honeybees, so is probably pollinated by bees and flies.
(Yucca has large beautiful large pendant white flowers which are not visited. They are pollinated by mostly-nocturnal female Tegeticula [Yucca moths] that do not feed and gather pollen with modified mouthparts and place it onto another flower’s stigma, then they lay eggs in the carpel and the larvae eat the growing seeds [Powell, 1992]; Yucca is rarely pollinated by honeybees and bumblebees, as the flowers sometimes have nectar.)

TYPHACEAE
Butterflies do not visit the three species of wind-pollinated Typha (cattails) in Colorado. The family is wind-pollinated (Judd et al. 2008).

JUNCACEAE, CYPERACEAE, POACEAE=GRAMINAE
Butterflies do not visit these wind-pollinated rushes/sedges/grasses. Juncaceae and Poaceae are pollinated by wind; Cyperaceae are usually pollinated by wind, sometimes by insects in other lands ([for some Rhynchospora and Ascolepis, and by insects for Hypolytrum; Judd et al. 2008].

COMMELINACEAE
Commelinaceae in general are pollinated by bees or wasps (Judd et al. 2008).
Tradescantia occidentalis blue is fairly common but is mostly shunned and has almost no visits: Epargyreus clarus only 1 sec. Tradescantia is reportedly pollinated by long-tongued bees (honeybees and bumblebees); syrphid flies visit without pollinating.

PONTEDERIACEAE
These are rare in Colorado so I have no observations. The family in general is pollinated by bees, flies, and butterflies (Judd et al. 2008). Pontederia cordata is common along the Atlantic coast of U.S., where it is popular with butterflies and marsh skippers seeking nectar, including the skipper Problema bulenta
which surely helps pollinate it. *P. cordata* is pollinated by generalist bees *Bombus impatiens* and *B. vagrans*, and a specialist anthophorid bee *Melissodea apicata* (Harder and Barrett 1992, 1993) that is adapted to *Pontederia*. Another bee *Dufourea novaangliae* also specializes on *P. cordata*.

**CANNACEAE**

*Canna* is present in some Colorado gardens, but I have seen no butterflies visiting the large showy orange flowers. *Canna* varieties are mostly pollinated by hummingbirds (*Helomaster furcifer* pollinates *Canna indica*, a parent of many cultivated *Canna* [Ginos and Curucci 2011]). The flowers have nectar, and might be pollinated by bees, butterflies, moths, and birds (Judd et al. 2008).

**PAPAVERACEAE** (includes FUMARIACEAE)

Butterflies rarely visit these. Papaveraceae in general are pollinated by bees, wasps, and flies (Judd et al. 2008).

(Argemone) is beautiful but not visited. *Argemone hispida* is pollinated by bumblebees [*Bombus*] that roll in the pollen, and other bees [*Andrena argemonis*, *Epeolus auriginea*, *E. enavata*, *E. menuacha*, *Podalirium occidentalis*] and beetles [*the curculionid *Peritaxia hispida* and nectarulid *Carpophilus pallipennis*], and flies probably also pollinate [Willemstein 1987]. *Argemone mexicana* usually selfs but is sometimes pollinated by small stingless bees. Bees pollinate *Argemone aurantiaca* and beetles facilitate self-pollination.

(Papaver spp. including *P. orientale* are beautiful but not visited. They lack nectar and are reportedly buzz-pollinated by bumblebees, and pollinated by honeybees and other bees, flies, beetles, and selfing. European *Papaver rhoes* is pollinated by bumblebees and honeybees seeking pollen [McNaughton and Harper 1960].)

*Corydalis* (Fumariaceae) is not visited by butterflies in my experience, but is rarely visited by butterflies elsewhere. In Colorado the bumblebee *Bombus appositus* is the most common visitor and pollinator of *Corydalis caseana*, while *Bombus occidentalis* and *B. flavifrons* mostly chewed a hole in the flowers and robbed them of nectar, and hummingbirds visited occasionally, and even the butterfly *Papilio zelicaon* visited once (Maliof 2000). In central Europe the bee *Anthophora acervorum* is a common pollinator of *Corydalis cava* and the bumblebee *Bombus terrestris* both pollinates and robs the flowers (but robbers usually pollinate the flower anyway due to its peculiar morphology), while in Denmark *B. terrestris* is the only pollinator (Olesen 1996, 2013?). Bumblebees are regular visitors to *Corydalis caseana*. *Anthophora acervorum* bees and *Bombus terrestris* bumblebees are common pollinators of *Corydalis cava* in Europe. *Corydalis ambigua* is pollinated by bumblebees and honeybees. *Corydalis flavula* sometimes self-pollinates but honeybees mostly pollinate it in New England, and flies and the butterfly *Anthocharis midea* sometimes visit (Farnsworth 2001).

(Dicentra) has no records. Bumblebees pollinate them [Mácor 1978].

*Eschscholzia californica* orange (Calif.): *Euchloe ausonides ausonides* 1x, *Junonia coenia* 1x. In California it is pollinated by bumblebees, halictid and andrenid bees, honeybees and other Apidae (*Perdita*), and occasionally by other insect visitors syrphid flies, beetles, minute pirate bugs, and butterflies which seldom pollinate.

**BERBERIDIDACEAE**

Berberidaceae in general is pollinated by insects, mainly bees; pollen-bearing flaps on *Berberis* stamens contact the insect’s head (Judd et al. 2008).


**RANUNCULACEAE** (includes Thalictraceae)
There are many beautiful flowers in this family (nearly all those listed below are pretty), but they are unpopular flowers for butterflies, except *Clematis* and *Delphinium* are popular and *Ranunculus* is sometimes visited. Judd et al. (2008) note the following concerning pollination: Most *Ranunculaceae* are pollinated by insects. Some *Thalictrum* and *Anemone* and *Clematis* do not produce nectar and are pollinated by various pollen-gathering insects [including honeybees and other bees on *Thalictrum*, which is sometimes wind-pollinated] [however *Clematis ligusticifolia* obviously has nectar as it is very popular with butterflies as noted below]. They state that *Ranunculus Delphinium* and *Aquilegia* have nectar-producing petals and are visited mainly by bees and hummingbirds. *Caltha* has nectar glands at base of carpels and is bee pollinated. The fly *Chiastocheta* pollinates *Trollius europaeus* and its larvae feed on the seeds.

(*Aconitum columbianum* blue-purple has no records. It and other *Aconitum* are pollinated by bumblebees including *B. flavifrons* and less often *B. appositus* [Macior 1995, Bosch and Waser 1999; Marden 1984; Proctor et al. 1996, Inouye 1978].)

*Anemone canadensis* white: *Ancyloxypha numitor* 2x, *Celastrina humulus* hop-ecotype (landed on it and flew), *Celastrina neglecta*, *Euphyes vestris*, *Vanessa cardui* (the butterfly found dead with proboscis wrapped around peduncle).

*Anemone cylindrica* greenish-white: *Argynnis* (*Speyeria*) *hesperis*.

*Aquilegia coerulea* blue: *Colias eurytheme*. Bumblebees pollinate dark blue short-spurred flowers, while sphingid moths pollinate pale long-spurred ones such as *A. pubescens* (Dodson and Dunmire 2007). Hummingbirds pollinate many *Aquilegia* (Grant 1994) including *A. formosa* (Hirota and Nitta 2012).

*Caltha* “Psychrophila” *leptosepala* white: *Boloria freija*, *Boloria titania* 2x, *Boloria eunomia* 2x, *Erebia epipsodea*.

*Clematis hirsutissima* blue: *Celastrina humulus* (lupine-ecotype) landed on flower but left. *Clematis* is pollinated by bumblebees honeybees flies moths and other insects; *Clematis stans* is pollinated by bumblebees *Bombus diversus* and *B. honshuensis* (Dohzono and Suzuki 2002).


*Clematis xjackmani* blue: *Papilio multicaudata* 2x (but both only 2 sec.), *Papilio cresphontes* (4 sec.). This garden *Clematis* may lack nectar as it is mostly shunned.

*Delphinium* is pollinated by bumblebees (Bauer 1983, Dodson and Dunmire 2007 etc.) and sometimes by other Hymenoptera and Diptera and butterflies; the cultivated *D. ajacis* may be pollinated sometimes by butterflies as noted below. Elsewhere, *Delphinium nudicaule* and *D. cardinale* are pollinated by hummingbirds (Grant 1994).

*Delphinium ajacis* violet is popular with some butterflies with long proboscis: *Euptyoeta claudia*, *Papilio glaucus rutulus* 4x, *Papilio multicaudata* 85x (males land on a lower flower of inflorescence then helicopter up to the other ~4-5 flowers one by one by aiming body vertical and flapping forewings to rise up), *Papilio polyxenes* 2x, *Pieris rapae* (violet flower 2x [+ one only 1 sec.], pink flower 1x), *Plebejus melissa*, *Poanes taxiles* 23x (+1x on pink flower), *Polites themistocles* briefly, *Pontia protodice* 2x, *Vanessa cardui* 3x and 1/3 sec.

*Delphinium cariopepalum* violet: *Poanes taxiles* 2x.

*Delphinium ~geyeri* blue: *Colias philodice*, *Erynnis telemacus*, *Papilio zelicaon* (whitish flower).

*Delphinium nuttallianum* deep blue-purple: *Papilio eurymedon* 5x. This is pollinated primarily by bumblebees, solitary bees, and hummingbirds in Colorado (Bosch and Waser 1999). *D. nuttallianum* ~nelsonii is pollinated by *Bombus* bumblebees, *Habropoda* and *Osmia* bees, and less often by *Apis* honeybees, *Xylocopa* bees, sphingid moths and hummingbirds (Waser 1988).
Delphinium ramusatums blue: Boloria eunomia, Colias alexandra, Papilio indra, Thorybes mexicana. (Nigella damascena) has pretty blue flowers but I have seen no butterflies on it in local gardens. It is pollinated by honeybees. Nigella bucharica is pollinated by bees. Nigella sativa is pollinated by flies. The commonest visitors [Phytomyza atricentris, Melanagromyza phaseoli, Liriomyza congesta], bees [honeybees were less common but they increase seed production, and a few Megachile submucida], a few Polistes gallicus wasps, plus a few Hemiptera [Oxyanus halinipennis] and beetles Coccinella undecimpunctata that doubtfully pollinate [Abd El-Wahab and Ibadah 2011].

Pulsatilla patens multifida purplish-white: Boloria freija, Erynnis persius.

Ranunculus acris yellow: Chlosyne gorgone. In Europe R. acris is pollinated by muscid and anthomyid flies, and some Hymenoptera and Coleoptera. The Colorado Ranunculus alismifolius is pollinated by bees. The bee Chelostoma florisomone specializes on Ranunculus in California (Peng and Dobson 1997). In Europe, five Ranunculus species are pollinated by 50 species of flies (50% of visitors, mostly Syrphidae), Hymenoptera (25%, 20 bees and 2 wasps), Coleoptera (15%, 20 species), plus a few thrips and Micropterix moths and Hemiptera; the syrphids (mainly Cheilosia) and beetles were often covered with pollen (Steinbach and Gotsberger 1994).


Ranunculus ?glaberrimus yellow: Erynnis persius.

Ranunculus macounii yellow: Pieris rapae 3x.

Ranunculus yellow: Callophrys sheridanii lemberti 2x, Carcharodus flocciferus (Europe), Chlosyne palla palla, Coenonympha tullia california 2x. Euchloe auronides auronides 1x, Junonia coenia ~15x, Junonia evarete nigrosuffusa and hybrids ~7x, Phyciodes pulchella camillus, Phyciodes tharos tharos, Vanessa cardui.

Ranunculus yellow flower without usual yellow petals: Adopaeoides prittwitzi.

Thalictrum dasycarpum whitish: Chlosyne gorgone, Epargyreus clarus. Thalictrum have pollen but no nectar and are mostly wind pollinated, but are effectively pollinated by halictid bees and Bombylus flies (Willmer 2011).

Trollius laxus yellow: Pyrgus centaureae.

PLATANACEAE

(Platanus occidentalis has tiny inconspicuous wind-pollinated flowers in balls. I saw no butterflies on the one tree near my house in Denver.)

PAEONIACEAE

Paeonia lactiflora is not popular: Eupotioeta claudia (white and yellow-centered flower), Papilio glaucus rutulus (pinkish flower) a couple sec. Most peonies lack nectar, but Oregon Paeonia browni provides it and is pollinated by solitary bees Andrena and Lasionotidium in the morning and syrphid flies and vespid and polistid wasps in the afternoon (N. Vance, http://nps.Oregon.org). In Britain Anthophora plumipes bees visit garden Paeonia for pollen.

CRASSULACEAE

Sedum lanceolatum is very popular, but the others are not popular. Crassulaceae in general are pollinated by a variety of insects (some Kalanchoe are bird pollinated) (Judd et al. 2008).

Sedum cultivated “Hen and Chickens” pink and bluish-pink: Pieris rapae 3x.

Sedum (Amerosedum) lanceolatum yellow is enormously popular, esp. for Argynnys (Speyeria) callippe, Coenonympha tullia, Euphydryas, Oarisma, and Parnassius: Aglais milberti 5x, Apodemia nais, Argynnys (Speyeria) aphantodite 3x, Argynnys (Speyeria) callippe 27x, Argynnys (Speyeria) coronis, Argynnys (Speyeria) edwardsii 3x, Argynnys (Speyeria) hesperis, Boloria titania, Callophrys eryphon, Callophrys gryneus sivus 2x, Callophrys spinetorum 2x, Chlosyne gorgone 4x, Chlosyne palla calydon, Coenonympha tullia 27x, Colias alexandra, Colias eurytheme 3x, Colias meadii, Colias philodice 2x, Cupido amytulata 2x, Erebia callias 7x, Erebia epipsodea 3x, Erebia stubbendorfii “theano” ethela 8x, Erynnis martialis 7x, Erynnis pacuvius, Erynnis persius 13x, Euchloe olympia, Euphydryas anicia capella 49x (including


*Sedum* *(Rhodiola, Tolmachevia)* roseum integrifolium dark-rose-purple: *Boloria eunomia*, *Colias scudderii harroweri* 2x, *Erebia epipsodea*.

**GROSSULARIACEAE**

*Ribes* are only moderately popular, and are usually avoided by butterflies with a small proboscis such as lycaenids. *Ribes* are pollinated by wild bees (Paget-Seekins 2012) and honeybees and bumblebees and megachilid bees (*Osmia lignaria*), sometimes by scatophagid and syrphid flies, and most can self-pollinate. *Ribes speciosum* is pollinated by hummingbirds (Grant 1994). The bee *Andrena nivalis* specializes on *Ribes*.


**SAXIFRAGACEAE**

These (including *Heuchera*) are unpopular. I have no records for most genera. *Saxifragaceae* in general are pollinated by small short-tongued insects (mainly flies and bees) gathering nectar and pollen (Judd et al. 2008).

*Astilbe* ~“Venus” pink: *Papilio multicaudata* 2x. *Astilbe* are reportedly pollinated by slugs and beetles and pollen-oreating insects.

~*Heuchera* ~greenish/yellowish: *Pontia callidice occidentalis*. The bee *Colletes aestivalis* specializes on *Heuchera*.

(*Lithohragna parviflorum* is rare in Colorado. It is pollinated mostly by bombyliid flies, solitary bees, and also by the moth *Greya politella* [Prodoxidae] which pollinates as the female oviposits eggs through the corolla tube [Thompson and Pellmyr 1992].)

*Saxifraga* are unpopular flowers.

*Saxifraga* *(Micranthes) oregana* white: *Boloria titania*, *Plebejus glandon* 2x.

*Saxifraga* *(Micranthes) rhomboidea* white: *Erebia epipsodea*.

“Saxifraga” white: *Plebejus shasta*.

**VITACEAE**

These have inconspicuous flowers that are not visited. *Vitaceae* are visited by bees wasps flies and beetles (Judd et al. 2008).

*(Parthenocissus quinquefolia* yellowish-green is reportedly pollinated by bees and wasps, and supposedly by butterflies but it is common in Denver where butterflies shun it so I have no records.)
**ZYGOPHYLLACEAE**

Zygophyllaceae in general are pollinated by various insects (Judd et al. 2008). Tribulus terrestris yellow is not very popular: Nathalis iole, Pontia protodice 2x. It is pollinated by honeybees and other insects and is self-pollinated in India (Ganaie 2011, who misidentified the two butterflies he claimed pollinated, which his photos suggest are perhaps an orange Colotis and a Glaucopsyche melanops-like blue).

**CELASTRACEAE** (includes *Parnassia*)

These are not popular, but most are uncommon garden plants, except the native *Parnassia*. Celastraceae in general are pollinated by bees, flies, and beetles (Judd et al. 2008).

*Euonymus sp.* with small yellow flowers is ignored in my yard.

*Euonymus atropurpureus* with larger red flowers is spreading as a weed in Denver suburbs, and *Euonymus alatus* purple with orange fruit in Oct. is getting popular planted in suburbs, but I have never seen a butterfly on them. However, Bright and Ogard (2010) observed several Alabama Satyrinae butterflies on *E. atropurpureus* flowers (Clylopsis gemma and Megisto cymela).

*Helianthemum* “Ben Nevis” orange is beautiful but I have not yet seen a butterfly on the one local plant. *Helianthemum* lack nectar and the pollen is gathered by bees, although *H. oelandicum* is wind-pollinated in Scandinavia.

*Parnassia* have small white flowers but I have no records. *Parnassia palustris* white is pollinated mostly by flies including various Syrphidae and Asilidae [plus Tipulidae, Calliphoridae, Culicidae], by non-social wasps [Ichneumonidae, Pompoioidea, Symphyta, Vespoidae], bees [Apoidea], beetles [Nitidulidae], and butterflies and moths; the scent from nectaries induces flies to land; in sunny weather Sutherland (2006) found that Syrphidae were the majority of pollinators, Asilidae nearly half of them. Beetles and self-pollination also help pollinate some *Parnassia*. The bee *Andrena* parnassiae is a specialist on *Parnassia glauca*.

**OXALIDACEAE**

*Oxalis* are uncommon and inconspicuous and only occasionally visited by small butterflies. The *Oxalis* weeds in my garden were only visited several times by rare migrant pierid butterflies. Oxalidaceae in general are pollinated by various insects (Judd et al. 2008), and several German species are pollinated by flies.

*Oxalis dillenii* yellow: Plebejus glandon. *Oxalis montana* is pollinated by bumblebees, and *O. cornuta* and *O. violacea* pollinated by bees at least.

*Oxalis stricta* yellow: Ancyloxypha numitor, Cupido comynatas 7x.

*Oxalis ~stricta* weeds yellow: Eurema nicippe 2x, Nathalis iole.

**VIOLACEAE**

Violets are unpopular, with few records. Violaceae in general are pollinated by various flies, bees, wasps, and bumblebees (Judd et al. 2008).

*Hybanthus verticillatus* greenish-white small-flowered herbs are not visited. Several *Hybanthus* spp. self-pollinate and the flowers never open. In the tropical shrub *Hybanthus prunifolius* the main pollinator is *Melipona interrupta* bees seeking nectar and pollen [Roubik and Buchmann 1984].

*Viola* are pollinated by numerous insects especially bumblebees, honeybees and other bees (*Anthophora plumipes*, *Osmia*, *Andrena*, *Lasioglossum*, *Halictus*), and hoverflies (Beattie 1971, 1972); and by bumblebees and other insects (Dodson and Dunmire 2007). The bee *Andrena violae* specializes on *Viola*. Many *Viola* produce hidden self-pollinating flowers after the conspicuous flowers senesce.

*Viola canadensis scopulorum* white: *Colias eurytheme* 4x (violet to white?), *Erynnis telemachus* 2x.
Viola labradorica violet-purple: Pyrgus centaureae.
Viola nuttallii yellow: Colias philodice, Erynnis persius (1x and one 2 sec.), Euchloe olympia 3x, Euptoieta claudia 5x, Pontia sisyphrii 3x, Pyrgus communis.
Viola ~odorata blue: Vanessa cardui 2x.
Viola ornamental blue: Phyciodes tharos tharos briefly.
Viola tricolor var. hortensis ?white to purple: Nathalis iole.
Viola tricolor var. tricolor purple: Ancyloxypha numitor, Eurema nicippe 3 sec., Pieris rapae, Pyrgus communis 2x.
~Viola-similar yellow flower: Pyrgus philetas.

SALICACEAE
The flowers (catkins) of Salix are very popular, but those of Populus are shunned. Judd et al. (2008) note that Salicaceae in general are pollinated by various unspecialized insects, but Populus is wind-pollinated and has reduced flowers, while Salix flowers (catkins) have nectar glands and an odor and attract insects but are probably also partly/mostly wind-pollinated (Salix pollen is almost as numerous in the air above Britain as Populus [Hyde 1950]).

Salix. Numerous bees specialize in visiting only Salix catkins: Andrena andrenoides, A. bisalicis, A. erythrogaster, A. jenningeri (also visits Prunus [plum, peach]), A. frigida, A. illinoiensis, A. mariae, A. salicaria, A. sigmundi. In Europe Andrena vaga bees collect pollen only from Salix, attracted by 1,4 dimethoxybenzene emitted by the catkins (Dotterl et al. 2005).

Catkin of Salix ?amygdaloides: Phaeostrymon alcestis several.
Catkin of Salix arctica male flowers pinkish: Pyrgus centaureae; female flowers ~whitish: Boloria improba harryi.
Catkin of Salix exigua female flower ~whitish: Plebejus icarioides, Nymphalis antiopa 2x Anne U. White.
Catkin of Salix monticola ~whitish: Aglais milberti male catkin 5x, Callophrys eryphon 12x, Callophrys spinetorum, Celastrina lucia sidara 7x, Nymphalis antiopa 5x, Papilio zelicaon f. nitra female catkins 2x, Polygonia faunus 9x, Polygonia gracilis zephyrus 4x, Polygonia satyrus 6x.
Catkin of Salix planifolia whitish: Boloria freja male catkin, Boloria frigga (another landed on dry catkin so flew after ~1 sec.), Pontia callidice occidentalis.
Catkin of Salix scouleriana ~whitish: Callophrys eryphon several.
Catkin of Salix spp. whitish: Callophrys gryneus siva 2x, Callophrys sheridanii pseudodumetorum some, Pontia protodice, Strymon melinus.

(Populus catkins have no visits. The tiny flowers are wind-pollinated.)

HYPERICACEAE
(Hypericum) has showy yellow flowers but H. perforatum occurs in few Colorado localities, is not popular and I have no records. Hypericaceae in general are pollinated by bees and wasps, and pollen is the usual reward [Judd et al. 2008]. Hypericum including H. perforatum are pollinated usually by bumblebees [Bombus spp. and Lasioglossum for N.J. H. perforatum, Bombus and sometimes syrphid flies and halictid bees for Illinois H. prolificum], and H. perforatum sometimes selfs.)

EUPHORBIACEAE
Most genera are rarely visited by butterflies even though many are showy (I have no records for most Euphorbia [including Chamaesyce etc.] or Tragia). Cnidoscolus is a popular exception. Euphorbiaceae in general are pollinated by insects (flies, bees, wasps, butterflies) seeking nectar (Judd et al. 2008).

Cnidoscolus angustidens white is enormously popular in S Ariz.: Codattractus arizonensis, Codattractus hippalus, Cogia hippalus, Copaeodes aurantiaca, Eurema proterpia, Codattractus valeriana=mystie, Zerene cesonia. Cnidoscolus urens is pollinated by the butterfly Eurema daira in the dry season, and by nocturnal moths in the wet season (Bawa et al. 2008). Cnidoscolus texanus is pollinated by nectar-seeking sphingid moths (Hyles lineata, Manduca quinquemaculata) that carry copious amounts of pollen on their proboscis (Perkins et al. 1975).
Acacia greggii whitish is not very popular: Lycaena helloides, Ministyron led, Plebejus melissa 2x, 
Strymon melinus 3x. Wasps are the most important pollinators of Croton species in Mexico (Narbona and 
Dirzo 2010) and Argentina (Freitas and Bernardello 2001), and sarcophagid flies pollinate others.
Euphorbia “Agaloma” marginata green and white is not popular: Euptoieta claudia ½ sec., Nathalis iole 2x, 
Papilio polyxenes 2 sec., Phyciodes tharos orantain 2x.
Euphorbia esula yellow-green is common but not very popular: Argynnis (Speyeria) hesperis 4x, Callophrys 
erphon 2x, Callophrys gryneus siva 4x, Celastrina humulus lupine-ecotype 2x, Erebia epipsoidea, 
Euphiletos anicia capella 4x, Euphyes vestris, Lycaena rubidus tiny yellow flowers many, Papilio multicaudata, Phyciodes coca 3x, Satyrium californica tiny flowers 3x, Satyrium liparops, Strymon melinus (and palpated its flowers some for 2 min. then flew), Vanessa cardui 3x. This is 
pollinated by Diptera and Hymenoptera in Finland, a soldier beetle in Iowa; ants bees flies and 
mosquitoes fed on the nectar in Saskatchewan.
Euphorbia marginata green and white: Strymon melinus.

LINACEAE
Linum lewisi blue is common but not popular; Amblyscirtes phylace, Celastrina humulus lupine-ecotype 
landed below petals to ?feed once for ~10 sec., Erynnis telemauchus, Euchloe olympia 4x, Euptoieta 
claudia, Glaucoptyche lygamanus, Oarisma edwardsii (Scott and Scott 1978), Oarisma garita 2x, 
Paratrytone snowi 2x, Phyciodes pulchella camillus 1x (+ one only ½ sec.), Plebejus melissa, Pontia 
protodice 1x, + another only 1 sec., Pyrgus communis. Small bees and generalist flies pollinate it in 
Colorado (Kearns and Inouye 1994); honeybees also pollinate it.

FABACEAE=LEGUMINOSAE
These flowers in general are only moderately popular, though most Astragalus, Melilotus, Medicago 
sativa, Oxytropis, and Trifolium seem popular. Other Astragalus such as A. bisulcatus seem rather 
unpopular. Amorpha, Coronilla, Dalea, Glycyrrhiza, Lathyrus, Lotus, Lupinus, Phaseolus, Robinia, 
Thermopsis, and Vicia are not very popular. Hedysarum boreale is very popular but only to skippers, 
evidently because it has red flowers and requires a long proboscis. Skippers seem overrepresented as 
visitors for most legumes evidently because they have a longer proboscis, though the popular legumes 
(including the small-flowered Astragalus flexuosus and the small-flowered Melilotus) attract all 
bees including Papilionoidea. But Psoralea have small flowers yet are not popular. Judd et al. 
(2008) note that Fabaceae in general are pollinated by nectar-gathering bees wasps ants butterflies flies 
beetles birds and bats, but bee pollination is characteristic especially of most legumes with pea-type 
flowers the Faboideae (as contrasted with Mimosoideae and Caesalpinoideae with more primitive flowers 
that are pollinated by many animals—Caesalpinia pulcherrima is pollinated by butterflies [Cruden and 
Hermann-Parker, 1979]) in which the banner attracts bees and the two wings form a landing platform, 
then the bee deppresses the keel which encloses the stamens and carpel so the stamens and stigma contact 
the bee’s underside (“the stigma and stamens of Genista and Medicago are explosively presented”). 
Literature search indicates that bumblebees are the major pollinators of Faboideae. The bees Megachile 
rotundata and M. sculpturalis and Osmia caerulescens specialize on Fabaceae (M. sculpturalis visits 
other flowers also) and have been introduced into the U.S. (Cane 2003). But butterflies can sneak their 
narrow proboscis into many Faboideae flowers to steal the nectar.
Acacia (formerly in Mimosaceae) angustissima spineless white-flowered: Cadtractus arizonensis, Eurema 
proterperia. Most Acacia elsewhere offer only pollen and are pollinated by social and solitary bees (some 
are visited by bees wasps Lepidoptera beetles flies), while those with nectar are pollinated by honeyeater 
birds; Australian Acacia are pollinated by a broad range of bees and wasps.
Acacia greggii yellow: Lasaia maria.
(Toamorpha canescens has beautiful purple flowers but I have seen no butterflies on it. It is pollinated by a bee 
Andrena quintilis that specializes on Amorpha [the colletid bee Colletes robertsonii specializes on 
Amorpha and Dalea, while the andrenid bee Callitopsis andreniformis visits Amorpha and all Fabaceae] 
[Slagle and Hendrix 2009]. A. canescens in Illinois is visited by bumblebees, leaf-cutting bees

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[Megachile], green metallic bees, and plasterer bees [Colletes], plus the specialist Andrena quintilis, plus wasps [Hilty 2013]. It is sometimes pollinated by clerid beetles Phyllobaenus subfuscatus. The bee Hoplites cylindrica is apparently an Amorpha specialist.)

(Amorpha fruticosa has beautiful purple flowers but has no records. Amorpha fruticosa is visited in Illinois primarily by small to medium bees seeking nectar and pollen including halictids [Lasioglossum], masked bees [Hyloicus], Andrenids [Andrena], little carpenter bees [Ceratina], cuckoo bees [Nomada, Coelioxys], plus the specialist Andrena quintilis [Hilty 2013].)

Astragalus spp.: Amblyscirtes eos, Glaucopsyche lygdamus, Plebejus melissa. Astragalus americanus is pollinated only by bumblebees (usually Bombus flavifrons) in Wyo. (Kudo and Hardes 2005). Five Bombus species visit A. filipes in Utah. A bee Megachile concinnata that specializes on Astragalus has been introduced to the U.S. (Cane 2003). Astragalus coccineus is pollinated by hummingbirds (Grant 1994).

Astragalus agrestis purple: Amblyscirtes phylace, Colias eurytheme 2x, Erynnis martialis, Erynnis pacuvius, Erynnis persius 3x, Glaucopsyche lygdamus 2x, Hesperia nevada 33x, Oarisma garita violet 2x, Papilio polyxenes, Phyciodes pulchella camillus 1x + 2 sec, Plebejus melissa 2x, Plebejus saepiolus 18x, Polites draco 11x, Polites themistocles 5x.

Astragalus alpinus purple (or white with small purple areas): Glaucopsyche lygdamus 2x, Pieris marginalis mcallonnoughii, Plebejus melissa pseudosamuelis, Plebejus saepiolus 2x, Polites sabuleti.

Astragalus bisulcatus purple is not very popular: Oarisma garita 12x, Plebejus melissa 3x, Poanes taxiles, Strymon melinus.

Astragalus ?bisulcatus large tall pinkish-purple: Hesperia viridis, Notamblyscirtes simius [not on A. miser].

Astragalus crassicarpus white: Erynnis pacuvius.

Astragalus drumondii white: Callophrys gryneus siva 3x, Cupido amyluctea, Erynnis brizo, Euphyes vestris, Glaucopsyche lygdamus, Glaucopsyche piasius, Hemiarus isola 2x, Hesperia nevada, Hesperia pahaska 20x, Hesperia uncas 3x, Notamblyscirtes simius 5x, Phyciodes pulchella camillus, Plebejus melissa 3x, Polistes (Yvretta) rhesus 3x (preferred, Scott and Scott 1978), Polistes draco several, Polistes sonora, Satyrion behrii, Vanessa cardui 5x, Vanessa virginiensis.

Astragalus flexuosus purple is popular as its tiny flowers are accessible even to small lycaenid butterflies: Amblyscirtes vialis 13x, Callophrys dumetorum homoperplexa 2x, Colias eurytheme, Colias philodice, Cupido amyluctea 12x, Erynnis martialis 6x, Erynnis pacuvius 3x, Erynnis persius 14x, Euphyes vestris 2x, Glaucopsyche lygdamus 10x, Glaucopsyche piasius 3x, Hemiarus isola 2x, Oarisma garita 27x, Piruna pirus 5x, Plebejus alupini texanus, Plebejus icarioides 4x, Plebejus melissa 8x, Plebejus saepiolus 2x, Polistes draco 5x, Polistes themistocles, Pyrgus communis 2x, Strymon melinus 3x, Vanessa cardui 3x.

Astragalus gracilis var. parviflorus purple: Hemiarius isola 2x, Phyciodes thoros thoros 2x, Pholisora catullus 2x, Polistes peckius?

Astragalus hallii purple: Hesperia nevada, Paratrytone snowi 60x.

Astragalus kentrophyta impexus blue: Plebejus saepiolus.

Astragalus kentrophyta yellowish-white: Hesperia uncas.

Astragalus kentrophyta or sericolous ~yellow-white: Polistes (Yvretta) rhesus.

Astragalus laxmannii= “adsurgens” white: Argynnis (Speyeria) coronis, Coenonympha tullia, Colias alexandra 8x, Colias eurytheme 5x, Erynnis persius 3x, Euphyes vestris, Glaucopsyche piasius daunia, Hesperia nevada 2x, Ochodes sylvanianus, Papilio polyxenes white with pink center 4x, Papilio zelicaon, Parnassius hoebus smintheus 2x, Plebejus glandon, Plebejus icarioides 2x, Plebejus melissa, Polistes themistocles 3x, Pontia protodice, Strymon melinus 3x, Vanessa cardui 6x.

Astragalus miser white: Neominois ridingii, Paratrytone snowi.

Astragalus miser pinkish-white: Plebejus icarioides.

Astragalus miser var. oblongifolius [not A. bisulcatus as reported by Scott 1973d] pale-violet: Hesperia pahaska 3x, Notamblyscirtes simius 7x [not A. bisulcatus], Stinga morrisoni.

Astragalus missouriensis rose-purple: Colias philodice, Notamblyscirtes simius, Plebejus melissa, Polistes (Yvretta) rhesus.

Astragalus parryi white: Chlosyne gorgone, Erynnis brizo 11x, Erynnis telemachus 3x.
Astragalus sericoleucus blue-purple: Plebejus alupini texanus (on flower?).
Astragalus shortianus purple: Polistes (Yvetta) rhesus dozens, Strymon melinus, Thorpes pyleades.
Astragalus spatulatus 20 cm blue: Argynnis (Speyeria) edwardsii, Colias edwardsii altiplano.
Astragalus blue: Plebejus acmon, Plebejus icarioides 3x.
Astragalus L?bluish [whitish?): Oarisma edwardsi.
Astragalus purple: Paratrytone snowi.
Astragalus red-purple: Paratrytone snowi 2x.
Astragalus yellow: Euphydryas anicia alena.
Cercis (formerly in Caesalpinaceae) occidentalis pink: Papilio eurymedon, Callophrys augustinus,
   Callophrys mossii windi, Callophrys johnsoni (Scott 1973b). This is pollinated by bumblebees (Bombus)
   and blue orchard mason bees (Osmia lignaria).
Coronilla varia pink is now common in Denver but is not very popular: Colias eurytheme 15x, Pieris rapae,
   Pyrgus communis, Vanessa atalanta 3x. Thymelicus lineola visits it in E U.S. It is pollinated primarily
   by honeybees even though it is not a good nectar source.
Dalea candida white: Plebejus melissa, Strymon melinus. In New Mexico Dalea candida is visited by
   colletid bees Caupolicana yarrowi and Colletes sp. that buzz-pollinates. Five Bombus species visit Dalea
   in Utah, and honeybees help pollinate it. 22 species of bees including bumblebees and honeybees and
   Megachile rotundata pollinate Dalea ornata and D. searlsiae in Oregon (especially Bombus, Eucera,
   Melissodea, Anthidium, Colletes), including the Dalea specialist Colletes petalostemonis (Cane et al.
   2012).
Dalea purpurea pink-purple: Atrytone aroges 2x, Hesperia leonardus montana, Strymon melinus 2x Anne U.
   White and Janet Chu. In Utah, Dalea purpurea sometimes self-pollinates, but attracts a rich bee fauna
   and is pollinated by Apis mellifera and Megachile rotundata, alfalfa leaf-cutting bees, alkali bees (Nomia
   elanderi), wild bumblebees (Bombus fervidus and B. nevadensis), Agapostemon, Anthophora, Dialictus,
   Halictus, and Hoplitis bees; in Minnesota >65 species of bees visit including Bombus 10 sp., Colletes 7
   (Colletes albescens and C. susannae specialize on Dalea purpurea and probably other Dalea, and C.
   robertsonii and C. wilmattae specialize on Dalea), Dialictus 16 sp., Halictus 4 sp., Perdita many (Cane
   2006). 55 bee species are recorded visiting in Illinois, including Melissodea and Megachile dentiarus,
   plus wasps, flies, butterflies and skippers, beetles, and plant bugs. There are so many bees recorded
   visiting Dalea purpurea, that it is considered a desirable species to plant for prairie restoration to support
   mostly ground-nesting bees.
   (Gleditsia triacanthos trees are common in Denver but I have never seen a butterfly on the greenish-white
   flowers.)
Glycyrrhiza lepidota yellowish-white is unpopular: Epargyreus clarus 16x (one got proboscis caught ½ sec),
   Glaucopsycie piasus, Hemiarus isola 3x, Plebejus alupini texanus, Strymon melinus.
Hedysarum boreale red is visited by numerous Hesperitiidae with long proboscis, and shows why other
   butterflies (the Papilionoidea) seldom visit red flowers which are usually long: Amblyscirtes oslari,
   Erynnis horatius, Erynnis pacuvius, Euphyes vestris, Hesperia pahaska, Oarisma edwardsii, Oarisma
   garita, Poanes hobomok abundant, Poanes taxiles, Polistes origenes abundant, Polistes themistocles many,
   Thorybes mexicana, Thorybes pyleades. This is pollinated usually by bumblebees (Bombus esp. B.
   flavifrons) (by Megachile also in Alaska) gathering pollen and nectar (Kudo and Hardes 2005). Nine
   species of bumblebees visit it in Utah.
Lathyrus or Vicia ?blue-purple-pink: Thorpes pyleades.
Lathyrus eucosmus (pink unless noted): Amblyscirtes nysa, Amblyscirtes oslari (white), Amblyscirtes vialis
   (rose-purple), Atrytonopsis lunus, Calephelis rawsoni arizonensis, Erynnis funeratis, Euphyes vestris
   (red-purple), Eurema proterpia, Piruna pirus (rose-purple), Poanes hobomok (red-purple), Thorybes
   pyleades. Lathyrus are pollinated by bumblebees (Proctor et al. 1996).
Lathyrus latifolius pink: Poanes taxiles. This species (and several other Lathyrus) are known to be pollinated
   by bumblebees, and the bee Xylocopa latifolia is also known to pollinate it.
Lathyrus leucanthus white: Pontia sisybrii, Thorpes pyleades, Cupido amyntula 3x, Erynnis martialis 3x,
   Erynnis persius.
Lathyrus polymorphus incanus purple and pink: Amblysirtes oslari, Colias eurytheme, Erynnis afranius, Euchloe olympia, Euphyes vestris, Thorybes pylades 2x.

text continued...
Oxytropis sericea, Oxytropis lambertii, Melilotus, Melilotus officinalis, Melilotus alba,
Pisum sativum.

Wyo. (Kudo 1982).  Erynnis afranius, Erynnis horatius, Cercyonis oetus, is pollinated by bees, and sometimes self pollinates.

India it is pollinated by two specialist bees Megachile haryanaensis and Chalicodoma rubripes (Sihag 1993).  Bembex wasps can pollinate it and other small-flowered legumes.

Melilotus alba white: Argynnis (Speyeria) edwardsii 2x, Brephidium exilis, Callophrys gramineus siva,
Callophrys spinetorum, Cercyonis oetus 2x, Colias eurytheme 3x, Colias philodice 6x, Cupido comyns 2x, Erynnis afranius 2x, Erynnis horatius 4x, Euphyes vestris, Euptoieta claudia, Glaucopsyche lygdamus, Hemiarus ceraunus gyas, Hemiarus isola 6x, Hesperia viridis some, Leptotes marina 4x, Lycaena arota 20x, Lycaena heteroea, Lycaena rubidus 2x, Neominois ridersii, Oarisma edwardsii, Piruna pirus, Plebejus icarioides 2x, Plebejus melissa 5x, Poanes taxiles, Pontia protodice 2x incl. Janet Chu, Satyrium acadica 11x, Satyrium behrii many, Satyrium calanus, Satyrium californica, Satyrium liparops, Satyrium sylvinus, Satyrium titus, Strumy melinus 5x, Vanessa carye.  Melilotus is pollinated by bees, and sometimes self-pollinates.

Melilotus officinalis yellow: Callophrys gramineus siva commonly (Scott 1973a), Celastrina neglecta 2x, Cercyonis oetus, Chlosyne nycteis, Colias edwardsii altiplano, Colias eurytheme 2x, Colias philodice, Erynnis horatius, Euphyes bicamula, Glaucopsyche lygdamus, Hemiarus isola 2x, Hesperia pacifica 2x, Junonia coenia (?Mel. officinalis) 10x, Lycaena heliolis, Lycaena rubidus 3x, Lycaena xanthoides "editha” varali 2x, Oarisma garita, Oarisma edwardsii, Ochrodes yuma, Phyciodes pallida, Phyciodes thoros thoros, Plebejus alupini texanus, Plebejus glandon 2x, Plebejus icarioides, Plebejus melissa 5x, Polites sonora, Pontia protodice, Pyrgus communis 2x, Satyrium calanus many, Satyrium sylvinus nootka, Strumy melinus 5x.

Melilotus white or yellow: Plebejus melissa common.

Oxytropis deflexa var. sericea white: Hesperia uncas, Notamblyscirtes simius, Paratrytone snowi.

Oxytropis lamberti mostly reddish-purple: Amblyscirtes oslari 9x, Amblyscirtes phylace ~20x, Amblyscirtes vialis, Apyrrothrix araxes 5x, Argynnis (Speyeria) callipe, Argynnis (Speyeria) coronis, Argynnis (Speyeria) edwardsii, Battus philenor, Colias alexandra 2x, Colias eurytheme 3x, Colias philodice, Erynnis afranius 4x, Erynnis persius 3x, Erynnis tristis tatuus, Eurema mexicana, Glaucopsyche lygdamus 5x, Hesperia nevada 20x, Hesperia pacifica 20x, Hesperia uncas, Hesperia uncas, Hesperia viridis, Notamblyscirtes simius 3x, Oarisma edwardsii 2x, Oarisma garita 5x (one sucking each flower of inflor.), Papilio eurymedon 3x, Papilio glaucus rutulus, Papilio polyxenes 5x, Papilio zelicaon 4x (+ pinkish 1x f. nitra), Paratrytone snowi 82x, Plebejus glandon, Plebejus icarioides, Plebejus melissa 2x (one placed proboscis into base of flower), Poanes taxiles 2x, Polites (Yvyreta) rhoeas-violet 29x, Polites draco 4x, Polites mystic 3x, Polites origenes, Polites themistocles 2x, Pyrgus communis 3x, Pyrgus scriptura, Stigma morrisoni 14x, Strumy melinus, Thorybes pylades, Vanessa cardui 11x, Vanessa virginiensis, Zerene cesonia.

Oxytropis sericea white: Euphydryas bernadetta rorina, Hesperia nevada 2x, Hesperia uncas 2x, Polites (Yvyreta) rhesus 5x, Thorybes mexicana.  This is pollinated by bumblebees (usually Bombus flavifrons) in Wyo. (Kudo and Harder 2005), and Oxytropis campestris is pollinated by bumblebees in Montana (Bauer 1982).

pea flower: Nathalis iole (white flower), Thorybes pylades.
(Pisum sativum is unpopular.  71-96% of plants self-pollinate before the flower opens, but bumblebees visit the few flowers that open before selfing.)
*Phaseolus heterophyllus* flower with two orange hoods and yellow center with vine stem and tri-part leaves: *Amblyscirtes phylace, Leptotes marina.*

*Phaseolus vulgaris* whitish is unpopular: *Epargyreus clarus, Pieris rapae* (only 1 sec.). This self-pollinates but insects can also pollinate it. *Phaseolus coccineus* is pollinated by honeybees and usually by bumblebees.


*Psoralea?* thin blue legume: *Hemiarugas isola, Hesperopsis alpheus.*

(Robinia pseudoacacia* white and *R. neomexicana* rose-pink have no records on the flowers, but other people have seen butterflies on them. *R. pseudoacacia* is reportedly pollinated by bumblebees [especially] and honeybees [it makes good unifloral honey] and hummingbirds, and sometimes by butterflies and moths [Hilty 2013], although Robertson [1929] wrote that butterflies and moths are not effective at cross-pollination, because strong bees are required to force the petals open for cross-pollination.)

*Senna hirsuta* var. *leptocarpa* yellow: *Amblyscirtes nysa, Ministrymon leda.* *Senna* (often placed in *Cassia*) is “buzz pollinated” by bumblebees and bees (the bee leaving the flower sends up a cloud of light pollen and some sticks to the bee—and reportedly the bee on the pollen picks up a positive electric charge during flight, and the pollen has a negative charge, so the pollen is attracted to the next flower (Vakinin et al. 2000). The bees *Anthophora walshii* and *Svastra atripes* are specialists on “*Chamaecrista*” [often placed in *Cassia*] and possibly *Senna*.

*Thermopsis divaricarpa* yellow: *Amblyscirtes vialis* 5x, *Atrytonopsis hianna hianna, Erynnis afranius,* *Erynnis persius* 12x and female tried to feed on flower twice, *Erynnis telemachus* 5x (2 were seen to feed on this by putting proboscis just inside sepals outside of corolla), *Glaucopsyche lygdamus* 8x (5 of these were seen placing proboscis between corolla and sepal), *Oeneis uhleri, Papilio zelicaon* 3x, *Polites peckius, Polygonia gracilis zephyrus.*

*Thermopsis montana* yellow: *Hesperia pahaska.* This is pollinated by bumblebees (Dodson and Dunmire 2007 and internet websites). *Thermopsis lanceolata* is pollinated primarily by *Megachile* and *Hoplitis* bees (who also chewed holes in flower bases to steal nectar) in Inner Mongolia (Hongyan et al. 2012).

*Trifolium dasyphyllum* purple/pink: *Boloria eunomia.* This is pollinated by bumblebees (Bauer 1983).

*Trifolium hybridum* pinkish-white: *Argynnis (Speyeria) cybele cybele, Callophrys grneus siva, Colias eurytheme, Cupido comynstas 4x, Oarisma garita 2x, Plebejus saepiolini 11x, Thymelicus lineola 2x.*

*Trifolium pratense* red-purple is moderately popular: *Amblyscirtes vialis* 2x, *Ancyloxypha numitor* 6x (and one 5 sec.), *Argynnis (Speyeria) aphonide 11x* (one only 1 sec.), *Argynnis (Speyeria) atlantis sorocco, Argynnis (Speyeria) edwardsi, Argynnis (Speyeria) hesperis 3x, Argynnis (Speyeria) mormonia, Argynnis (Speyeria) nokomis 8x, Argynnis (Speyeria) zereene, Atalopedes campestris 2x, *Celastrina neglecta, Colias alexandra 8x, Colias eurytheme 58x, Colias philodice 35x, Cupido amynuta, Cupido comynstas 2x, Danaus plexippus 14x, *Erynnis batisae, Euchloe ausonides, Euphyes vestris 2x, Euptoieta claudia 4x, Hemiarugas isola 2x, Hesperia ottoe, Ochloides sylvanoides 7x, Papilio polyxenes 26x, Paratraunte snowi, Phyciodes pulchella camillus, Pieris rapae 5x, Piruna pirus, Plebejus icarioides, Plebejus saepiolus 2x, Poanes taxiles 8x, *Polites mystic 13x, Polites peckius, Polites themistoecles 3x, Thymelicus lineola 2x, Vanessa atalanta 47x, Vanessa cardui 73x, Vanessa carae, Vanessa virginniensis 2x.* This is pollinated by bumblebees (*Bombus lapidarius, hortorum, pascuorum, terrestris,* etc., the longer-tongued spp. pollinate best) and leaf-cutter bees in the U.S. (honeybees are least effective at tripping the flowers), by bumblebees and sometimes honeybees in Europe. In New Zealand it is pollinated by honeybees and two species of long-tongued bumblebees (the shorter-tongued *Bombus terrestris* that is used in tomato greenhouses pollinates much less) (Palmer-Jones et al. 1966). In Italy
bumblebees are the main pollinators (*Bombus terrestris*, *Pyrobombus lapidarius*, and 5 *Megabombus* spp.); honeybees visit less but also pollinate (Manino and Ferrazzi 1990).


**Trifolium** (usually white to pink): *Chlosyne pallia australomontana* some, *Erynnis horatius*, *Hesperia pahaska*, *Parnassius clodius*, *Satyrium favonius autolycus=violeae* 2x, *Strymon melinus*.


**Vicia cracca** bluish-purple: *Anatryptone logan logan*, *Polites peckius*, *Vanessa atalanta*, *Vanessa cardui*. Bumblebees are frequent visitors (Laverty 1994).

**Vicia villosa** violet-and-white to rose: *Cupido comynatas*.

~**Vicia** tall skinny “wild pea”? blue or purple: *Danaus plexippus*.

**ROSACEAE**

In general, Rosaceae flowers are unpopular, although there are a number of records for common *Physocarpus*, *Potentilla*, and *Prunus* which are moderately popular (*Prunus americana* is a popular flower in early spring when there are not many other flowers around). This is surprising, as these flowers are usually showy (such as *Amelanchier*, *Crataegus*, *Chaenomeles*, *Dryas*, *Fragaria*, *Holodiscus*, *Pyrus*, *Rosa*, *Rubus*, and *Spiraea*), yet are unpopular. *Pyrus malus* is abundant in towns but is rarely visited. Wild roses are sometimes visited, but cultivated roses are generally ignored because breeders bred the aroma and nectar out of most roses and gave them hundreds of petals that block insects. Rosaceae in general have generalist pollinators, the smaller flowers visited by flies and short-tongued bees, the larger flowers pollinated by long-tongued bees wasps butterflies moths and beetles (Judd et al. 2008). Fruit trees (*Pyrus*, *Prunus*) are pollinated mostly by bees including honeybees, sometimes by flies (chironomids, mycetophilids, muscids and calliphorids etc.), and nitidulid beetles. The introduced bees *Osmia cornifrons* and *O. cornuta* specialize on Rosaceae flowers, and *O. cornifrons* visits old-world tree-fruit flowers (apple, peach, pear, etc., Cane 2003). The blue orchard mason bee *Osmia lignaria* is a more efficient pollinator of fruit trees than the honeybee.

(*Agrimonia striata* has small yellow flowers and is uncommon and has no records.)

**Amelanchier**? (white-flowered shrub similar to it): *Erynnis propertius meridianus*, *Libythea carinenta larvata*, *Ministrymon ledia*. *Amelanchier* is reportedly pollinated by insects.

**Amelanchier** white: *Callophrys augustinus iroides*.

“**Cercocarpus**” (similar to, tiny white-yellow-flowered tiny-leaf, Ariz.): *Microtia dymas* several, *Ministrymon ledia*.

**Chaenomeles japonica** orange-red: *Papilio glaucus rutulus*. This is pollinated by bees and sometimes other insects.

**Crataegus erythropoda** white: *Polygonia satyrus*. Other *Crataegus* species are reportedly pollinated by numerous bees including honeybees and bumblebees and solitary bees and wasps and flies and even a few beetles and midges and other insects, and the butterfly *Vanessa virginiensis*.

(**Cotoneaster** white or pink has no records. It is often visited by wasps in Britain [Proctor et al. 1996].)*

**Dryas octopetala** white: *Argynnis* (*Speyeria*) *mormonia*, *Erebia magdalena*, *Euphydryas anicia brucei*, *Oeneis polixenes* 2x, *Vanessa cardui* 12x. The flowers track the sun to warm, and are pollinated by five
sp. of flies in Sweden (Thricops and Phaeonia feed exclusively on pollen and nectar) (Pont 1993, who notes that Muscidae flies are the predominant insect pollinators of open blossoms in arctic-subarctic habitats.)

(Fallugia white flowers; no Polites peckius were seen on this. Fallugia paradoxa is insect-pollinated and attracts a wide variety of insects.)

Fragaria ~vesca white is unpopular: Callophrys spinetorum. Commercial Fragaria strawberries are pollinated by honeybees and bumblebees etc., and Calliphora blowflies can pollinate them in greenhouses.

Fragaria virginiana glauca white is also unpopular: Lycaena floris, Pieris marginalis mcdunnoughii 2x, Plebejus glandon 1x + 1 sec., Plebejus saepiolus 2x, Pyrgus centaureae 2x. It is visited by ants, bees, and flies [Ashman 2000].

Geum (Acomastylis) rossii turbinatum yellow: Lycaena cupreus snowi 2x, Parnassius phoebus smintheus, Plebejus glandon, Plebejus saepiolus.

Geum aleppicum yellow: Euphydryas anicia capella.

Holodiscus discolor whitish: Apodemus nais, Argynnis (Speyeria) hesperis, Asterocampa celtis jeffermont 2x, Celastrina neglecta cinerea, Satyrium californica 11x, Satyrium behrii 2x.

Physocarpus monogynus white is popular: Argynnis (Speyeria) coronis, Argynnis (Speyeria) hesperis, Callophrys gryneus siva, Celastrina lucia sidara 3x, Chlosyne gorgone 16x, Erebia epipsodea, Euphydryas anicia capella 19x, Euptoieta claudia 3x, Hesperia juba, Limenitis weidemeyeri 6x, Nymphalis antiopa, Papilio eurymedon, Parnassius phoebus smintheus, Phyciodes pulchella camillus 2x, Polygonia gracilis zephyrus 2x, Polygonia satyrus 2x, Vanessa atalanta 14x, Vanessa cardui 3x. Effective pollinators of Physocarpus amurensis are Apidae bees, sometimes butterflies.

Potentilla concinna yellow: Callophrys spinetorum, Oarisma garita 2x.

Potentilla diversifolia yellow: Boloria eunomia, Boloria titania 2x, Erebia callias, Lycaena cupreus snowi, Plebejus glandon 2x.

Potentilla fissa yellow is common but unpopular: Callophrys dumetorum homoperplexa, Celastrina lucia sidara, Chlosyne gorgone 6x, Coenonympha tullia, Ereynnis martialis 2x, Ereynnis persius 2x, Euphydryas anicia capella (and 1 briefly), Oarisma garita, Papilio zelicaon, Parnassius phoebus smintheus, Plebejus glandon 2x, Poladryas minuta arachne.

Potentilla fruticosa=Pentaphylloides floribunda=Dasiphora fruticosa floribunda yellow is common but not very popular: Boloria eunomia 3x, Cercyonis oetus 4x, Lycaena floris 16x, Lycaena heteronea 4x, Lycaena rubidus 2x, Lycaena xanthoides “edita” vurali, Oeneis calais altacordillera?, Papilio glaucus rutulus, Pieris rapae, Plebejus glandon 5x, Plebejus melissa pseudosamuelis, Poanes taxiles only 2 sec., Pontia protodice 2x, Satyrium californica, Satyrium saepium 14x. This is pollinated by bees and flies.

Potentilla gracilis yellow: Argynnis (Speyeria) atlantis sorocco, Coenonympha tullia, Lycaena floris 4x, Lycaena rubidus 3x, Parnassius phoebus smintheus 2x. In Oregon this species is pollinated by bees (Ceratina nanula, Trichodes ornatus, Halictus ligatus, Lasioglossum sisybrii, and L. olympiae), while the weed Potentilla recta is pollinated by honeybees, C. nanula, Halictus tripartrus, L. sisybrii, and Bombus rufocinctus (McIver and Erickson 2012). Other herbaceous Potentilla are pollinated mostly by bees including honeybees, sometimes by syrphid flies, mini wasps, and occasionally butterflies; some species (but not P. gracilis) are self-compatible.

Potentilla hippiana yellow: Oarisma garita, Parnassius phoebus smintheus, Phyciodes pallida, Plebejus glandon, Poladryas minuta arachne 4x.

Potentilla hippocanaXpulcherrima yellow: Oarisma garita.

Potentilla norvegica yellow: Ancyloxypha numitor 12x, Pieris rapae 3x.

Potentilla pensylvanica yellow: Hesperia uncas.

Potentilla pulcherrima yellow: Argynnis (Speyeria) mormonia 3x, Cupido amyntula, Euchloe auronides, Hesperia comma colorado, Lycaena floris 23x + 1/3 sec., Lycaena rubidus 2x, Oarisma garita, Plebejus glandon 7x, Plebejus saepiolus (1x + 1/2 sec. twice), Pontia callidice occidentalis, Pontia protodice.

Potentilla subviscosa yellow: *Pyrgus xanthus* often.


*Prunus cerasus* white (sour cherry): *Vanessa atalanta*, *Vanessa cardui* 24x.

*Prunus domestica* white (plum) is rarely visited: *Nymphalis antiopa*.

*Prunus maackii* white: *Vanessa cardui*.

*Prunus pissardi* rosea white: *Vanessa cardui* 2x.

*(Prunus persica* pink [peach] is common in towns but I have not seen a butterfly on it.)


*Purshia tridentata* pale-yellow: *Coenonympha tullia*, *Callophrys gryneus chalcosiva*, *Papilio glaucus rutulus*, *Satyrium fuliginosum*. This is pollinated by various insects, also by wind, and by self-fertilization.

*(Pyracantha* white has no records.)

*Pyrus* crabapple: *Vanessa cardui* (1x + pink 3x, double-flowered crabapple pink 6x).

*Pyrus floribunda* pinkish-white: *Vanessa cardui*.

*Pyrus malus* (apple) white: *Vanessa cardui* 2x. Honeybees and bumblebees pollinate it (bumblebees can buzz-pollinate it); the megachilid blue orchard mason bees *Osmia lignaria propinququa* are claimed to be superior pollinators (*Osmia cornifrons* is used in Japan, *O. cornuta* in Europe, *O. rufa* and *Andrena* in Britain). *Andrena*, *Halictus*, and *Lasiosglossum* bees pollinate fruit trees in Nova Scotia. Willmer (2011) notes that early midges and fungus gnats, some higher flies (bibionids, muscids), and also ntitidulid beetles occur regularly on the flowers of orchard fruits (*Pyrus* apples and pears, *Prunus* plums and cherries).

*(Pyrus communis* [pear] has no records, but there are few trees to observe. It is pollinated by honeybees and the megachilid blue orchard mason bee *Osmia lignaria*.)

*Rosa* spp. are unpopular flowers. The bee *Synhalonia rosae* specializes on wild *Rosa*. *Rosa* ~woodsii pink 5 cm flower: *Oarisma garita*, *Vanessa atalanta*.

*Rosa* pink: *Callophrys eryphon*, *Euphydryas gilletti*, *Cercyonis pegala* 1 sec. only.

*Rosa* red: *Papilio multicaudata* (cultivated red, one bushy, one had single petals) 6x (two only 2 sec.), *Vanessa atalanta* (red giant with few petals).

*Rosa* cream: *Poanes taxiles*.

*Rosaceae* shrub white: *Coenonympha tullia californi*, *Satyrium californica*, *Satyrium sylvius dryope*.

*Rubus* sp. (“blackberry”) white: *Callophrys gryneus nelsoni*, *Euchloe ausonides ausonides*, *Pyrgus communis* (on Darrow Blackberry). *Rubus arcticus* is pollinated by honeybees in Estonia. Some *Rubus* can self-pollinate.

*Rubus deliciosus* white is unpopular: *Atrypontopsis hianna hianna*, *Callophrys eryphon*, *Chlosyne gorgone* (one 1/3 sec, another hovered over 1 sec then flew), *Coenonympha tullia*, *Euphydryas anicia capella* 2x, *Lycaena arota* 2x, *Papilio eurymedon*, *Vanessa cardui*.
Rubus idaeus melanolasius white: Amblyscirtes vialis 2x, Erebia epipsodea, Pieris rapae, Polygonia gracilis zephyrus. Raspberry varieties are pollinated by bumblebees and honeybees and solitary bees, sometimes by megachilid (Osmia) bees; bumblebees are better pollinators in Scotland (Willmer 2011).

(Sibbaldia procumbens is an unpopular flower; it is common near timberline but I saw no visits. It is reportedly pollinated by various insects [probably flies].)

(Sorbus has no records even though Sorbus canadensis is common in towns and S. scopulina is occasional in the high mts. In Illinois Sorbus [mostly S. aucuparia] is visited by honeybees, bumblebees, various solitary bees, syrphid flies, and beetles for nectar and pollen, and cross-pollination is necessary for fruiting [Hilty 2013].)

Spiraea japonica: Poanes taxiles (on “Gold Flame” pink-red), Vanessa cardui (pink). Spiraea is pollinated by honeybees (usually) and flies. Spiraea -japonica var. ovalifolia white: Pontia protodice.

RHAMNACEAE

These flowers seem popular, though Rhamnus cathartica is shunned.

Ceanothus fendleri white is very popular: Amblysictes phylace, Apodemia mormo puelbo, Apodemia nais ~74x, Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) callipe 4x, Argynnis (Speyeria) edwardsii, Argynnis (Speyeria) hesperis 6x, Callophrys dumetorum homoperplexa 9x, Callophrys gryneus siva 26x incl. Janet Chu, Celastrina humulus hop-ecotype 4x incl. Janet Chu, Celastrina humulus lupine-ecotype, Celastrina lucia sidara, Celastrina neglecta cinerea, Cercyonis oetus 2x, Chlosyne gorgone, Chlosyne leanira fulvia, Chlosyne pallula calydon, Coenonympha tullia 3x, Colias alexandra, Erora laeta quaderna, Erynnis martialis 13x, Erynnis pacuvius 9x, Euphydryas anicia capella 17x, Euphyes vestris 9x, Glaucopsyche piasus, Hesperia viridis 2x, Limenitis weidemeyerii 2x, Lycaena heteronea 3x, Nymphalis californica, Oarisma edwardsii 2x, Oarisma garita 5x, Oeneis chryxus, Papilio eurymedon, Parnassius phoebus smintheus, Phyciodes coycya 3x, Phyciodes pallida, Phyciodes pulchella camillus 3x, Piruna pirus 3x, Plebejus alupini near-lutzi 11x, Plebejus icarioides 4x, Plebejus melissa, Plebejus saepiolus, Poanes taxiles 2x, Poladryas minuta arachne 4x, Polites draco, Polygonia gracilis zephyrus 4x, Satyrium behrii 30x, Satyrium californica 8x, Satyrium lifarops Janet Chu, Satyrium saepium 7x, Satyrium titus 6x, Strymon melinus 4x, Vanessa cardui. Ceanothus fendleri and most Ceanothus are pollinated by bees, while some species are also pollinated by hoverflies and even hummingbirds.

Ceanothus velutinus white: Agrilis milberti, Argynnis (Speyeria) edwardsii, Argynnis (Speyeria) zerene, Papilio glaucescens rutulus.

Ceanothus sp. Whitish Calif.: Callophrys johnsoni, Chlosyne pallula palla. Rhamnus californica yellowish: Callophrys augustinus many.

(Rhamnus cathartica is a common weedy bush in towns but has ugly little greenish flowers that are shunned, so there are no records. It is pollinated by bees and flies.)

ELEAGNACEAE

These are evidently unpopular.

Eleagnus angustifolia yellow is rarely visited: Argynnis (Speyeria) edwardsii. Erynnis juvenalis and Atrytonopsis hianna hianna visits are recorded in eastern U.S. The small fragrant yellow flowers are pollinated by honeybees and bees in Eurasia. (Shepherdia canadensis has no records. It is fairly common but occurs in shade and has small brown flowers that are pollinated primarily by syrphid and empid flys [Borkent and Harder 2007].)

ULMACEAE

Butterflies do not visit wind-pollinated Celtis and Ulmus trees. Ulmaceae in general (including Ulmus, Celtis and Trema) are wind-pollinated (Judd et al. 2008).

CANNABACEAE
**Humulus** has inconspicuous small flowers generally ignored by butterflies. Cannabaceae in general are wind-pollinated (including **Humulus** and **Cannabis**) (Judd et al. 2008).

**Humulus lupulus** female flower: **Hemiargus isola** (one wonders if it obtained any nourishment).

**MORACEAE**  
**Morus alba** trees are scattered in Denver but have tiny greenish flowers that are wind-pollinated.

**URTICACEAE**  
Butterflies very rarely visit the inconspicuous tiny wind-pollinated flowers of **Urtica** and shun **Parietaria**. Urticaceae in general is usually wind-pollinated (Judd et al. 2008). (**Parietaria pensylvanica** is uncommon and has tiny inconspicuous flowers and no records.) **Urtica dioica gracilis** gray-green (maybe the butterfly was seeking water and not nectar?): **Paratrytone snowi**.

**CUCURBITACEAE**  
All are unpopular flowers for butterflies (bees love them and pollinate Colorado garden squash and cucumbers). Cucurbitaceae in general are pollinated by various insects. Birds and bats seeking pollen and nectar (Judd et al. 2008). The Gourd Bee **Xenoglossa strenua** is a specialist on Cucurbitaceae including **Curcurbita pepo**. **Cucumis sativus** var. **cantalupensis** has a recorded visit by **Amblyscirtes nysa**. **Cucumis sativus** (cucumber) yellow: **Pyrgus communis**, **Pieris rapae** 5x (proboscis sucking) (+ one only 1 sec). This is reportedly pollinated by honeybees and stingless bees (by **Scaptotrigona aff. depilis** and **Nannotrigona testaceicornis** in greenhouses). Bumblebees are better pollinators than honeybees (Stanghellini et al. 2002).

**Cucurbita maxima** yellow: **Pieris rapae** (only ½ sec). Butternut squash is common in my garden but is not visited.

**Cucurbita pepo** yellow is common in my garden (zucchini squash) but is not visited. It is pollinated by bumblebees and squash bees (**Peponapis pruinosa**) (Hladun and Adloer 2009). **Cucurbita pepo** and other **Curcurbita** are pollinated by honeybees, and by **Peponapis pruinosa**, a specialist wild bee that gathers pollen before sunup (an hour before any other bees) and can pollinate whole squash fields (Sampson et al. 2008, Cane et al. 2011); **P. pruinosa** feeds only on wild and domestic **Curcurbita** (Hurd et al. 1971). Gourd Bees **Xenoglossa strenua** also visit. **Echinocystus lobata** cream is not popular: **Danaus plexippus** 1 sec. The tiny flowers are pollinated by insects and by self-fertilization.

**FAGACEAE**  
Butterflies do not visit the inconspicuous flowers of **Quercus**, which are wind-pollinated. Fagaceae in general are wind-pollinated, including **Quercus** and **Fagus**, though **Castanea** is pollinated by flies, beetles and bees (Judd et al. 2008).

**JUGLANDACEAE**  
(Butterflies do not visit the inconspicuous flowers of numerous **Juglans nigra** in Denver, which is wind-pollinated [thousand cankers disease transmitted by bark beetles has now killed almost all these trees]. Juglandaceae in general are wind-pollinated [Judd et al. 2008].)

**BETULACEAE**  
**Alnus** and **Betula** and the uncommon **Corylus cornuta** are not visited and are wind-pollinated. Betulaceae are wind-pollinated (Judd et al. 2008). **Betula glandulosa** almost always selfs on Baffin Island but in central Quebec it is usually sexually pollinated (by wind).

**GERANIACEAE**
These are not very popular, although *Geranium caespitosum* is moderately popular and several tiny skippers love it. Geraniaceae in general are pollinated by a wide variety of insects for a nectar reward, and nectar guides are often present (Judd et al. 2008).

*Erodium cicutarium* violet is common but unpopular: *Euchloe ausonides ausonides*, *Junonia coenia* 2x, *Papilio zelicaon*.

*Geranium ?carolinianum* red: *Junonia coenia*.

*Geranium caespitosum* pink is popular, especially for *Piruna pirus*: *Amblyscirtes aenus*, *Amblyscirtes phylace* 2x, *Amblyscirtes vialis*, *Argynnis (Speyeria) aphrodite* 2x, *Argynnis (Speyeria) callippe*, *Argynnis (Speyeria) hesperis* 3x, *Atrytone argos*, *Callophrys gryneus siva*, *Celastrina humulus* hop-ecotype, *Celastrina humulus* lupine-ecotype (7x and white 6x), *Cercyonis meadii* only ½ sec., *Cercyonis oetus* 2x, *Cercyonis pegala* 6x, *Coenonympha tullia*, *Colias alexandra*, *Colias eurytheme* 2x, *Epargyreus clarus* 2x, *Erynnis horatius* (red flower), *Erynnis pacavus*, *Euphyes vestris* 15x, *Euptoieta claudia*, *Eurema mexicana* ½ sec, *Glaucopsyche piasus*, *Hesperia comma*, *Hesperia leonardus montana*, *Hesperia nevada*, *Leptotes marina*, *Lycaena xanthonides “editha” vurali* 1 sec., *Oarisma edwardsii* 3x, *Oarisma garita* 13x (one seen placing proboscis on base of column), *Ochloides sylvanoides* 8x, *Oeneis jutta*, *Paratrytone snowi* 4x, *Pholisora catullus*, *Pieris marginalis mcdunnouhii* sucking on top 2x, *Pierus rapae* 2x, *Piruna pirus* 404x incl. Janet Chu (This *Geranium* is the favorite flower of *Piruna*). When feeding, both sexes land on petals with head toward anthers/stigmas and put proboscis next to stamen column [they put proboscis down into holes by stamens and probably contact them sometimes while they suck nectar, but they are too small to often contact the 4 stigmas which rise in a column surrounded by the arching stamens, so they should be classified as illegitimate visitors.], *Plebejus glandon* 3x, *Poanes taxiles* 8x, *Polites mystic* 3x (but another ignored it), *Polites origenes* 2x, *Polygona gracilis zephyrus*, *Satyrium titus* 2x, *Strymon melinus*, *Vanessa atalanta*. Internet search indicates that bees are known to visit this species, which is self-compatible; Dodson and Dunnire (2007) note that lavender lines on the flowers help bees to get the nectar. Willmer (2011) notes that large brightly-colored *Geranium* (such as *G. pratense*, *G. sylvaticum*) are pollinated by insects especially bees, while smaller dull-pink *Geranium* (such as *G. molle*, *G. dissectum*) are self-pollinated. The bee *Andrena distans* is a specialist on *Geranium maculatum*.

*Geranium hybrida* orange: *Pieris rapae* 3x.

*Geranium purpureum* pink: *Piruna polingii* 6x.

*Geranium richardsonii* white: *Argynnis (Speyeria) mormonia*, *Erebia epipsodea* 2x, *Nathalis iole*, *Pieris marginalis mcdunnouhii*.

*Geranium ~sanguineum* red: *Papilio multicaudata* (+ others only 2, 2, 3 sec.).

ONAGRACEAE

Most genera are shunned by butterflies, except *Epilobium danielsi* is moderately popular. *Clarkia xantiana* in California has two specialist bees (*Megachile griffithii* and *M. pascoensis*) that evidently visit only *Clarkia* (Eckhart et al. 2006).

*Calycophus serrulata* yellow: *Euphyes vestris*. Other *Calycophus* spp. in Texas are pollinated by halictid bees, several chrysolomelid and buprestid beetles, several syrphid flies, the sphingid moth *Hyles lineata*, several noctuid moths, and honeybees (Clinebell II et al. 2004). *Calycophus hartwegii* flowers open afternoon-evening and attract sphingid moths and hummingbirds.

*Epilobium brachycarpum=paniculatum* pink tiny flowers: *Pieris rapae*.

*Epilobium* (*Chamerion*) danielsi “angustifolium” red-purple: *Argynnis (Speyeria) aphrodite*, *Argynnis (Speyeria) aphrodite* (or for *Epilobium leptophyllum*?), *Epargyreus clarus*, *Erebia stubbendorfii “theano” ethela* 2x, *Ochloides sylvanoides* 3x, *Poanes taxiles* 2x, *Pontia protodice* 2x,. This *Epilobium “angustifolium”* is usually bumblebee-pollinated but often self-pollinates (Benham 1969). *Epilobium (“Zauschneria”) canum* is pollinated by various bees, butterflies, and hummingbirds.

*Epilobium-like flower: Lasiommata megera* (Europe).
Evening primrose? pink was shunned by butterflies during several days.

*Datura stramonium* 2x: *Euptoieta claudia*. Primary pollinators of this are a noctuid and a geometrid moth, while *G. villosa* is pollinated by ant lions (esp. *Scotoleon minusculus*), two noctuid moths, and two halictid bees (*Sphecodogastria*) (Clinebell II et al. 2004).

**Gaura reddish**: *Euphyes vestris*.

*(Gayophytum* whitish-turning-rose has no records. The tiny *Gayophytum ramosissimum* self-pollinates.

Flower flies and small bees pollinate some larger *Gayophytum*. In *Gayophytum diffusum* the smaller flowers self, larger ones cross-pollinate.)

*Oenothera albicaulis* white: *Colias philodice*. Most *Oenothera* have large white flowers and bloom from sunset to early morning and are pollinated by moths (Dodson and Dunmire 2007), while smaller yellow flowers of other species bloom in daylight and are pollinated by bees. *Andrena* bees are important pollinators of California *Oenothera*. In eastern U.S. 8 sp. of *Lasiglossum* bees (Halictidae) including *L. oenotherae* visit only flowers of Onagraceae including *Oenothera* for pollen (Zayed and Packer 2007). The halictid bee *Euvylaeus* also specializes in *Oenothera*. The bee *Anthedonia compta* specializes on *Oenothera biennis* and probably other *Oenothera*.

*(Oenothera caespitosa* whitish aging pink or rose is common but is shunned. It is pollinated by the sphingids *Sphinx vachti* and *Hyles lineata* [whose larvae eat the plant], while small crepuscular bees *Lasiglossum* and *Andrena* and large crepuscular bees *Xylocopa* are all nectar thieves.)

*Oenothera hookeri* yellow: *Paratrorytone snowi* 2x.

**LYTHRACEAE**


*Lythrum* is very popular. Judd et al. (2008) state that Lythraceae in general are pollinated by bees, beetles, and flies (birds for *Cuphea*, bats for *Sonneratia*).

*Cuphea rosea* purple was very popular in a greenhouse for at least one butterfly: *Pieris rapae* 10x.

*Lythrum alatum* purple: *Anolyxysa numitor*.

*Lythrum salicaria* purple was very popular in the tiny patch it occupied NE Bass Lake in Wheatridge Colo. before eradication as a weed: *Papilio multicaudata*, (Lazri and Barrows 1984 saw it on *Lythrum*);

*Cercyonis pegala* 3x, *Epargyreus clarus* 6x, *Junonia coenia*, *Ochloedes sylvanoides* 8x, *Papilio polyxenes, Poanes taxiles* 2x. *Lythrum salicaria* and *L. alatum* are pollinated by honeybees, bumblebees, xylocopid bees, megachilid bees, and the butterflies *Pieris rapae*, *Colias philodice*, and *Cercyonis pegala* (Levin 1970, Levin and Kerster 1973). In Britain this is visited by *Bombus pascuorum* and short-tongued bees which surely pollinate, and by syrphid flies and butterflies. Butterflies transport some pollen in Washington D.C. (Lazri and Barrows 1984) so some pollination is possible. In Colo. *Lythrum* may be pollinated by butterflies also, in addition to honeybees.

**ANACARDIACEAE**

*Rhus* are mostly shunned, but some lycaenids like them. *Toxicodendron* has tiny flowers and is rarely visited. Anacardiaceae in general are pollinated by various insects (Judd et al. 2008). *Anacardium* is reportedly pollinated by butterflies and moths and secondarily by bats, while *Anacardium occidentale* is pollinated by ants.

*Rhus glabra* greenish flowers: *Argynnis (Speyeria) hesperis* 6x, *Celastrina neglecta* (whitish or greenish-yellow) a long time 3x, *Cercyonis pegala*, *Limenitis weidemeyerii* 2x, *Satyrium behrii* 2x, *Satyrium behrii* 2x, *Satyrium californica* 5 min., *Satyrium saepium* 2x, *Satyrium titan* 2x, *Vanessa atalanta* 3x. This is pollinated by bees including honeybees. The cultivated *Rhus typhina* is pollinated by honeybees.


*Toxicodendron rydbergii* “radicans” has tiny yellowish-white or greenish-white flowers and has no records by me, but Senchina (2008) saw 17 *Celastrina neglecta* butterflies sucking nectar from them, averaging 39 seconds per visit, and cited papers noting that cantharid, cerambycid, and clerid beetles and honeybees
have been reported to pollinate the flowers. Also reportedly pollinated by insects including honeybees, small bees, and flies.

SAPINDACEAE (includes Aceraceae and Hippocastanaceae)

_Acer_ trees (formerly in Aceraceae) are wind-pollinated and are not visited by butterflies (though _Acer saccharum_ is also partly animal-pollinated [Judd et al. 2008 p. 69]). Sapindaceae in general are pollinated by birds and a wide variety of insects that are rewarded by nectar (Judd et al. 2008). _Aesculus californica_ white to pale-rose (formerly in Hippocastanaceae) is enormously popular in Calif. especially for hair streaks: _Adelpha californica_ 3x, _Athides halesus_ 1x, _Battus philenor_ hirsuta, _Celastrina neglecta_ echo, _Euphydryas chalcedona_ chalcedona 2x, _Hesperia lindseyi_ 12x, _Junonia coenia_ 1x, _Lycaena gorgon_ 3x [ _Lycaena arota_ is also recorded], _Ochloides agricola_ 6x, _Poanes melan_ 2x, _Phyciodes mylitta_, _Plebeius icarioides_, _Satyrium auretorum_ 32x, _Satyrium californica_ 21x, _Satyrium saepium_, _Satyrium sylvius_ dryope, _Satyrium sylvius_ sylvius 1x, _Satyrium tetra_ 203x, _Strymon melinus_, _Thorybes pylades_ 1x, _Vanessa carpe_. _Aesculus californica_ is pollinated by butterflies (Moldenke 1976), and its nectar is toxic to the imported honeybee (but not to native bees or butterflies). Other _Aesculus_ are pollinated by bees (_A. turbinata_ and _A. glabra_ by bumblebees, Macior 1978), and the red flowers of _Aesculus pavia_ are pollinated by hummingbirds in SE U.S. ( _Koelreuteria paniculata_ little trees are becoming popular in Denver, but so far I have seen no butterflies on the beautiful yellow flowers.)

_Sapindus saponaria_ var. _drummondii_ has white flowers but I saw no butterflies on them in one visit. _Sapindus marginatus_ is visited by butterflies _Baoris zelleri_ and _Euploea core_ in India [Reddi and Bai 1984].)

RUTACEAE

_Ptelea trifoliata_ occurs in SE Colorado, but the small greenish-white foul-smelling flowers are pollinated by carrion flies (Elias 1980). Rutaceae in general are pollinated by insects esp. bees and flies (Judd et al. 2008).

SIMAROUBACEAE

Simaroubaceae in general are pollinated by various insects (esp. bees) and birds (Judd et al. 2008). ( _Ailanthus altissima_ trees have tiny yellowish-green flowers [the male flowers produce an unpleasant odor] and are frequent in towns but I have not seen butterflies on them. _A. altissima_ is pollinated by large bees and honeybees [ _Bombus_], flies [ _Anthomyiidae_, _Calliphoridae_, _Musciidae_, _Syrphidae_, _Tachinidae_], and abundant cantharid beetles [ _Chauliognathus marginatus_] that pollinate it, and numerous ants [ _Formica_, _Prenolepis_, _Camponotus_] are not pollinators because they cannot travel from male to female trees [Thompson 2008; Aldrich et al. 2008].)

THYMELAEACEAE

( _Daphne Xburkwoodii_ “Variegata” grows around some houses, but I have seen no butterflies on the pink flowers. _Daphne laureola_ is pollinated by nitidulid beetles, solitary bees, and noctuid moths [Alonso 2004]).

MALVACEAE (includes Tiliaceae)

These flowers are showy but mostly unpopular. The flowers of _Tilia_ trees are moderately popular especially to butterflies that can fly at tree height especially _Nymphalinae_ and _Papilio_. Malvaceae in general are pollinated by bees wasps ants flies moths birds and bats (Judd et al. 2008). _Sidax_ and _Malvastrum_ are pollinated by Andrenidae and Apidae bees (Morato and Antonio de O. Campos, 2000). _Abutilon indicum_ is pollinated mostly by honeybees, _Bembix_ wasps visited for nectar and pollen, while butterflies (_Pieris_, _Eurema_, _Anthocharis_, _Colotis_, “ _Lycaena_” [actually a Polyommatine blue resembling _Hemiargus_ based on the photo], and _Danaus_ regularly visited the flowers but butterflies are “merely visitors as not a single pollen grain was found on their body parts” (Abid et al. 2010).
Arabis stricta
Arabis pycnocarpa "hirsuta"
Arabis glabra
Arabis fendleri
Arabis divaricarpa
Alyssum saxatile
Alyssoides utriculata
Tilia europaea
Tilia americana
Tilia
Sphaeralcea coccinea
Sidalcea malvaeflora
Malva sylvestris

(Hibiscus syriacus is cultivated in Denver, but is shunned. In Illinois a specialist bee Pilothis bombiformis [Apoidea] visits only Hibiscus flowers including H. lasiocarpus, and resembles a bumblebee. Hummingbirds pollinate some Hibiscus, while bumblebees and anthophorid bees pollinate H. moscheutos [Snow et al. 1996].)

Malva neglecta pinkish-white: Chlosyne gorgone, Colias philodice, Pyrgus communis 3x. M. neglecta can self-pollinate, and its pollen easily becomes airborne and spreads. Honeybees pollinate some Malva spp., and solitary bees visit.

Malva sylvestris pink: Polites peckius.
Sidalcea malvaeflora purple: Pyrgus communis.
Sphaeralcea coccinea orange: Hemiarus isola, Pholisora catullus 3x, Pontia protodice, Pyrgus communis 3x, Strymon melinus. This is pollinated by the bumblebee Bombus huntii, Diadasia bees and honeybees in Utah.

Tilia trees are sometimes visited by large butterflies that often fly at tree height.

Tilia americana yellowish-cREAM: Asterocampa celtis jeffermont, Nymphalis antiopa, Polygonia interrogationis, Vanessa cardui, Epargyreus clarus 2x, Papilio glaucus rutulus 2x, Papilio multicaudata 2x, Vanessa atalanta 6x. 66 species in 29 families of insects were identified as pollinators of the tiny flowers (which are evidently partially wind-pollinated); bees and flies were the most common diurnal visitors and moths the primary nocturnal visitors (Anderson 1976). Honeybees make great honey from Tilia.

Tilia europaea ochre: Limenitis weidemeyerii, Nymphalis antiopa 4x, Papilio glaucus rutulus 3x, Papilio multicaudata 4x (two briefly when flowers old), Vanessa atalanta, Vanessa cardui 2x.

BRASSICACEAE=CRUCIFERAE (includes Cleomaceae Capparaceae and Tropaelolaceae)
Most genera are only slightly attractive to butterflies, although Barbarea is popular, Berteroa and Brassica and Raphanus are moderately popular, and Erysimum is very popular. Cleome (sometimes placed into Cleomaceae) is moderately popular. Brassicaceae in general are pollinated by bees flies butterflies moths and beetles seeking nectar (by birds or bats in some tropical Capparis [which is often placed in the family Capparaceae]) (Judd et al. 2008). Osmia bees are good pollinators. The bee Andrena arabis specializes on Brassicaceae.

Alyssoides utriculata light-yellow: Vanessa cardui.
Alyssum saxatile yellow Vanessa cardui 4x. Alyssum "Lobularia" maritimum (white to yellow pink violet purple) is pollinated by bees so much that plantings help pollination of adjacent fruit trees; and in summer it is pollinated by ants as much as by flying insects. Alyssum alyssoides mostly selfs.
Arabis divaricarpa blue: Hesperia uncas 2x.
Arabis fenderii: (blue 1x + pinkish-white 1x) Pontia sisyrbii.
Arabis glabra pink-purple: Pontia sisyrbii 4x, Euchloe auronides coloradensis.
Arabis glabra white: Euchloe auronides coloradensis 5x. A. glabra is pollinated by insects and self-pollination. The bee Andrena arabis visits the flowers.
Arabis pycnocarpa "hiruta" white: Pontia sisyrbii 2x.
Arabis stricta white: Euchloe auronides, Plebejus saepiolus.

Barbarea orthoceras yellow is popular: Aeglais milberti 9x, Amblyscirtes phylace, Argynnis (Speyeria) coronis, Callophryis dumetorum homoperplexa 3x, Callophryis eryphon 35x, Callophryis polios 2x, Celastrina humulus hop-ecotype 3x, Celastrina humulus lupine-ecotype 4x, Celastrina lucia sidara 14x, Chlosyne gorgone 12x, Coenonympha tullia 3x, Colias scudderii, Erebia epipodea 12x, Erynnis persius 4x, Erynnis telemachus 10x, Euchloe auronides 8x, Euchloe olympia, Glaucopsyche lygdamus 9x, Glaucopsyche piasus 5x, Hesperia juba 2x, Phyciodes coarya 2x, Phyciodes pallida 2x, Phyciodes pulchella camillus 13x, Pieris rapae 6x, Plebejus glandon, Plebejus melissa, Plebejus saepiolus, Polygonia faunus, Polygonia gracios zephyrus 4x, Polygonia satyrus, Pyrgus centaureae 2x, Thorybes pylades, Vanessa cardui 3x.
(Barbarea vulgaris is similar to B. orthoceras but is scarce in Colorado. It is pollinated by flies, bees, beetles, and self-pollination.)

Berteroa incana white is moderately popular: Argynnis (Speyeria) coronis snyderi, Coenonympha tullia california 2x, Euchloe auronides auronides 41x, Junonia coenia 119x, Lycaena xanthoides nigromaculata, Papilio zelicaon 2x, Plebejus acmon, Satyrium sylvius dryope. Brassicaceae similar to Brassica yellow: Satyrium auretorum. Bumblebees reportedly buzz-pollinate Brassica (including cultivated B. oleracea), and Osmia bees and honeybees and alfalfa leafcutter bees also pollinate it, even Calliphora flies less well. Bees and syrphid flies are important pollinators of Brassica napus (Willmer 2011).

Brassicaceae: Plebejus acmon.

Brassicaceae white: Glaucopsyche piasus.

Brassicaceae yellow: Argynnis (Speyeria) callippe 2x, Papilio zelicaon, Pontia sisybrii 3x. (Capsella bursa-pastoris has small white flowers and is unpopular, and has no visits. It is mostly self-pollinated.)

Cardamine cordifolia white: Argynnis (Speyeria) zerene 2x, Boloria eunomia, Boloria frigga 3x, Boloria titaia 4x (+ one only 3 sec), Euchloe auronides 2x, Pieris marginalis mcdunnoughii 2x.

Cardaria (Lepidium) latifolium white: Vanessa cardui. Cardaria draba is reportedly pollinated by bees and other insects, and by self-fertilization. (Cardaria chalepensis white is not visited. It often self-pollinates.)

Chorispora tenella purple-rose is common but unpopular: Euchloe olympia (pink flowers 4x, purple flowers 1x), Pontia protodice 2x.

Cleome lutea yellow: Amblyscirtes nysa, Battus philenor 2x, Papilio polyxenes. Honeybees help pollinate it. Cleome spp. are moderately popular.

Cleome (Peritoma) serrulata pinkish: Argynnis (Speyeria) aphrodite?, Argynnis (Speyeria) nokomis, Callophrys griseus siva, Cercyonis pega 2x, Chlosyne gorgone, Colias eurytheme, Colias philodice 2x, Danaus plexippus 2x, Hesperia ottoe Janet Chu, Hesperia pahaska 3x, Hesperia viridis, Limenitis archippus 2x, Lycaena rubidus, Neophasia menapia 3x, Oarisma garita, Papilio machaon bairdii 4x (+ pinkish 4x [incl. for form hollandi and f. brucei], whitish 1x), Papilio zelicaon (Scott and Scott 1978), Pholisora meijcanica briefly on, Pieris rapae, Polites sabuleti, Pontia beckerii, Pontia callidice occidentalis 2x, Pontia protodice 7x, Satyrium titus 2x, Vanessa cardui. This Cleome is pollinated by bees (Dodson and Dunmire 2007).

Descaria is unpopular.

Descaria pinnata yellow: Pontia protodice, Vanessa cardui.

Descaria sophia yellow: Hesperia pahaska.

Draba lanceolata white: Boloria freja.

Draba stenoloba? yellow: Euchloe auronides.

Draba yellow: Colias philodice, Cupido amyntula, Euchloe olympia.

Erysimum is popular:

Erysimum asperum yellow: Aglais milberti, Amblyscirtes aenus, Argynnis (Speyeria) callippe, Atrytonopsis hianna hianna 7x, Callophrys griseus siva, Chlosyne acastus arkanyon 4x, Chlosyne gorgone 2x, Colias alexandra, Colias edwardsii altiplano 4x, Colias philodice 2x, Erynnis brizo, Erynnis horatius, Euchloe olympia 10x, Euploea claudia 5x, Glaucopsyche lygdamus, Hesperia pahaska 10x, Hesperia uncas 4x, Notamblyscirtes simius 1x, Papilio indra 2x, Papilio polyxenes 2x, Papilio zelicaon, Phyciodes pulchella camillus, Plebejus melissa, Polites (Yvretta) rhesus 39x, Pontia protodice, Pyrgus communis 4x, Vanessa...
*Lobularia maritima* is pollinated by numerous insects (visited by more than 100 species in Spain), including bees, syrphid and other flies, beetles, ants, butterflies.

*Erysimum capitatum* usually orange sometimes yellow: *Argynnis (Speyeria) aphrodite* (yellow), *Argynnis (Speyeria) callippe* (yellow 2x, orange 9x), *Argynnis (Speyeria) coronis* (yellow 2x, orange 6x), *Argynnis (Speyeria) edwardsii* (yellow + 1 sec twice), *Argynnis (Speyeria) edwardsii* (16x + one red-orange), *Coenonympha tullia*, *Colias alexandra* 2x, *Colias eurytheme* (1 yellow, 2 orange), *Colias philodice* (yellow 1x, orange ½ sec. 2x), *Erynnis brizo* (orange–yellow), *Erynnis martialis* (orange 1x, yellow 2x), *Erynnis pacuvius* (yellow), *Erynnis persius*, *Erynnis telemachus* 2x, *Euchloe auronoides* 12x (orange except 1 yellow–orange and 1 yellow), *Euchloe olympia* (yellow) 6x, *Euchloe olympia* 3x, *Euphydryas anicia capella* (orange 5x, yellow 2x); *Euploiea claudia* (yellow, orange) 2x, *Hesperia juba*, *Hesperia nevada* (usually orange) 52x, *Papilio eurymedon* 4x (2 orange, 1 yellow), *Papilio indra* (orange 14x, yellow–orange 2x, yellow 4x), *Papilio multicaudata* 4x, *Papilio polyxenes* 8x, *Papilio zelicaon* (yellow 4x + 8x f. nitra), *Papilio zelicaon* (7x + 2x f. nitra), *Parnassius phoebus* (orangish-yellow) 3x, *Phyciodes cocyta*, *Phyciodes pulchella camillus*, *Poladryas minuta arachne* (1x + yellow 1x), *Polites draco* (yellow 1x, orange) 3x, *Polygonia gracilis zephyrus* (yellow), *Stinga morrisoni* (yellow), *Vanessa cardui* (orange 6x, yellow 3x).

*Hesperis matronalis* pink is not very popular in my back yard: *Papilio eurymedon*, *Papilio glaucus rutulus* 2x, *Papilio multicaudata* 21x (but 4 were only 1 sec. and two were 2 sec.), *Pieris rapae* 30x (+ several only 3 sec.), *Poanes taxiles*, *Polites peckius*, *Pontia protodice* 4x, *Strymon melinus* 1x (+another only 2 sec.), *Vanessa cardui* 4x. It is pollinated predominantly by bumblebees (*Bombus*) and honeybees and syrphid flies (80% of visitors in Pennsylvania and Ohio), with occasional visits by butterflies and crepuscular moths (Majetic et al. 2009) and is partially self-compatible. In Illinois it is visited by butterflies such as pierid and moths, syrphid flies (including long-proboscs *Rhingia*) and Soldier flies, halictid and andrenid bees, and honeybees (Hilty 2013; this site claims that butterflies and moths pollinate because other insects have mouthparts that are too short so they are attracted to pollen [but pollen visitors surely pollinate also]).

*Hesperis matronalis* var. *alba* white: *Argynnis (Speyeria) edwardsii*, *Epargyreus clarus*.

*Lepidium campestre* white is very common but is seldom visited: *Euchloe olympia*, *Glacocysychae lygdamus*, *Pieris rapae* 4x, *Pontia protodice* 5x, *Vanessa virginiensis*. This species mainly self-pollinates, but occasionally is pollinated by flies. *Lepidium meyenii* also self-pollinates. *Lepidium papilliferum* is visited by 25 insect families of 5 orders, and the most likely pollinators are bees (*Apidae*, *Colletidae*, *Halictidae*).

*Lepidium eastwoodiae* white: *Hesperia uncas tompich* ½ sec.

*Lepidium montanum* white: *Chlosyne gorgone*, *Neophasia menapia*, *Pieris rapae*, *Pontia protodice* 2x incl. “*Lepidium* white tall”.

*Lepidium ?ramosisissimum* white: *Pieris rapae*.

*Lepidium virginicum* white: *Lycaena helloides* 6x, *Pieris rapae*.

Lesquerella yellow: *Callophrys sheridani paradoxa*. Lesquerella is pollinated most commonly by bees and flies (Rollins and Shaw 1973).


Lesquerella parvula yellow: *Euphydryas editha*.

*Lobularia maritima* “blue Alyssum”: *Pyrgus communis*. This *Lobularia* is visited by 50 species of insects, especially ants (*Camponotus micans* and three other sp., *Formicidae*) that pollinated the flowers just as much as all winged insects put together, and bees (*Halictidae*, *Eumenidae*) wasps (*Tenthredinidae*, *Hymenoptera*).
Vespidae, Ichneumonidae, Chalcididae), flies (11 families), lycaenid butterflies, beetles (7 families), but the flowers visited only by winged visitors set no more seed than self pollination (Gomez 2000). mustard (usually white tiny flowers): Aglais milberti, Celastrina lucia sidara “mustard” Janet Chu, Glaucopsyche lygdamus white and yellow Janet Chu, Nymphalis antiopa, Polygonia gracilis zephyrus, Polygonia satyrus.

Nasturtium officinale white is only slightly popular: Adopaeoides prittwitzii many, Cercyonis pegala Janet Chu, Chlosyne leanira julvia, Euphydryas chalcedona mcglyshani-wheeleri, Lethe eurydice, Pieris rapae 2x, Piruna pirus, Vanessa cardui. Reportedly pollinated by bees (including honeybees), flies, and self-pollination.

Physaria vitulifera yellow: Erynnis persius, Euchloe olympia, Glaucopsyche lygdamus 2x. Physaria filiformis pollen carriers were 38 species of bees (Andrenidae [Andrena 8 sp.], Apidae [honeybees, Bombus griseocollis, Ceratina 5 sp.], Colletidae [Hylaeus 4 sp.], Halictidae [Agapostemon texanus, Augochlora 3 sp., Augochloropsis fulgida, Halictus 3 sp., Lasiosglossum 11 sp.], Megachilidae [Osmia 2 sp, Hoplistis simplex]), several syrphid flies and a calliphorid fly, Lepidoptera (the butterflies Callophrys “Mitoura” gryneus, Junonia coenia, the diurnal moth Alypia octomaculata) while mordellid beetles that visited had no pollen (Edens-Meier et al 2011). Physaria obcordata visitors are generalist insects including Tachinid flies (Gonio), but the primary visitors are ground-nesting solitary bees (Andrenidae and Halictidae), and only two bee species were likely mustard specialists.

(Polanisia dodecandra) whitish: I have not seen enough Polanisia to assess its popularity, but it is reported to be popular in south Texas, where it is pollinated by bees and butterflies and visited by many species of butterflies.)

Raphanus sativus bluish-white is moderately popular: Copaeodes aurantiaca 3x, Erynnis tristis tatus, Euchloe ausonides ausonides 26x, Eurema necippe, Junonia coenia 3x, Neophasia menapia, Papilio zelicaon, Pieris rapae 6x, Pontia callidice occidentalis, Pyrgus (communis?) albescens, Vanessa cardui common, Vanessa carvey 2x, Vanessa virginiensis 2x. Many insects visit the flowers of this (including its wild weedy progenitor Raphanus variety “rhapistrum”), but Lathri and Barrows (1984) found Pieris rapae butterflies transported pollen of Raphanus enough to evidently pollinate it, and Kay (1976) found that Pieris and Erystalis flies pollinated it sometimes and preferred yellow flowers (rather than white or pink or bronze flowers) (honeybees were the major pollinators with 90% of the visits, and honeybees preferred yellow or white flowers, while syrphid flies preferred pink ones, Stanton 1987). Raphanus “rhapistrum” is pollinated by Pieris rapae, honeybees, many small solitary bees and syrphid flies (Koelling and Karoly 2007).

Rorippa sinuata yellow: Argynnis (Speyeria) edwardsii, Colias philodice 2x, Hemiargus isola, Phyciodes pulchella camillus, Plebejus melissa, Pyrgus communis 2x, Vanessa atalanta 2x, Vanessa cardui 2x. Rorippa palustris is pollinated by tiny flower flies in Finland.

Schoenocrambe linifolia yellow: Callophrys gryneus siva, Chlosyne acastus arkanyon 18x.

Sisymbrium altissimum yellow: Cercyonis oetus, Colias alexandra, Oarisma garita, Phyciodes pallida, Pieris rapae 7x, Pyrgus communis. This is pollinated by insects.

Thlaspi is very common but not very popular.

Thlaspi arvense white: Callophrys dumetorum homoperplexa landed 2x but I didn’t see proboscis, Callophrys augustinus, Callophrys sheridanii 2x, Erynnis afranius, Erynnis pacuvius, Erynnis persius 4x, Euchloe ausonides, Euchloe olympia 6x, Glaucopsyche lygdamus 17x, Hemiargus isola 10x, Pieris rapae, Pontia sissymbrii 18x, Vanessa cardui 4x.

Thlaspi (Noccaea) fendleri “montanum” white: Callophrys eryphon, Callophrys sheridanii 4x, Celastrina lucia sidara 3x, Chlosyne gorgone, Cupido amyntula, Erynnis persius, Euphydryas anicia brucei 2x, Euptoieta claudia, Glaucopsyche lygdamus 2x, Phyciodes pulchella camillus, Polygonia gracilis zephyrus, Pontia sissymbrii 5x, Vanessa atalanta, Vanessa cardui. The similar Thlaspi “alpestre” [true alpestre is European] is pollinated by bees and flies, and self-pollination. In the Colorado alpine zone, Thlaspi montanum “alpestre” pollen-carrying visitors were the chrysolinelid beetle Phyllotreta albionica most often, the ant Formica neorufibaris often, the muscid fly Quadraria laetifica sometimes, and...
other insects sometimes, and it often self-pollinates (Petersen, 1977); elsewhere bees and flies reportedly pollinate it and it selfs.

(Tropaeolum majus [sometimes placed in Tropaeolaceae] is a garden plant with pretty flowers of all colors, but I have seen no butterflies on it. It is pollinated by hummingbirds in native habitats. The sphingid moth Hyles lineata visits it. Tropaeolum tricolor is pollinated by the hummingbird Sephanoides sephanoides in Chile.)

SANTALACEAE (includes Viscaceae)
This family of mostly parasitic plants is mostly shunned by butterflies.

(Arceuthobium are probably shunned by butterflies as they have ugly tiny flowers. Penfield et al. [1976] found that pollination is done both by insects and wind; they found 200 sp. of insects bearing Arceuthobium pollen, the principle pollinators being the ant Formica fusca for Arceuthobium americanum, and an encrytid wasp Copidosoma bakeri for Arceuthobium cryptopodium and A. cyanocarpum.)

Comandra umbellata whitish is common but unpopular: Erynnis persius, Callophrys dumerorum homoperplexa 2x, Callophrys gryneus siva, Euptoteta claudia 2x, Phyciodes pulchella camillus. It is pollinated by long- and short-tongued bees, and by Diptera.

Phoradendron flowers are also tiny and ugly yet Bright and Ogard (2010) observed Atlides halesus feed on them in Alabama. Phoradendron serotinum is pollinated by wasps bees and possibly ants. Phoradendron leucarpum nectar is used by bees, and the flowers are also pollinated by ants flies and beetles.

TAMARICACEAE
Tamarix chinensis=ramosissima pink (some rosy-white) is very popular where it occurs along drainages in S and W Colo: Cercoyonis pegala 30x, Danaus gilippus, Epargyreus clarus, Hesperia uncas, Limenitis archippus, Lycaena heteroea, Satyrium acadica. The flowers have nectar, and bloom for months, and are pollinated by bees (it makes good honeybee honey) and other insects and Lepidopera (butterflies evidently).

POLYGONACEAE
Eriogonum species are popular. They attract many butterfly species, and are almost the sole adult foods of Euphilotes species and Apodemia “mormo” species whose larvae feed only on Eriogonum (Plebejus acmon and P. alupini larvae mostly eat Eriogonum but adults visit many flowers). Eriogonum, Fagopyrum, and Polygonum have exposed floral nectaries that are easily accessible. Polygonum is moderately popular. Rheum and Rumex have inconspicuous wind-pollinated flowers that are shunned. Polygonaceae in general are pollinated by insects especially bees and flies, while Rumex is wind-pollinated (Judd et al. 2008).

(Eriogonum kennedyi is reportedly usually pollinated by bees, and flies wasps and butterflies also carry a few grains of pollen. Eriogonum pelophilum is visited by over 50 insect species, mostly native bees, and 18 native ants.)

Eriogonum (bluish-gray with no or small leaves, bushy 1.5’ tall) white: Apodemia mormo mormo, Euphilotes rita emmeli.

Eriogonum alatum has tiny yellowish flowers that are not popular: Strymon melinus (ovipositing?).

Eriogonum annuum whitish: Plebejus alupini texanus 2x.

Eriogonum brevicaule yellow: Argynnis (Speyeria) zerene, Hesperia comma 3x, Plebejus alupini texanus, Plebejus melissa, Pyrgus communis.

Eriogonum compositum cream “dense Eriogonum vaguely like effusum”: Apodemia mormo mormo 11x, Argynnis (Speyeria) zerene picta, Coenonympha tullia ampelos few, Heliopetes ericetorum 3x, Hesperia comma, Hesperia juba.

Eriogonum corymbosum var. velutinum whitish: Hemiaragus isola, Plebejus alupini texanus, Strymon melinus, Euphilotes battoides (ellisii) anasazi many. Reportedly pollinated by bees.
Eriogonum corymbosum var. orbiculatum white: Apodemia mormo mormo 12x.
Eriogonum corymbosum whitish: Euphilotes battoides ellisi many.
Eriogonum effusum white: Argynnus (Speyeria) aphrodite, Argynnus (Speyeria) edwardsii, Cercyonis pegala 2x, Chlosyne gorgone, Colias eurytheme, Colias philodice, Cupido amyntula, Euphilotes rita coloradensis 30x, Euptoieta claudia 2x, Hesperia comma 8x, Hesperia leonardus pawnee raiting=perching?, Phyciodes pulchella camillus 3x, Plebejus alupini texanus 59x, Plebejus icarioides, Plebejus melissa 5x, Poladryas minuta arachne, Pontia protodice, Pyrgus communis, Satyrium saepium, Strymon melinus 17x.
Eriogonum fasciculatum var. polifolium whitish: Euphilotes bernardino martini many. This is pollinated by honeybees and many species of small native bees, flies, wasps, and beetles.
Eriogonum flavum var. chloranthum cream: Plebejus alupini cotundra, Plebejus shasta pitkinensis, Strymon melinus.
Eriogonum flavum (= E. jamesii var. flavescens) yellow: Apodemia nais 2x, Argynnus (Speyeria) aphrodite, Argynnus (Speyeria) callippe 20x, Argynnus (Speyeria) hesperis 8x, Asterocampa celtis jeffermont, Atrytone arogos, Callaphrys dumetorum homoperplexa, Callaphrys gryneus siva 2x, Cercyonis oetus 21x, Chlosyne gorgone 2x, Euphilotes ancilla barnesi 2x, Euphydryas anicia capella 3x, Euptoieta claudia 3x, Hesperia comma 3x, Hesperia pahaska, Lycaena heteroea 29x, Neominois ridingsii 2x, Ochlopes sylvanoides, Papilio polyxenes, Parnassius phoebus smintheus, Phyciodes pulchella camillus 2x, Plebejus alupini lutzi, Plebejus melissa, Plebejus shasta minnehaha 3x, Polygonia gracilis zephyrus, Satyrium behrii 8x, Satyrini californica, Satyrium saepium 55x, Satyrium titus 16x, Strymon melinus 9x.
Eriogonum heermannii var. humiliss white: Euphilotes battoides (ellisi) basinensis 2x.
Eriogonum incanum yellow: Euphilotes enoptes enoptes.
Eriogonum jamesii cream: Apodemia mormo pueblo ~49x, Euphilotes glaucon centralis 24x, Euphilotes spaldingi pinjuna, Lycaena arota 97x, Paratrytone snowi 4x, Plebejus alupini ?texanus, Satyrium behrii, Satyrini californica, Strymon melinus, Vanessa cardui.
Eriogonum kearneyi var. kearneyi whitish: Euphilotes rita pallescens.
Eriogonum latifolium whitish: Apodemia mormo langei, Euphilotes enoptes bayensis abundant, Hylephila phyleus, Junonia coenia 16x, Lerodea eufala, Papilio zelicaon, Plebejus acmon 12x, Strymon melinus 4x.
Eriogonum leptocladon: Euphilotes rita emmeli (var. leptocladon yellow many visits, var. ramosissimum white several).
Eriogonum leptophyllum whitish: Hesperia viridis.
Eriogonum like E. shockleyi 1” cream balls with gray spoonlike leaves: Euphilotes glaucon.
Eriogonum lobbii var. robustius cream: Aglais milberti, Argynnus (Speyeria) callippe nevadensis, Argynnus (Speyeria) zerene malcolmii, Callaphrys eryphon, Colias alexandra, Cupido amyntula, Euphilotes ancilla gilvatunica, Hesperia comma abundant, Plebejus acmon many, Plebejus icarioides, Satyrium behrii several, Satyrini californica.
Eriogonum lonchophyllum var. lonchophyllum whitish/cream: Apodemia mormo mormo many, Hesperia nevada, Hesperia unca tomichi 22x, Neominois ridingsii 6x, Papilio glaucus rutulus, Plebejus alupini texanus 2x, Pontia beckerii 10x, Satyrium behrii 2x, Strymon melinus 2x.
Eriogonum marifolium yellow: Plebejus alupini alupini, Vanessa cardui.
Eriogonum nudum yellowish: Euphilotes enoptes enoptes 12x.
Eriogonum ~nudum ~yellowish ½ m tall: Euphilotes battoides intermedia many, Plebejus alupini alupini many.
Eriogonum ovalifolium var. ovalifolium pinkish or cream: Callaphrys gryneus siva, Euphilotes ancilla stanfordorum 6x.
Eriogonum racemosum cream: Euphilotes spaldingi pinjuna.
Eriogonum subalpinum [pinkish]-cream is very popular: Argynnus (Speyeria) callippe 4x, Argynnus (Speyeria) callippe calgariana, Argynnus (Speyeria) mormonia, Argynnus (Speyeria) zerene platina, Cercyonis oetus, Callaphrys dumetorum affinis 2x, Callaphrys spinetorum 3x, Chlosyne palla flavula, Coenonympha tullia, Erebia epipodea 4x, Euphilotes ancilla ancilla 5x, Euphilotes ancilla barnesi 5x, Euphydryas bernadetta dorina 2x, Euphydryas editha lehmani, Hesperia nevada 3x, Lycaena florus 9x.
Boloria frigga

5x

Boloria eunomia

9x

Boloria eurytheme

12 minutes,

Polygonia gracilis zephyrus

12 minutes,

Polygonia gracilis zephyrus

9x

Euphydryas helioidea

12 minutes,

Euphydryas helioidea

9x

Euphydryas boehmii

12 minutes,

Euphydryas boehmii

9x

Euphydryas boehmii

11x

Euphydryas boehmii

12 minutes,

Euphydryas boehmii

9x

Euphydryas boehmii

11x

Euphydryas boehmii

12 minutes,

Euphydryas boehmii

9x

Euphydryas boehmii

11x

Euphydryas boehmii

12 minutes,

Euphydryas boehmii

9x

Euphydryas boehmii

11x

Euphydryas boehmii

12 minutes,

Euphydryas boehmii

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Euphydryas boehmii

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Euphydryas boehmii

12 minutes,

Euphydryas boehmii

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Euphydryas boehmii

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Euphydryas boehmii

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Euphydryas boehmii

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Euphydryas boehmii

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Euphydryas boehmii

12 minutes,

Euphydryas boehmii

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Euphydryas boehmii

11x

Euphydryas boehmii

12 minutes,

Euphydryas boehmii

9x

Euphydryas boehmii

11x

Euphydryas boehmii

12 minutes,
Lychnis coronaria (Polygonum [Bistorta] viviparum) has tiny white flowers and is not visited. In North America and Colorado it reproduces only by bulbils (bulblets growing within the inflorescence) because the fertilization process is defective and embryos abort (Diggle et al. 2002.)

(Rheum rhaponticum [rhubarb] has tiny ugly wind-pollinated flowers [with no records, although a visit by Celastrina –neglecta is recorded in eastern U.S.], although Calliphora blowflies are sometimes used to pollinate it in greenhouses.)

(Rumex spp. have inconspicuous ugly wind-pollinated flowers that are not visited.)

**PLUMBAGINACEAE**

*Ceratostigma plumbaginoides* violet. I have seen very few bushy plants in gardens, but they were popular: *Poanes taxiles* 2x, *Polites peckius*, *Vanessa cardui* 2x.

*Limonium latifolium* (which looks like a wispy *Eriogonum*) violet-blue tiny flowers in gardens are popular for tiny lycaenids: *Hemiarus isola* 6x, *Pontia protodice*. This is pollinated by bees (*Bombus terrestris*, *B. hortorum*, and *Melitiea reptus*) and probably tiny parasitoid wasps. Elsewhere, *Limonium vulgare* is self-pollinated, and sometimes pollinated by bees (including bumblebees *Bombus lucorum* and *B. lapidarius*) and flies; *Limonium otolepis* primary pollinators are bees and hoverflies (Huang et al. 2012).

**CARYOPHYLLACEAE** (includes Alsinaceae)

In general these plants are not popular, but *Cerastium* and *Silene* are fairly popular, cultivated *Lychnis* is visited by some Hesperiinae, and *Arenaria (Eremogone)* has some visits. Caryophyllaceae in general are pollinated by insects (flies, bees, butterflies, moths) (Judd et al. 2008).

*Arenaria (Eremogone)* fendleri white: *Argynnis (Speyeria) mormonia*, *Oeneis polixenes*, *Parnassius phoebus smintheus* 2x. *Arenaria uniflora* and *A. glabra* have nectar-rich flowers that are pollinated by generalist flies (Syrphidae, Bombyliidae), small bees (Halictidae) and honeybees, and *A. uniflora* self-pollinates where it overlaps the range of *A. glabra* (Fishman and Wyatt 1999).


*Dianthus barbatus* is not popular: *Papilio multicaudata* (orange flower), *Poanes taxiles* (orange), *Papilio polyxenes* (red flowers 3x), *Vanessa cardui* (red flower). *Dianthus* have a leathery calyx to prevent nectar-robbery by hole-chewing. Some *Dianthus* are reportedly pollinated by butterflies (and honeybees): *Dianthus carthusianorum* red is pollinated by the butterflies *Satyrs ferula* and *Melanargia galathea*, also by *Ochloides venatus*, *Thymelicus* and other butterflies and zygaenid and sphingid moths (Bloch et al. 2006); *Dianthus deltoides* red is pollinated by butterflies (Jennersten 1984) including *Ochloides venatus*, *Thymelicus lineola*, and also by syrphid flies. Elsewhere, *Dianthus sylvestris* is pollinated by nocturnal moths (*Hadena compta* primarily, whose caterpillars eat the seeds), and also by the sphingid moth *Herse convolvuli*, *Macroglossum stellatarum* bees, and syrphid flies. *Dianthus gratianopolitanus* is pollinated mainly by the sphingid *Macroglossum stellatum* in Europe (Erhardt 1990).

*Dianthus* “Pink Delight” pink: *Vanessa carye*.

(*Gypsophila paniculata* white is uncommon but I have seen no visits [*Polites* ignore it, etc.]. It is visited by numerous small insects and predominantly pollinated by bees and flies (Darwent and Corpland 1966.)

*Lychnis coronaria* red is not very attractive though *Polites peckius* visits it somewhat: *Papilio multicaudata* 3x (all 1 sec., not very attractive in scent or nectar evidently), *Poanes taxiles* 4x, *Polites peckius* 12x, *Polites themistocles*. (This is visited by bees, flies, butterflies, and moths, and mosquitoes etc. and at least the bees surely pollinate it. *Lychnis flos-cuculi* is pollinated by *Bombus lapidarius*, also by *Rhingia*
campestris and the noctuid moth Hadena bicurris, and is visited occasionally by the butterfly Pieris napi. Aphids pollinate some Lychnis spp.)

(Paronychia pulvinata and P. jamesii have tiny yellowish flowers and have no records. Paronychia pulvinata is an alpine cushion plant that in the Cascade Mts. is pollinated by ants [Formica neorufibarbis gelida] that harvest nectar and lipids and pollinate on 45% of their visits [Puterbaugh 1998]. Other Paronychia spp. are visited by Dialictus bees (P. chartacea by D. miniatus, D. nymphalis, and D. placidentis; Paronychia herniarioides by D. nymphalis; Paronychia americana by D. nymphalis and D. placidentis).)

Pseudostellaria “Stellaria” jamesiana white: Erynnis persius, Erynnis telemachus.

Saponaria officinalis pinkish (white to pink) is not popular: Papilio multicaudata 4x (one on var. caucasica).

This is pollinated at night primarily by the noctuid moth Autographa gamma, also by the noctuid Hadena bicurris; its nectar production is greatest at night and it gets few daytime visits. But Autogramma is a very ineffective pollinator, and up to 5% of visitors were sphingid moths which produced higher seed set (Wolff et al. 2006).

Silene acaulis pink/purplish is moderately popular: Boloria improba acrocnema 3x (Scott 1982), Boloria improba harryi 4x, Chlosyne whitneyi damaetas 4x, Erebia magdalena 11x, Euphydryas anicia brucei 3x, Vanessa cardui 19x. This is an alpine/arctic plant, which is pollinated also by bumblebees Bombus lapidarius, butterflies, flies, moths and beetles. Andersson (2006) noted it is butterfly pollinated in northern Sweden, and noted other reports of pollination by bumblebees and flies. There is considerable research on pollination of other Silene (see Kephart et al. 2005). Several showier Silene such as Silene virginica are pollinated by hummingbirds (Grant 1994), many are pollinated by bumblebees (sometimes honeybees), several are pollinated by flies, and several by selfing. And the night-bloomer Silene latifolia is mostly pollinated by the noctuid moth Hadena bicurris (whose caterpillars eat the seeds of S. latifolia) and by sphingid moths and the geometrid moth Perizoma (S. vulgaris and S. alba are similarly pollinated, and Silene alba is also pollinated some by bees flies wasps until flowers close in midmorning).

Silene armeria pink: Poanes taxiles 1x.

(Stellaria spp. are evidently not popular [I have no certain records because most or all of what I identified long ago as Stellaria was actually Cerastium strictum]. The lawn weed Stellaria media white attracts andrenid and halictid bees, syrphid and muscid and sarcophagid and anthomyiid flies, and it can self-pollinate [Hilty 2013]. Stellaria pubera in North Carolina is usually visited by Bombus major flies, and often by anthophorid bees [Nomada] and andrenid bees [Andrena nigrihirta and A. erigeniae], and seldom by other bees and flies and skippers and the butterflies Celastrina neglecta [called “argiulus”] and Pieris protodice [misidentified as “Euchloe creusa lotta”] [Campbell 1985].)

AMARANTHACEAE (includes Chenopodiaceae)

The native genera such as Amaranthus weeds and Froelichia are not visited and are wind-pollinated, but the cultivated Gomphrena is moderately popular. The common plants formerly placed into Chenopodiaceae (Salsola, Atriplex, Suaeda, Chenopodium weeds and shrubs) have tiny ugly wind-pollinated flowers that are rarely visited by butterflies (oddly Gillespie and Wratten noticed 28 visits of Lycaena salustius butterflies on Chenopodium sp. in New Zealand [New Zealand lacked a typical pollinator fauna so dozens of bees were introduced there to pollinate crops and fruits]). The edible greens Beta vulgaris [swiss chard and beets] and Spinacia oleracea [spinach] are similarly wind-pollinated, though thrips can transfer Beta pollen. Amaranthaceae in general is pollinated by wind [most of them] or insects [Gomphrena evidently] (Judd et al. 2008).

(Amaranthus graecizans, A. retroflexus etc. have tiny flowers and are not visited. Amaranthus palmeri is usually wind-pollinated, but also pollinated by the solitary bee Melissodea thelypodii [Cane 1992]).

(Celosia argentea [orange etc.] did not attract any Polistes themistocles.)

Gomphrena globosa purple or bright purplish-crimson is moderately popular: Hylephila phyleus, Polistes peckius 13x (prefers Gomphrena over Salvia), Polistes themistocles 35x, Pyrgus communis, Vanessa cardui some.
AIZOACEAE
The prostrate cultivated garden flowers are rarely visited. The family in general has showy flowers visited by bees, wasps, butterflies, flies, and beetles (Judd et al. 2008).

*Aptenia cordifolia* purple-pink: *Pyrgus communis*. Pollinated by honeybees.

*Delosperma ~cooperti* yellow: *Papilio multicaudata*.

~*Melephora crocea* yellow: *Pontio protodice*.

SARCOBATACEAE
(I have no records for wind-pollinated *Sarcobatus* weeds.)

NYCTAGINACEAE
These are rarely visited. Nyctaginaceae in general are pollinated by bees, butterflies, moths, and birds, for a nectar reward (Judd et al. 2008).

*Abronia elliptica* white: *Pontio protodice*.

*Abronia fragrans* whitish: *Strymon melinus*. Its fragrance is strong at night when it is pollinated by moths such as *Nycterophyta luna* (Keeler and Fredericks 1979).

*Mirabilis multiflora* purplish-pink: *Hesperia pahaska*. This is pollinated by sphingid moths (*Hyles lineata* and *Mandaca quinquemaculata* [with a proboscis 11-12 cm long], and sometimes by *Sphing chersis* (S. Hodges). *Mirabilis longiflora* is also pollinated by *M. quinquemaculata* (Grant and Grant 1983).

*Mirabilis jalapa* is pollinated by sphingid moths in late afternoon-evening, and can self-pollinate (Martinez and Burquez 1986); the red flowers appear dark late in the day but the corolla base appears yellow (the pollen absorbs ultraviolet and fluoresces blue, which would evidently not occur at night when uv is minimal). *Mirabilis macfarlaneti* pink in Idaho-Oregon is pollinated by solitary bees and *Bombus fervidus*.

(Mirabilis [Oxybapus] pink has no records. *Oxybapus* is pollinated by bees and hummingbirds and self-pollination.)

MOLLUGINACEAE
(Mollugo verticillata is a prostrate weed with tiny white flowers, but is too uncommon for me to determine if butterflies visit it. It is reported to be pollinated by selfing and insects.)

PORTULACACEAE
Cultivated *Portulaca* has pretty flowers of many colors that are not visited, and butterflies ignore small *Portulaca oleracea* weeds, but *Claytonia* is pretty and moderately popular, and *Calyptridium* is showy and very popular. Portulacaceae in general are pollinated by bees, flies, beetles, and butterflies, and the flowers are open only a short time (Judd et al. 2008).


*Claytonia rosea* pinkish-white: *Calliphrys sheridani* 5x, *Celastrina humulus* lupine-ecotype, *Erynnis persius*, *Erynnis telemachus*, *Pontia sisybrii*. In eastern U.S. it is visited by *Erynnis icelus*, *E. brizio*, *E. juvelalis*, *Pyrgus centaureae*, *Anchocharis midea*, *Anaea andria*, *Aglaist milberti*, and *Glaucocephyl us lygdamus*. *Claytonia virginica* is pollinated usually by the solitary bee *Andrena erigeniae* (a specialist on *C. virginica*), and frequently by the bee fly *Bomblylus major* which visits many different flowers (Motten et al. 1981).
(Phemeranthus [formerly Talinum] parviflorus pink is too uncommon to observe much and has no records. Several Phemeranthus are reportedly pollinated by selfing and by insects, and P. calycina is supposedly attractive to honeybees and butterflies.)

(Portulaca grandiflora has pretty red yellow to white flowers but is shunned.)

(Portulaca oleracea is a superabundant prostrate weed with tiny yellow flowers but is shunned. It usually self-pollinates but is sometimes visited by bees and other insects [the pollen is too sticky to be wind-pollinated] [Miyajima 2006].)

CACTACEAE

Cactus flowers—at least Opuntia—are popular with some Hesperiinae skippers that have a long proboscis to get through the forest of stamens, including Notamblyscirtes which often crawl right in among the stamens! Cactaceae in general are pollinated by various insects (bees, flies, sphingid moths), birds, and bats (Judd et al. 2008). The giant Saguaro and Cardon cacti in SW U.S. are pollinated by bats, but apparently none are pollinated by bats in Colorado. Echinocereus triglochidiatus is pollinated by hummingbirds (Grant 1994). Barrel cactus Ferocactus wislizenii is pollinated by four generalist bees and two specialist bees that visit only that cactus, and is visited by other bees and flies (Mcintosh 2005).

Coryphantha vivipara purple: Papilio zelicaon f. nitra.

Opuntia (Cylindropuntia) imbricata purplish: Satyrum titus.

Opuntia macrorhiza yellow: Hesperia uncas, Hesperia viridis, Notamblyscirtes simius 26x. The similar species Opuntia humifusa is pollinated by the cactus-specialist bee Lithurgus gibbosus in Florida (Archbold Biol. Station research). Diadasia and Lithurgis bees may have evolved with Opuntia. In Texas, Opuntia macrocentra is pollinated by Diadasia rinconis (Apoidae), Lithurgis littoralis, Ashmeadiella opuntiae (Megachilidae) (all three bees specialize on Cactaceae pollen), and Melissodea tritis (Apoidae), while secondary pollinators are Apis mellifera, LasioGLOSSUM (DiaLICTUS) pruinosisformis, and LasioGLOSSUM spp. (Halictidae) (these other bees visit many different flowers); numerous Carpophilous beetles eat the floral parts and mate but do not pollinate, and ants collect pollen but do not pollinate (Pendley 2002). In Florida, Opuntia humifusa is visited by 16 species of bees (Deyrum et al. 2002).

Opuntia phaeacantha yellow: Hesperia viridis 2x.

Opuntia polyacantha yellow: Callophrys gryneus siva, Hesperia pahaska 45x, Hesperia pahaska martini 1x, Hesperia uncas 8x, Hesperia viridis, Notamblyscirtes simius (adults crawl into and almost disappear among the stamens! [and evidently pollinate the flowers], where many small beetles also occur) 77x (Opuntia polyacantha purple had no visits), Polistes (Yvretta) rhesus, StINGA morrisoni 3x. This is self-compatible, unlike O. phaeacantha. Both are pollinated by medium to large bees of genera Diadasia, Lithurgis, Melissodea, Bombus, Agapostemon, and Megachile in southern Colorado (Osborn et al. 1988).

CORNACEAE

Cornaceae in general is pollinated by bees flies and beetles (by wind in Davidia) (Judd et al. 2008).

Cornus sericea=stolonifera white is unpopular: Celastrina neglecta 5x, Vanessa atalanta 2x. It is pollinated by long-tongued and short-tongued bees including bumblebees and solitary bees and the specialist pollinator Andrena fragilis (that visits only Cornus) (Hilty 2013), and probably sometimes by visiting wasps flies beetles and butterflies. Several other Andrena bees specialize on Cornus.

HYDRANGEACEAE

Beautiful cultivated Hydrangea and Philadelphus are rarely visited, but native Jamesia is very popular. Hydrangeaceae in general produce nectar and are pollinated by insects (butterflies, moths, flies, bees, wasps, beetles) (Judd et al. 2008).

(Hydrangea spp. purple/pink/blue/white are showy and planted in some Denver yards, but are not visited.)

Jamesia americana white is very popular: Aglais milberti 3x, Amblyscirtes vialis, Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) callippe 10x, Argynnis (Speyeria) coronis 4x, Argynnis (Speyeria) edwardsii 10x incl. Janet Chu, Argynnis (Speyeria) hesperis 3x, Asterocampa celtis jeffermont often,
Calophrys dumetorum homoperplexa, Calophrys gryneus siva 8x, Celastrina humulus hop-ecotype 6x, Celastrina lucia sidara 24x, Chlosyne gorgone, Chlosyne nycteis 2x incl. Janet Chu, Chlosyne palla calydon, Epargyreus clarus, Erebia epipodea, Erynnis martialis, Erynnis pacuvius, Erynnis persius 4x, Euphydryas anicia capella 15x, Euphyes vestris, Glaucopsyche piasus, Hesperia pahaska, Limenitis weidemeyerii 3x, Oeneis chryxus, Papilio eurymedon 8x, Papilio glaucus rutulus, Papilio indra 22x, Papilio multicaudata, Papilio zelicaon 4x, Parnassius phoebus smintheus, Piruna pirus, Plebejus saepiolus, Poanes taxiles 3x, Polistes themistocles, Polygonia gracilis zephyrus, Thorybes pylades, Vanessa atalanta 4x, Vanessa cardui 11x.

**Philadelphus lemoinei** (=Mock Orange) white is not very popular: *Epargyreus clarus, Papilio glaucus rutulus 2x, Papilio multicaudata.* It can self-pollinate. *Philadelphus pubescens* reportedly attracts pollinators including bees butterflies and hummingbirds. In Maryland the megachilid bee *Chelostoma philadelphi* is a specialist on *Philadelphus* (Sedivy et al. 2008).

**LOASACEAE**

*Mentzelia* are common and have beautiful pale flowers but only open toward evening and are rarely visited by butterflies. Loasaceae in general are pollinated by bees wasps flies butterflies hawkmoths hummiringbirds and rodents seeking nectar and/or pollen (Judd et al. 2008). Several bees specialize on Loasaceae in Chile and Argentina.

*Mentzelia* ~yellow: *Satyrium californica.* *Mentzelia decapetala* and *M. laevicaulis* are reportedly pollinated at night by moths and other insects. But *M. oligospora* is pollinated by bees by day (early morning?) and moths at night, which may be the usual pattern. But *M. nuda* has nectar to attract bees (Keeler 1981) and *M. multiflora* is reportedly pollinated by bees. *M. involucrata* has nectar that attracts *Xeralticth* bees, and is mimicked by another plant *Mohavea confertiflora* that lacks nectar and mimics *M. involucrata* (Little 1983).

**BALSAMINACEAE**

(*Impatiens capensis* orange is common in S Minnesota marsh edges but butterflies do not visit it. However in eastern U.S. it is sometimes visited by longer-proboscs butterflies *Papilio troilus* (frequently), *Zerene cesonia,* and *Euphyes conspicua.* *Impatiens capensis* is pollinated by bumblebees *Bombus vagans* and *B. fervidus* and other *Bombus,* by honeybees that rob nectar but still pollinate as well as bumblebees, and sometimes by wasps *Vespula maculifrons,* and hummingbirds [Rust 1977, 1979; Young et al. 2007].

Hummingbirds often visit it. *Impatiens trichocarpa* is pollinated in India usually by honeybees (*Apis florea, indica, dorsata*), also by hawk moths *Macroglossum variegatum,* butterflies (*Pachlioptera aristolochiae, Euploea core* and *Papilio demoleus*), and *Chrysomya megacephala* flies [Kulloli and Sreekala 2009]. *Impatiens cuspidata* in India is pollinated by *Apis cerana* and *Trigona* bees, by *Macroglossum variegatum* and *M. corythus* hawk moths, butterflies, and flies which are poor pollinators [Sreekala et al. 2011]. *Impatiens glandulifera* is pollinated by bumblebees in Britain [Proctor et al. 1996].)

**POLEMONIACEAE**

These flowers are pretty but frequently too long for the butterfly proboscis and are not popular (including cultivated *Eryngium, Polemonium*). But *Phlox* with shorter corollas are still not popular, though some *Phlox* elsewhere are reportedly moderately popular. Polemoniaceae in general attract bees flies beetles butterflies and moths (Judd et al. 2008).

*Gilia pinnatifida* white: *Epargyreus clarus.* (*Gilia subnuda* is pollinated by hummingbirds [Grant 1994].) (*Gilia* scarlet had no butterfly visits in several days, including no visits by *Polistes peckius* or *P. themistocles.*

Red *Gilia* are mostly pollinated by hummingbirds.)

*Ipomopsis* are not very popular, and the flowers are too long. Cary et al. (2011) claim that *Ipomopsis sancti-spiritus* is pollinated by the butterfly *Paratrytone snowi* in New Mexico.

*Ipomopsis aggregata collina* [not *Gilia texana*] red: *Paratrytone snowi.* This is pollinated by hummingbirds (Bauer 1983, Grant 1994). In Colorado it is pollinated mainly by Broad-tailed and Rufous Hummingbirds
because they are the most common visitors, but in some years by bumblebees (superior pollinators when they are present), solitary bees, syrphid flies, long-tongued sphingid moths, and Swallowtail butterflies can be important pollinators (Mayfield et al. 2001; Campbell et al. 1991, Snow et al. 1996).

*Ipomopsis globularis* purplish-white: *Euphydryas anicia brucei.*

*Ipomopsis rubra* “Fuchsia Gilia” red: *Papilio multicaudata* (Jean Morgan photo).

(Polemonium spp blueish are fairly common in higher mountains but I have no records. *Polemonium brandegeei* blue and another sp. are pollinated by hummingbirds [Grant 1994] at least in part. *P. viscosum* is pollinated by Muscid flies, solitary bees, syrphid flies, and bumblebees *Bombus* (in declining importance) in krummholz (upper limit of trees) while *Bombus* is the major pollinator and the others are much less important on alpine tundra (Galen 1996). *Polemonium foliosissimum* is frequently visited and presumably pollinated by *Bombus flavifrons* and less often by *B. bifarius* (Pleasants 1983). The bee *Andrena polemonii* specializes on *Polemonium reptans.*)

*Phlox hoodii canescens* white with yellow centers: *Calliphrys gryneus siva,* *Polites* (*Yvretta*) *rhesus* 2x, *Strymon melinus.*

*Phlox longifolia* lavender: *Pontia beckerii.*

*Phlox multiflora* [white-pink-blue]: *Boloria improba acrocnema* (Scott 1982). Some *Phlox* are butterfly pollinated (Reddi and Bai 1984).

*Phlox paniculata* pink: *Papilio glaucus glaucus* (This Old House TV show); *Papilio multicaudata* 2x incl. var. Brigadier 5 min. (even stopped wings from fluttering). *Danaus plexippus* 5x (+2x on white flowers).

*Phlox paniculata* and *P. drummondii* are pollinated by butterflies and moths (Grant and Grant 1965; Levin 1985).

*Phlox pilosa* ~pinkish: *Ancyloxypha numitor* 3x (and male 2 sec and 2 sec). *Colias eurytheme,* *Colias philodice?,* *Danaus plexippus,* *Vanessa cardui.* *Phlox pilosa* and *P. glaberrima* place pollen on different places on *Colias* butterflies that pollinate them (Levin and Berube 1972).

*Phlox subulata* var. *nelsonii* pink: *Vanessa cardui.*

*Phlox* white: *Poanes taxiles* 2 sec.

**PRIMULACEAE**

Primulaceae (*Androsace, Dodecatheon, Primula*) are unpopular. Primulaceae in general are pollinated by various insects, and *Dodecatheon* are “buzz-pollinated” (Judd et al. 2008).

(*Androsace septentrionalis* has tiny white flowers and is very common in montane Colorado but is shunned. It is pollinated by flies in Finland.)

(*Dodecatheon* has no records. *Dodecatheon pulchellum* is pollinated by bumblebees (Dodson and Dunmire 2007). *Dodecatheon meadia,* *D. amethystinum,* and *D. conjugens* are buzz-pollinated by worker bumblebees elsewhere in North America for tiny 12.5μm pollen that they shake out of the anthers with 400Hz buzzing [Harder and Barclay 1994]. Some showy species are reportedly buzz-pollinated by bumblebees.)

(*Lysimachia nummularia* is a pretty yellow flower but prefers shade in towns and I have no records on it. In Wisconsin the bee *Macropis nuda* specializes on *Lysimachia* pollen and even has a parasitic bee *Epeoloides pilusula* that lays an egg in its nests [Alan Barbian, www.fs.fed.us]. The *Macropis steironematis* bee also specializes on *Lysimachia.* The European *Lysimachia punctata* is pollinated by the specialist bee *Macropis fulvipes,* and has a parasitic bee *Epeoloides coecutiens* that lays an egg in its nests [Dotterl 2008]; the European *Hoplitis adunca* bee also specializes on *Lysimachia.*)

Primrose small violet: *Euptoieta claudia,* *Junonia coenia,* *Junonia evarete nigrosuffusa.*

(*Primula parryi* reddish-pink and *P. angustifolia* pink are locally common in the alpine zone but are shunned. *P. parryi* is pollinated by bumblebees *Bombus* [predominantly *B. balteatus*], and sometimes by hummingbirds; *P. angustifolia* has the same but fewer pollinators [Miller et al. 1994].)

**ERICACEAE**

*Arctostaphylos* is moderately popular, but most genera are not popular and I have no records for *Vaccinium* or *Gaultheria.* *Pyrola* and *Chimaphila* etc. (often placed in Pyrolaceae) have flowers pointed
downward and are not visited by butterflies. Ericaceae in general have nectar and are pollinated by bees and wasps (Rhododendron has pollen tetrads that are pulled out of the anther by pollinators) (Judd et al. 2008).

Arctostaphylos (manzanita) pink/white: Callophrys mossii windi. A. pringlei and A. glandulosa are pollinated by bees and flies in California (Fulton and Carpenter 1979). They are reportedly “buzz pollinated” by bees. In Ariz. Arctostaphylos pungens is mostly visited by 10 bees and 2 flies: it is mostly pollinated by Osmia ribifloris (Megachilidae) bees, half as often by Eucera bees, and 1/5 as often by Lasiglossum bees (which buzz-pollinate the flowers), and honeybees pollinate sometimes; Bombylus bee flies are common but poor pollinators, Volucella aida flower flies and Melissodea and Anthophora bees are good pollinators but seldom visit, while Halictus, Nomadia, and Augochlorella bees and small butterflies mostly rob nectar and are less common so seldom pollinate (Nomadia are 100% robbers, while all the others can sometimes pollinate); Anna’s Hummingbirds visit sometimes and wreck the flowers while eating thrips (Richardson and Bronstein 2012).

Arctostaphylos uva-ursi whitish: Aglais milberti 3x, Callophrys augustinus augustinus 21x. Callophrys eryphon 5x, Callophrys polios 18x, Callophrys sheridani lembari, Callophrys spinetorum 2x incl. Janet Chu, Celastrina lucia sidara 10x, Erynnis brizo burgessi, Erynnis pacuvius, Erynnis persius, Polygonia faunus, Polygonia gracilis zephyrus, Stingen morrisoni, Vanessa cardui. There is little information about its pollination, but it is buzz-pollinated by bumblebees for pollen (Willmer 2011; captive bumblebees often visit it, Internicola and Harder 2012), and it can self-pollinate because shrinking corollas press stamens against style; butterfly pollination is evidently possible but probably infrequent. Thrips do 20% of pollination in SW Europe (Garcia-Fayos and Goldarazena 2008) but thrips are not found in Norwegian plants.

Kalmar polifolia pink: Pyrgus centaureae 3x. Bumblebees are effective pollinators.
(Linnaea borealis) whitish is uncommon and I have no records. The flowers rarely self and are mostly pollinated by bees (Bombus) bumblebees, megachild bees [Osmia spp.], halictid bees [three Lasiglossum spp.], colletid species [Hylaeeus spp.], plus two sphecid wasps, sawflies, five syrphid flies, Bombyliid, muscid, and fanniid flies, and occasionally by the staphylinid beetle Eusphalerum and the skipper butterfly Euphides vestris [Hilty 2013].

Rhododendron (Azalea) yellow to red: Part I and Bright and Ogard (2010) note visits in hotter regions than Colorado by the very large butterflies Papilio glaucus glaucus on yellow flowers 5x, P. polyxenes 3x on yellow, P. troilus on orange-red, P. palamedes, P. cresphonotes, Battus philenor, Phoebis sennae 4x on red to white. Rhododendrons are cultivated and scarce in Colorado. Rhododendron (Azalea) is pollinated by insects especially bumblebees and honeybees, while in mountain areas where bees are scarce ants may be primary pollinators. Beetles flies and butterflies also visit and may occasionally pollinate.
(Vaccinium is common in Colorado but the three species V. cespitosum, V. myrtillus oreophilum, and V. scoparium have 3-mm white-to-rose flowers that are not visited by butterflies. Vaccinium [blueberries and cranberries] are reportedly “buzz pollinated” by bees. In Europe, Vaccinium myrtillus is buzz-pollinated by bumblebees, but the smaller species usually self-pollinate [Proctor et al. 1996] which may apply to all three small Colorado Vaccinium listed above including V. myrtillus oreophilum. Elsewhere the Vaccinium are larger: Vaccinium macrocarpon cranberries are pollinated by bumblebees, honeybees [but honeybees cannot buzz-pollinate so Willmer (2011) states they are useless for blueberries and cranberries], and andrenid, halictid, and megachild bees. The Anthophora plumipes bee was imported to pollinate native blueberries [Cane 2003]. The anthophorid bee Habropoda laboriana visits mostly Vaccinium ashei and V. corymbosum in SE U.S., and occasionally visits Gelsemium, Quercus, and Cercis; these bees and Bombus bumblebees buzz-pollinate the Vaccinium [Cane and Payne 1988]; V. ashei is pollinated by honeybees [?], Osmia ribifloris bees, and H. laboriana [Sampson and Cane 2000]. The bee Melitta americana collects pollen from Vaccinium stamineum [Hilty 2013], the Andrena carolina bee is a specialist on Vaccinium blueberries, and the Osmia ribifloris bee pollinates some blueberries. Vaccinium viitis-idea is pollinated by various insects.)

BORAGINACEAE (includes some “Hydrophyllaceae”)

129
Lithospermum multiflorum
Lappula redowskii
Hydrophyllum fendleri
Heliotropium curassavicum
Hackelia floribunda
Eriodictyon
Eriodictyon californicum
Cryptantha
Cryptantha virgata
Cryptantha minima
Cryptantha jamesii
Cryptantha thyrsiflora

Anchusa azurea blue is scarce in Denver but moderately popular: Pieris rapae, Vanessa cardui. Anchusa is pollinated by bees.

(Borago officinalis blue-purplish has few local plants, and I have seen no visits. It is pollinated by honeybees who gather nectar, and by bumblebees that gather nectar and pollen and “buzz pollinate” it to shake out pollen while grabbing toothlike appendages on stamens and the scales [staminodes] with their legs.)

Cryptantha is moderately popular. megachilid bees in the Hoplites proteriades group visit Cryptantha flowers almost exclusively.

Cryptantha –thyrsiflora white: Piruna pirus.
Cryptantha fendleri white: Apodemia mormo pueblo.

Cryptantha jamesii white: Callophrys dumetorum homoperplexa, Callophrys eryphon 2x, Callophrys gryneus siva 12x, Coenonympha tulia, Euptoieta claudia 3x, Hesperia pahaska 13x, Hesperia uncas 4x, Hesperia viridis, Neominois ridesi, Lycaena arota 2x, Notamblyscirtes simius 15x, Paratyrtone snowi 1x, Phyciodes pulchella camillus, Poladryas minuta arachne 4x, Pontia protodice 8x, Pyrgus communis, Satyrium titus 2x.

Cryptantha minima white: Vanessa cardui 2x.

Cryptantha virgata white: Aglais milberti tall, Callophrys gryneus siva tall, Erebia epipodea, Erynnis persius, Euphydryas anicia capella 2x, Euptoieta claudia, Glaucopsyche piasus 2x, Hesperia nevada, Papilio indra, Pieris rapae 50 cm tall, Polites mystic 2x, Vanessa cardui 2x.

Cryptantha white: Callophrys gryneus nelsoni, Papilio zelicaon, Pontia beckerii.

(Cynoglossum officinale red-purple is uncommon and unpopular. It is reportedly pollinated by insects mainly bumblebees, also thrips, other bees, and butterflies, and can self-pollinate.)

Eriodictyon californicum white to lavender: Cercyonis shenele behrii [?Eriodictyon], Euphydryas editha editha 2x, Hesperia lindseyi several, Ochloides agricola, Satyrium saepium 2x, Satyrium tetra 2x.

Eriodictyon white to lavender is popular in California: Adelpha californica, Argynnis (Speyeria) callipe callipe, Chlosyne pallia palla, Euphydryas chalcedona chalcedona, Junonia coenia, Limenitis lorquinii, Lycaena gorgon, Papilio eurymedon, Papilio glaucus rutulus, Pieris rapae, Plebeius acmon.

Hackelia floribunda blue: Papilio indra, Phyciodes coca (bluish-white), Piruna pirus [?Hackelia floribunda 1m tall plant with tiny blue flowers], Polites mystic. Hackelia cronquisti is reportedly pollinated by bees and flies and can self-pollinate. Hackelia venusta is pollinated by Andrena nigrocaerulea bees, Protosmia rubifrons bees, and the fly Eulonchus (Recovery Plan for Hackelia venusta, www.fws.gov/pacific).

Heliotropium curassavicum “white-blue low scorpionid Borage”: Pyrgus scriptura. This is visited by bees and Lepidoptera.

Hydrophyllum fendleri white is unpopular: Vanessa atalanta. Hydrophyllum canadense is pollinated by bees (honeybees, Bombus pennsylvanicus, B. vagans, B. griseocollis, B. nevadensis, Osmia, Hoplitis, Anthophora), and flies also visit; the flowers can self-pollinate and they lack odor (Ramstetter and Popp 2001). The bee Andrena geranii specializes on Hydrophyllum.

Lappula redowskii has tiny light-blue flowers: Oarisma garita (bluish-white), Pholisora mejicanus, Pyrgus communis 9x.

Lithospermum multiflorum yellow is not popular: Argynnis (Speyeria) edwardsii, Poanes taxiles. But the butterfly Poanes hobomok reportedly is a common visitor to Lithospermum caroliniense yellow in Pennsylvania, and P. hobomok and the butterfly Plebeius meliss samuelis help pollinate it.
(Mertensia ciliata) is pollinated by bumblebees [Bauer 1983] as are other Mertensia [Macior 1978].
Mertensia brevistyla=fusiformis is pollinated by bumblebees, and by solitary Osmia bees [Forrest and Thomson 2010].

Mertensia alpina blue: Euphydryas anicia brucei 2x.
Mertensia lanceolata blue is common but only moderately popular: Amblyscirtes vialis 2x, Callophrys sheridani, Erynnis martialis 8x, Erynnis pacuvius, Erynnis persius, Erynnis telemachus 3x, Euchloe ausonides, Euchloe olympia, Glaucopsyche lygdamus 2x, Hemiarus isola flower that had lost its petals (intact flowers have petals too long for the short H. isola proboscis), Lycaena phlaeas arctodon, Pieris rapae, Plebejus icarioides, Poladryas minuta arachne, Vanessa cardui. The flowers are pollinated by bees (Dodson and Dunnire 2007).
Mertensia? blue: Pyrgus centaureae.
(Myosotis alpestris) blue is in some Denver gardens but I have no records, though it is reportedly pollinated by bees flies moths and butterflies. Most Myosotis are reportedly pollinated by flies and bees, and can self-pollinate. M. colensol can self but is primarily pollinated by a tachinid fly Protohystricia huttoni [Robertson 1989; Robertson and MacNair 1995].
(Nemophila menziesii) blue [formerly misplaced in Hydrophyllaceae]. I have seen no butterflies on the single local plant. This is pollinated by bees [90% of visitors], mainly honeybees and two bees Andrena macrocephala and A. crudeni that are apparently restricted to N. menziesii except when flowers are scarce, plus Andrena torulosa and megachilid bees; other Nemophila have megachilid bees and bijonid flies [Bibio spp.] as pollinators [Cruden 1972].
(Onosmodium occidentale) brownish-red is uncommon and shunned.
Phacelia heterophylla white to pinkish is very moderately popular: Callophrys dumetorum homoperplexa, Callophrys gryneus siva (white) 2x, Celastriina humulus hop-ecotype, Chlosyne gorgone (~pinkish) 2x, Erynnis persius 3x, Euphyses vestris 3x (usually purplish but one white), Glaucopsyche lygdamus, Glaucopsyche piasus 3x, Paratrytone snowi, Plebejus icarioides (white) 2x, Polites themistocles, Strymon melinus (~pinkish), Vanessa atalanta (white) probing with proboscis, Vanessa cardui (~pinkish). In California, several megachilid bees Chelostoma californicum and C. incisulum are specialists on Phacelia, and two others C. cockerelli and C. marginatum are specialists on Hydrophyllaceae (Sedivy et al. 2008). The bees Andrena lamelliterga and A. phaceliae and Proteriades specialize on Phacelia. Phacelia campanularia blue is pollinated by bumblebees Bombus terrestris and B. lucorum that eat only pollen, and syrphid flies (Episyrphus balteatus and Melanostoma scalare) and honeybees (Sutherland 2006).
Phacelia violet: Phyciodes orseis herlani.

RUBIACEAE
Rubiaceae in general may be pollinated by butterflies moths bees flies birds or bats all seeking nectar, though a few are wind-pollinated (Judd et al. 2008). The Colorado species are not popular, although Cephalanthus occidentalis is white is very popular in eastern U.S.
Bouvardia glaberrima a riparian shrub with red tubular flowers in S Ariz. is popular: Atrytonopsis cestus and Atrytonopsis ovinia edwardsi evidently on this flower, Papilio multicaudata. This is pollinated by hummingbirds (Grant 1994 etc.).
Galium is not popular: Galium species are pollinated by flies, small bees, beetles, and selfing. Galium septentrionale white: Argynnis (Speyeria) atlantis sorocco, Euphydryas anicia capella, Phyciodes pulchella camillus.
Galium ~triflorum whithish: Euphyses vestris.
Galium whitish: Lycaena nivalis, Lycaena flavus.

GENTIANACEAE
Gentianaceae such as Frasera and Gentiana and Pseumonanthe and Swertia are mostly shunned by butterflies. Judd et al. (2008) state that Gentianaceae in general are pollinated mainly by bees and butterflies seeking nectar, but butterflies shun them in Colorado. Gentiana with bell-shaped corollas are
pollinated by bumblebees (Proctor et al. 1996). Some South American species are pollinated by syrphid flies and bees, but most self-pollinate. (Frasera speciosa is shunned. Its large pale-green flowers bloom en-masse about every four years and are pollinated by a wide variety of insects [Beattie et al. 1973] including bumblebees and flies [Dodson and Dunmire 2007]).

Gentianella: *Callophrys gryneus nelsoni* (courting on flower, maybe nectaring first?). Gentianella acuta “amarella” blue: *Thorybes mexicana* 2x. The European Gentianella germanica is self-compatible but usually pollinated by Diptera and solitary bees. (Gentianopsis thermalis) bluish-purple is too uncommon for me to note any visits. It is pollinated by large insects [Dodson and Dunmire 2007]).

(Swertia perennis) blue is unpopular, with no records. Several *Swertia* spp. are known to be bee-pollinated. The Tibetan *Swertia przewalskii* is visited by a variety of insects but the most effective and common pollinators are bumblebees *Bombus keshimirensis* and honeybees [Duan and Liu 2003].

APOCYNACEAE (includes Asclepiaceae)

These are all enormously popular, except *Vinca*. Judd et al. (2008) note that frequent pollinators include various nectar-gathering insects (butterflies moths bees flies).


*Asclepias asperula* occidentalis purple: *Callophrys gryneus siva*, *Hesperia pahaska* (Scott 1973a).

*Asclepias hallii* white: *Hesperia nevada*, *Hesperia uncas tomichi* 5x, *Hesperia pahaska* 5x (purplish flowers).
Asclepias incarnata pink to rose-purple: Ancyloxypha numitor, Argynnis (Speyeria) cybele cybele, Atalopedes campestris, Colias eurytheme, Colias philodice 2x, Cupido comyntas 2x, Danaus gilippus 2x, Danaus plexippus, Euphyes bimacula, Euphyes conspicua 3x, Euphyes dion 6x, Euphyes vestris, Junonia coenia 2x, Lethe eurydice famosus 6x including pollinia on leg of 3 adults and pollinia on leg of 2 males (one had 3 pollinia on each middle leg) of A. incarnata or Asclepias syriaca, Limenitis archippus, Lycaena dione, Papilio glaucus glaucus 2x, Papilio glaucus rutulus 2x, Papilio multicaudata 3x, Papilio polyxenes 4x, Phyioedes tharsos tharsos, Poanes taxiles 2x, Poanes viator 51x, Pompeius verna, Satyrium calanus falacer, Vanessa cardui 15x.

Asclepias pink: Aguna asander (pollinia on leg, William McGuire), Callophrys augustinus, Callophrys spinetorum, Dione vanillae (pollinia on leg), Satyrium auretorum, Satyrium californica, Satyrium saepium, Satyrium sylvius.

Asclepias pumila: Atrytone arogos (white flowers 4x, whitish-green 1x), Hesperia ottoe (white flower), Strymon melinus (white flower).

Asclepias red: Calephelis rawsoni arizonensis.

Asclepias purple: Ochlodes yuma (Scott, Shields, and Ellis 1976).

Asclepias speciosa pink: Adelpha californica, Amblyscirtes eos, Argynnis (Speyeria) aphrodite 4x (one has pollinia on leg), Argynnis (Speyeria) cybele cybele pollinia on leg, Argynnis (Speyeria) hesperis pollinia on leg, Atalopedes campestris 2x, Atrytone arogos ~22x, Callophrys gryneus siva 3x, Cercyonis pegala, Colias philodice, Danaus plexippus 4x, Danaus plexippus 10x, Euphydryas anicia capella (2 pollinia on leg), Euphyes bimacula 13x (3 had pollinia on leg), Euphyes vestris 10x, Euptoieta claudia 1 sec. then 1 sec. (proboscis too short?), Hesperia lindseyi 3x, Hesperia ottoe 2x, Hesperia unca 2x, Hesperia viridis 2x (one has pollinia on leg), Lethe eurydice, Limenitis weidemeyerii many pollinia on leg, Lycaena aerota 2x, Lycaena dione 32x, Lycaena hyllus 9x (incl. pollinia on leg of 4x), Lycaena rubidus 5x, Nymphalis antiopa, Oarisma edwardsii 2x, Oarisma garita, Ochlodes sylvanoide, Papilio glaucus rutulus, Papilio glaucus rutulus 19x, Papilio machaon bairdii (f. bairdii 25x, f. brucei 4x), Papilio multicaudata 6x, Papilio polyxenes, Pieris rapae 2x (one had pollinia on leg and the other was dead caught by proboscis with 4 pollinia on legs), Pirana pirus 2x, Plebejus acmon, Poanes taxiles 2x, Poladrays minuta arachne, Polites mystic 16x (two of these had pollinia on leg; a female was caught between corona and petals by her proboscis), Polites origenes (leg had two pollinia), Polites themistocles 2x (one caught between corona and petals by proboscis, another had pollinia on leg), Pontia protodice, Satyrium acadica 27x, Satyrium behrii 3x, Satyrium behrii behrii some, Satyrium californica many, Satyrium liparops pollinia on leg, Satyrium saepium 2x, Satyrium sylvius 24x incl. female captured by flower, Satyrium sylvius sylvius, Satyrium tetra 2x, Satyrium titus 11x, Vanessa atalanta 2x, Vanessa cardui 2x.

Asclepias subverticillata white-cream: Callophrys eryphon, Ochlodes yuma.

Asclepias syriaca pink: Argynnis (Speyeria) cybele cybele 4x, Argynnis (Speyeria) idalia, Anatrytone logan logan 2 pollinia on legs of 2 adults, Ancyloxypha numitor, Atalopedes campestris, Atrytone arogos 2x, Boloria selene nebraskensis male has pollinia on leg, Callophrys gryneus gryneus, Colias eurytheme 2x, Danaus plexippus, Epargyreus clarus 2x, Euphyes bimacula 9x (one had pollinia on leg), Euphyes dion 4x, Euphyes vestris 13x, Lethe eurydice famosus 4x including male with pollinia on leg, Limenitis archippus, Nymphalis antiopa, Phyioedes tharsus tharsus pollinia on leg, Pieris rapae (had pollinia on leg), Poanes hobo (pollinia on leg, Poanes viator and 1 male pollinia on leg, Poanes viator (A. syriaca/ incarnata) pollinia on leg, Polistes origenes 3x (one leg had pollinia), Polygonia comma, Satyrium acadica, 2x, Satyrium calanus falacer pollinia on leg, Satyrium edwardsii ~7x, Satyrium liparops strigosus, Strymon melinus, Vanessa atalanta male had pollinia on leg. Asclepias syriaca (and A. incarnata and A. verticillata in the same area) are visited by many insects including bumblebees (Bombus 9 spp.), honeybees, wasps (Ammobia 2 sp., Bomhix spinolae, Polistes fuscatus, Tachytetes 2 sp., Vespuja 3 sp., Dolichevespula, Chlorion aerarium, Myzium quinguecinctum) (Macior 1965), and various butterflies are primary visitors in daytime, and moths are the primary nocturnal visitors; the flowers produce four times the amount of nectar at night as in daytime, yet nocturnal moths pollinated few flowers compared to diurnal bumblebees (Morse and Fritz 1983). Asclepias syriaca is pollinated mostly by Hymenoptera (bumblebees especially Bombus griseoecollis, honeybees, carpenter bees, Sphecidae and other wasps), and
sometimes by Lepidoptera (Theis et al. 2007). *A. syriaca* is sometimes butterfly-pollinated (Reddi and Bai 1984), but bumblebees are the main pollinators (Morse 1982).

*Asclepias tuberosa* orange is absent in N Colo., but is probably the most popular flower where it occurs eastward and southward (its common name Butterfly Milkweed is very appropriate): *Argynnis* (*Speyeria*) *aphrodite*, *Calephelis nemesis*, *Colias eurytheme*, *Danaus gilippus*, *Danaus plexippus*, *Polites mystic*, *Satyrium titus*, *Strymon melinus*.

*Asclepias verticillata* whitish: *Polites themistocles*.

*Vinca minor* blue mostly grows in shade, and is not popular: *Vanessa cardui*.

**OLEACEAE**

Oleaceae in general are pollinated by nectar-gathering bees butterflies and flies, and by wind in *Fraxinus* and *Foresteria* (Judd et al. 2008).

(*Fraxinus pennsylvanica* var. lanceolata is common but wind-pollinated and shunned.)

*Syringa reticulata* white: *Papilio glaucus* glaucus.

*Syringa vulgaris* pink-purple is not especially popular, except during migrations of *Vanessa cardui*: *Colias eurytheme*, *Papilio multicaudata* 3x, *Papilio polyxenes* 4x (one only 1 sec.), *Papilio zelicaon*, *Pieris rapae*, *Vanessa atalanta* 2x, *Vanessa cardui* 49x (+ one only 1 sec.) + white form alba 1x. *Syringa* is reportedly pollinated by bees and butterflies.

**PLANTAGINACEAE** (includes most “Scrophulariaceae”)

(Most of the former genera of Scrophulariaceae have been moved to Plantaginaceae.) Plantaginaceae in general are pollinated by nectar-gathering bees, flies and birds (Judd et al. 2008). Most Plantaginaceae are unpopular, except for *Penstemon* which is very popular especially for long-proboscs Hesperiinae.

*Antirrhinum majus* [many colors]: *Pyrgus communis* 2 sec. *Antirrhinum* is pollinated by bumblebees and honeybees.

*Antirrhinum majus* white: *Vanessa cardui* 4x.

*Antirrhinum majus* yellow: *Papilio multicaudata* 1 sec.

(*Besseya* is not popular. *Besseya bullii* is visited by many small insects, the most common being halictid bees [*Augochlorella striata* and *Dialictus* spp.], and it sometimes self-pollinates [McKone et al. 1995]).

*Collinsia parviflora* tiny 4 mm blue-white: *Pontia sisybrii*.

(*Digitalis* is in some gardens, but I have seen no visits. The purple or white flowers of *Digitalis purpurea* are pollinated by bumblebees in Washington [Best and Bierzychudek 1982].)

(*Hippuris* has vestigial flowers that are wind- and water-pollinated, so there are no records.)

*Linaria* is not popular, because it is too hard for butterflies to get into the flowers:

*Linaria canadensis* var. *texana* blue: *Strymon melinus*.

*Linaria genistifolia* dalmatica yellow but red at apex: *Colias philodice*, *Euptoieta claudia* ½ sec, *Hesperia paphaska*, *Ochlodes sylvanoides* (probed several times but did not succeed and flew), *Pieris rapae*.

*Linaria vulgaris* yellow with orange palate: *Colias eurytheme*, *Lycæa arota* 3x (one probed flower base 1-2 min.), *Strymon melinus* 15x by feeding through holes (made by *Bombus terrestris* bumblebees?) in spur (most flowers have such holes and one had 5 holes, a bumblebee fed out of same holes). *Linaria vulgaris* is reportedly pollinated by bumblebees and halictid bees; Proctor et al. (1996) note it is pollinated by strong bees (bumblebees and honeybees). Robertson (1929) found that bumblebees and other long-tongued bees, butterflies, and skippers visit the flowers, but only bumblebees are strong enough to push past the palate and enter the corolla throat, and butterflies and skippers are not effective pollinators.

*Penstemon* are popular mostly with skippers and *Papilio* which have long proboscis. In Arizona 80% of *Penstemon* species are bluish and are pollinated by bees (including honeybees, and some *Osmia* species rely heavily on *Penstemon* in montane western U.S.) and the wasp *Pseudomasar is vespoïdes* (other common visitors are *Megachile* bees, bumblebees [which often just visit for nectar, or chew a slit and steal the nectar, or buzz-pollinate to get pollen], the bees *Ceratina*, *Halictidae* [*Lasiosglossum*, *Dialictus*, *Halictus*, *Megalictus*], and *Hylaeeus*, long-tongued *Oligodranes* flies, and *Bombylius* flies, while hawkmoths *Hyles lineata* and syrphid flies [*Eulonchus*], and melyrid beetles and butterflies visit
sometimes but are not very effective pollinators); the few reddish species in Arizona are pollinated by hummingbirds and sometimes by bees (flies sometimes visit both kinds) (S. Kimball and P. Wilson 2009). Grant (1994) also notes that some Penstemon (usually red flowered) are pollinated by hummingbirds. Most of the pollen of Penstemon caryi is gathered by Anthophora ursina (Apidae) and the Penstemon specialist Osmia brevis (Megachilidae) which visits many Penstemon in western U.S. (Tepedino et al. 2011). The Osmia distincta bee mostly specializes on Penstemon. And the wasp Pseudomasaris occidentalis specializes on Penstemon and helps pollinate it. Penstemon confertus procerus is pollinated partially by bumblebees in Montana (Bauer 1983). Penstemon degeneri is pollinated by Bombus bumblebees and megachilid bees, and also Pseudomasaris vespoidea a wasp specialist on Penstemon (English et al. 2009). But butterflies often visit Penstemon:

Penstemon albidos white with violet guide lines: Hesperia uncas, Neominois ridingsii.

“Penstemon” ~albidus white: Atrytone aragost. 
Penstemon alpinus blue-purplish: Vanessa virginiensis.
Penstemon angustifolius blue: Erynnis persius. Papilio zelicaon, Polites (Yvretta) rhesus. 
Penstemon barbatus red: Phoebis sennae. Pollinated by hummingbirds (Dodson and Dunmire 2007, Grant 1994).

Penstemon blue: Amblyscirtes aenius, Atalopedes campestris (cultivated), Atrytonopsis hianna hianna, Paratrytone snowi.

Penstemon caespitosus blue: Paratrytone snowi 2x. 
Penstemon ~calycosus pink: Poanes taxiles 2x. 
Penstemon confertus procerus tiny blue flowers: Boloria bellona 6x, Oarisma garita. 
Penstemon cyathophorus pink-blue: Hesperia nevada.

Penstemon glaber deep blue or bluish-purple: Erynnis afranius. 
Penstemon griffonii blue: Paratrytone snowi 7x. 
Penstemon large purple: Paratrytone snowi 2x. 

Penstemon secundiflorus purple: Amblyscirtes simius 4x, Amblyscirtes vialis 5x, Argynnis (Speyeria) edwardsii, Atrytonopsis hianna hianna, Callophrys polios rear of flower, Epargyreus clarus, Euptoieta claudia ½ sec, Eurema mexicana, Hesperia pahaska 80x, Hesperia uncas, Hesperia viridis 2x, Notamblysphirtes simius 95x, Papilio eurymedon 4x, Papilio multicaudata 5x, Papilio polyxenes, Papilio zelicaon 3x, Phoebis sennae, Poanes taxiles 3x, Polites mystic 3x, Polites origenes 2x, Stinga morrisoni 11x, Vanessa cardui 6x. 

Penstemon strictus blue: Hesperia nevada, Pyrgus communis.

Penstemon virens blue is common but not very popular in part because it grows mostly in shade: Colias eurytheme 2x, Erynnis martialis, Erynnis persius, Euchloe olympia briefly, Euphyes vestris, Hesperia nevada, Oarisma garita 2x and another only ½ sec, Papilio eurymedon 6x, Papilio polyxenes 2x, Papilio zelicaon 25x, Oarisma edwardsii (P. virens?), Plebejus glandon, Poanes taxiles, Polites draco 2x, Polites mystic, Thoryx pylaeides, Vanessa cardui 2x.

Penstemon virgatus asagraysi lavender-purple: Hesperia comma, Hesperia pahaska 7x, Papilio multicaudata, Papilio polyxenes, Paratrytone snowi [not Penstemon secundiflorus] 96x, Poanes taxiles.

Plantago lanceolata white: Euchloe ausonides ausonides 15x, Junonia coenia 4x, Papilio zelicaon, Pieris rapae, Plebejus icarioides, Strymon melinus 2x. Plantago lanceolata and P. major have tiny wind-pollinated flowers, but are pollinated sometimes by honeybees in Australia. (Plantago major has tiny white wind-pollinated flowers, and has no records.) 

Veronica ~americana blue or nearly white: Polites themistocles only 1/3 sec., Pontia protodice, Pyrgus communis (on prostrate flower ½ sec.). Some Veronica spp. are pollinated by Syrphidae flies. Veronica catenata pale-blue or white: Callophrys grunneus siva, Euphyes vestris, Pieris rapae.

Veronica nutans blue: Plebejus saepiolus.

SCROPHULARIACEAE (now includes Buddleja; most previous genera are now placed in Plantaginaceae)
Scrophulariaceae are unpopular, except for Buddleja which is very popular (it was placed in Loganiaceae and later in Buddlejaceae). Scrophulariaceae in general are pollinated by a variety of nectar-gathering insects (Judd et al. 2008).

Buddleja davidii (pink to pink-purple to purple to violet) is very popular in towns: Argynnis (Speyeria) cybele cybele, Argynnis (Speyeria) Edwardssii, Chlosyne gorgone, Colias eurytheme, Danaus plexippus 7x, Limenitis weidemeyerii, Papilio multicaudata 2x, Papilio polyxenes, Pieris rapae 10x, Polistes peckius 27x, Polistes themistocles 2x, Strymon melinus 2x, Vanessa cardui 38x, Vanessa virginiensis. Buddleja davidii has fragrant nectariferous flowers that attract mainly butterfly visitors (Ebeling et al. 2012); Andersson (2003) studied those floral compounds in Buddleja that attract butterflies. Buddleja lindleyana often self-pollinates, while some South American species with long red flowers are pollinated by hummingbirds.

Buddleja davidii white is much less popular: Argynnis (Speyeria) aphrodite 3x, Argynnis (Speyeria) hesperis, Danaus plexippus 6x, Pieris rapae 2x, Vanessa atalanta, Vanessa cardui 61x.  

(Diascia ~rigescens [short spurs] pink is unpopular as no butterflies including no Polistes peckius or P. themistocles visited it in several days.)

Scrophularia macrantha red is unpopular: Papilio multicaudata. Scrophularia macrantha is pollinated by hummingbirds in its native range in New Mexico (Lightfoot and Sivinski 1994), while Scrophularia vernalis with yellow-green flowers and S. nodosa and S. umbrosa are primarily pollinated by wasps. British Scrophularia spp. including S. nodosa are pollinated by the wasp Vespuca germanica and V. vulgaris and honeybees (Proctor et al. 1996). Five Spanish Scrophularia are pollinated by bumblebees, wasps, and small bees.

Verbascum thapsus yellow is unpopular: Strymon melinus 2x, Vanessa cardui only \( \frac{1}{2} \) sec. Bumblebees are the most important pollinators; many insects visit the flowers including bees, halictid bees, syrphid and other flies, and butterflies, but only bees accomplish pollination; after one day the flowers self-pollinate.

PHRYMACEAE (Mimulus was in Scrophulariaceae)

Mimulus guttatus yellow with red spots: Callophrys gryneus nelsoni, Euphydryas editha rubicunda. M. guttatus is pollinated by bumblebees (Proctor et al. 1996; Dodson and Dunmire 2007), M. lewisi by bumblebees (Macior 1995), M. eastwoodiae and M. cardinalis red by hummingbirds (Grant 1994).

LAMIACEAE=LABIATAE

Many Lamiaceae genera are very popular; Monarda is one of the most popular flowers. Lamiaceae in general are pollinated by bees wasps butterflies moths flies beetles and birds (Judd et al. 2008).

Agastache rupestris red is not popular in cultivation: Pyrus communis 2x, Strymon melinus, (Polistes peckius and Polistes themistocles and other butterflies did not visit it during several days). It is pollinated by hummingbirds, bees, and other insects.

Agastache urticifolia mostly pinkish (white to rose to violet) is popular in western Colorado: Argynnis (Speyeria) atlantis sorocco, Argynnis (Speyeria) callippe 2x, Argynnis (Speyeria) cybele charlottii, Argynnis (Speyeria) egleis (on whitish flowers), Argynnis (Speyeria) hesperis electa, Argynnis (Speyeria) zerene 3x, Euphyes vestris, Papilio glaucus rutulus. (Agastache pallidiflora whitish is pollinated by bees [Dodson and Dunmire 2007] and honeybees).

Ajuga reptans blue: Vanessa cardui. This is pollinated by bumblebees and other long-tongued bees, sometimes by other insects. It is pollinated by bumblebees and Rhingia campestris hoverflies and Bombbylius bee flies in Europe (Proctor et al. 1996, who mistakenly list it as butterfly pollinated on their table 4.2).

Lamiaceae many undetermined species (Lamiaceae are popular, but microscope work is needed to identify most): Argynnis (Speyeria) callippe, Argynnis (Speyeria) callippe near-callippe, Argynnis (Speyeria) callippe stasha, Argynnis (Speyeria) coronis coronis, Argynnis (Speyeria) egleis near egleis, Argynnis (Speyeria) hesperis cottlei, Argynnis (Speyeria) hesperis irene, Argynnis (Speyeria) hydaspe near-rohodope some, Argynnis (Speyeria) zerene gunderi some, Argynnis (Speyeria) zerene near-zerene several, Cercyonis oetus oetus, Erynnis tristis tristis, Euphydryas chalcedona ~mcglashani, Euphydryas
Nepeta cataria, Monarda fistulosa, Mentha spicata, Marrubium vulgare, Lavandula angustifolia (Lamiaceae) Lamium amplexicaule, Polyxenes campestris (1978), Agastache h (pale violet, small).

Lamiaceae red: Dionys vanillae.
Lamiaceae purple: Polistes sonora sonora, Euphrydas chalcedona sierra.
Lamiaceae blue: Argynnis (Speyeria) nokomis, Codactactus valeriana small sp., Leptidea sinapis, Ochloides yuma.
Lamiaceae violet: Junonia coenia 2x, Lycaena hyllus (pale violet, small).

(Lamium amplexicaule) pink weeds are now superabundant in Denver but I have no records.
Lavandula angustifolia light-purple: Hemiargus isola 3x, Pieris rapae 13x, Poanes taxiles 3x (plus two only ½ sec.), Polistes peckius 3x, Pontia protodice, Vanessa cardui 2x. Honeybees pollinate it. Lavandula latifolia is pollinated by small bees and occasionally by flies and butterflies in Europe (Herrera 1987, whose visitors are copied on table 11.7 of Willmer 2011).

Marrubium vulgare cream is only moderately popular except Pieris rapae frequents it: Erynnis afranius, Euphyes vestris, Hesperia viridis, Pieris rapae 23x, Satyrium californica, Strymon melinus 2x. This is evidently pollinated mostly by bees; in Illinois it is visited by honeybees and the long-tongued bees Bombus (B. griseocallis, B. pensylvanica) and Anthophoridae (Ceratina dupla) and Megachilidae (Megachile brevis), short-tongued bees Halictidae (Nomia nortonii), bombyiidi flies (Bombylius atriceps), and butterflies (Pieris protodice) (Hilty 2013).

Mentha arvensis pink: Cercyonis oeetus 10x, Cercyonis pegala 4x, Lycaena helloides, Ochloides sylvanoides, Pieris rapae 4x, Plebejus icarioides, Polites mystic, Strymon melinus. Bees pollinate Mentha arvensis, Mentha pulegi (including honeybees), and Mentha Xipherita (butterflies may sometimes pollinate this also—Proctor et al. [1996 table 4.2] list Mentha with small tubular flowers as butterfly pollinated).

Mentha spicata pink utify, Plebejus icarioides [Mentha spicata or Nepeta cataria] white.

Monarda fistulosa rose-purple is very popular: Amblysicthes oeslari, Anatrytone logan lagus 23x, Argynnis (Speyeria) aphrodite 608x, Argynnis (Speyeria) atlantis sorocco, Argynnis (Speyeria) callippe 22x, Argynnis (Speyeria) coronis 5x, Argynnis (Speyeria) edwardsii 8x, Argynnis (Speyeria) hesperis 118x incl. Anne U. White and Janet Chu, Argynnis (Speyeria) hesperis near lurana several, Asterocampa celtis jeffermont 2x, Atrytone arogos 32x, Cercyonis oeetus (proboscis must be too small for this) only once, Cercyonis pegala 89x, Chlosyne gorgone, Epargyreus clarus 22x, Erynnis afranius, Euphyes vestris 106x incl. Anne U. White, Euphotoia claudia (hanging below flower maybe caught by predator), Hesperia ottoe 22x, Hesperia pahaska 4x, Hesperia uncas, Hesperia viridis 11x, Limenitis weidemeyerii 3x, Ochloides sylvanoides 6x [this flower blooms mostly earlier], Papilio multicauda, Papilio polyxenes 4x, Paratrytone snowi 40x, Parnassius phoebus smintheus, Phyciodes cocyta 2x, Pieris marginalis mcdunnoughii (for this Monarda?), Pieris rapae 1 sec. then flew, Piruna pirus 3x, Poanes taxiles 247x incl. Anne U. White and Janet Chu, Polites mystic 40x, Polites origenes 118x, Polites themistocles 2x, Polites vibex 2x, Polygonia interrogationis, Satyrium behrii 3x, Satyrium liparops 3x, Satyrium saepium 2x + 3x only 1-2 sec. (maybe proboscis too short), Satyrium titus 2x, Vanessa atalanta 4x, Vanessa cardui 12x, Vanessa virginiensis 2x. Internet search indicates that bees such as Bombus and Anthophora and others visit this species. Dodson and Dunmire 2007 wrote that long mouthparts are required to pollinate it, on some bees, moths, butterflies, and hummingbirds. Hummingbirds (Grant 1994) and honeybees also help pollinate it. The bee Dufourea monardae specializes on Monarda (and possibly Agastache).

Monarda fistulosa red cultivated var.: Poanes taxiles.
Monarda rose-purple: Argynnis (Speyeria) cybele leto, Aglais milberti, Papilio zelicaon (Scott and Scott 1978), Paratrytone snowi.

Nepeta cataria white is popular especially for Pieris rapae: Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) callippe, Argynnis (Speyeria) cybele charlottii, Argynnis (Speyeria) hesperis 12x, Atalopedes campestris, Cercyonis pegala 8x, Lycaena arota, Ochloides sylvanoides, Papilio glaucus rutulus, Papilio polyxenes, Pieris rapae 93x (+7x only a few sec. on old flowers lacking nectar), Polygonia
interrogationis, Pyrgus communis, Vanessa atalanta. The most important pollinators are honeybees, solitary halictid bees, and bumblebees, and it can self-pollinate (Sih and Baltus 1987).

Nepeta Xfaassenii=mussinii violet is fairly popular, often frequented Pieris rapae: Hemiargus isola 4x, Pieris rapae (blue 30x, pink-violet 29x, white 1x), Poanes taxiles 2x, Polites peckius 2x, Pontia protodice, Pyrge commons 7x, Vanessa cardui.

(Ocimum basilicum has tiny whitish flowers that are not visited. They are pollinated by bees.)

Origanum vulgare purplish-pink grew in my yard for a decade but is unpopular: Pieris rapae 4x. An internet photo shows Aglais urticae feeding on it in Britain. It is reportedly pollinated by bees including honeybees, moths, and butterflies.

Perovskia atriplicifolia blue (an Asian plant now abundant in gardens) is not very popular: Pieris rapae 4x, Hemiargus isola (Michael S. Fisher), Pyrgus communis 3x, Vanessa cardui, Vanessa carye likes it. (No butterflies and no Polites peckius or P. themistocles visited it in several days.) This is pollinated by bumblebees and honeybees.

Physostegia virginiana rosy-cream (sometimes white) is not popular: Polites peckius 1 visit to rosy-cream flower. No more visits by this or P. themistocles or other butterflies were seen in about 5 days.

Prunella vulgaris blue: Poanes taxiles. Reportedly pollinated by bumblebees Bombus vagans.

Pycnanthemum tenuifolium white is extremely popular in eastern U.S. (one of the most popular flowers studied by Robertson 1929): Junonia coenia. This is pollinated by honeybees. It is visited by many Hymenoptera and some Lepidoptera in New Jersey, most often by sweat bees Lasiosiglossum and Halictus which are probably the major pollinators there.

Salvia species are mostly pollinated by bees including honeybees (and some especially the shrubby-red flowered species by hummingbirds, Grant 1994). Salvia pratensis blue and S. glutinosa yellow are pollinated by bees in Europe (Proctor et al. 1996). In Britain cultivated red Salvia splendens are pollinated by bumblebees Bombus pascuorum and short-tongued bees that have to crawl down the long corolla; S. splendens is pollinated by hummingbirds in its native Brazil (Proctor et al. 1996).

Salvia sclarea pink has a powerful scent but is not popular: Papilio multicaudata 3x (but two only 1 sec. and several sec.), Pieris rapae (<1 sec.).

Salvia farinacea purple to seldom white is moderately popular: Colias eurytheme 2x, Euptoieta claudia, Polites peckius purple-blue 53x +violet-blue 13x +white 1x, Polites themistocles purple-blue 44x + white 4x (preferred over Gomphrena) (S. farinacea is not as popular as Verbena and Zinnia to both Polites), Vanessa cardui violet-blue “Blue Bedder”. This is pollinated by two species of stingless bees and by honeybees.

Salvia nemorosa “East Friesland” blue is moderately popular: Pieris rapae 3x, Polites peckius 8x, Pontia protodice, Vanessa cardui (“Mainacht” purple) 4x, Vanessa carye (“Mainacht” purple) 2x.

Salvia –officinalis blue: Polites themistocles 5x.

(Salvia “like Gilia” red had no visits by butterflies and no Polites peckius or P. themistocles during several days.)

Scutellaria brittonii deep-violet-blue is not very popular: Amblyscirtes vialis, Atrytonopsis hianna hianna, Papilio indra, Parnassius phoebus smintheus, Poanes taxiles, Polites (Yvretta) rhesus long time. Other Scutellaria spp. are reportedly pollinated by long-tongued bees (bumblebees and Anthophora ) and wasps; they are visited by short-tongued bees and syrphid flies and occasionally by butterflies but those are too small or weak to be effective pollinators.

Stachys olympica pinkish is unpopular: Pieris rapae ½ sec. (blue flower), Vanessa atalanta, Vanessa cardui. Stachys tenuifolia lavender is primarily pollinated by long-tonged bees for nectar, and short-tongued bees sometimes collect pollen, while flower flies feed on the pollen but are not very effective pollinators; occasional butterflies and skippers visit but are not very effective pollinators either (Hilty 2013). Stachys sylvatica is pollinated by Bombus pascuorum in Europe (Proctor et al. 1996). Three species of Stachys are pollinated by hummingbirds (Grant 1994).

Stachys palustris pink: Papilio polyxenes a little.

Teucrium chamaedrys red-purple is fairly popular: Atalopedes campestris 7x, Pieris rapae, Polites peckius 6x. This is pollinated by bees, and sometimes by self-pollination. Teucrium scorodonia is pollinated by
bumblebee Bombus lapidarius in Europe (Proctor et al. 1996, who mistakenly list it as butterfly pollinated on their table 4.2).

OROBANCHACEAE (includes many genera formerly placed in Scrophulariaceae, including Agalinis, Castilleja, Cordylanthus, Orthocarpus, Pedicularis)

These flowers are unpopular. The small parasitic Orobanche have Penstemon-like flowers that are often dull brown and are evidently rarely visited by butterflies. Castilleja are beautiful but are mostly shunned (and the colorful bracts are too large for the butterfly to get any nectar). Orobanchaceae in general are pollinated by bees wasps flies and birds (Judd et al. 2008).

(Agalinis tenuifolia had no visits on the few flowers I found in Wheatridge Colo.)

Castilleja integra crimson: Papilio machaon bairdii [briefly?], Papilio polyxenes 2x. Most Castilleja including this C. integra, C. affinis, C. chromosa, C. foliolosa, C. lanata, and C. miniata are pollinated by hummingbirds (Grant 1994). Elsewhere, Castilleja linariifolia is pollinated by hummingbirds, Castilleja pulchella by bumblebees (Bauer 1983), Castilleja sulphurea is regularly visited by bumblebees, a Peruvian Castilleja is pollinated by bees, and Castilleja cryptantha self-pollinates.

Castilleja rhexifolia lavender: Boloria eunomia ½ sec. This is pollinated by hummingbirds (Grant 1994) (Castilleja sessiliflora is common on the plains but is shunned. It is pollinated only by Bombus fervidus bumblebees in Wisconsin.)

(Orthocarpus luteus yellow: I have seen few flowers and no visits. Most Orthocarpus are pollinated by native bees and honeybees. But Orthocarpus campestris may self-pollinate, and O. pusillus resembles prostrate moss and is pollinated by ants.)

Pedicularis groenlandica reddish-purple to dark-rose is unpopular: Boloria frigga. Pedicularis is sometimes “buzz-pollinated” (Macior 1983). P. groenlandica and most other summer pinkish Pedicularis lack nectar and are pollinated by worker bumblebees (Dodson and Dunmire 2007, Macior 1978, 1995, Aluri and Robart 1991) and sometimes by cuckoo bees Psithyrus. But spring species with yellow flowers such as P. canadensis and P. palustris have nectar and are pollinated by queen bumblebees (Proctor et al. 1996), and Pedicularis procera has much nectar and is pollinated by hummingbirds and bumblebees (Macior 1995). Pedicularis densiflora is pollinated by hummingbirds (Grant 1994).


VERBENACEAE

Lantana and Verbena are very popular. Verbena spp. are some of the best butterfly-attracting flowers in Denver in late summer. Verbenaceae in general are pollinated by nectar-gathering bees wasps and flies (Judd et al. 2008).

Caryopteris clandonensis blue: Atalopedes campestris [on “Longwood Blue”], Pieris rapae 3x, [Polites peckius did not feed on it during several days]. This is sometimes visited by butterflies but is probably usually pollinated by the numerous honeybees and bumblebees that visit.

Lantana camara yellow (turning reddish with age): Amblyscirtes nysa, Copaeodes aurantiaca, Hylephila phyleus, Junonia evarete nigrosuifusa (~Lantana-type yellow flower with legume leaves), Lerodea eufala, Smyrnon bazochii common. Lantana is used in butterfly greenhouses, it is so popular. In the usual variety, only the yellow flowers have nectar, and they turn reddish and nectarless in three days. Butterflies are the main pollinators in America and India (Andersson 2006, Schemske 1976, Thakur and Mattu 2010) (Trigona fulviventris bees are nectar robbing, Barrows 1976), and most prefer the nectariferous yellow flowers (Dronamraju 1960) though some butterflies prefer orange. In Tanzania the flowers favor long-tongued insects, and butterflies are the most frequent pollinators (62%, compared to bees 14%, flies 7%, moths 7%, and others 10%) (Muthoka and Mananze 1976). Thrips pollinate L. camara regularly in India (Mohan Ram and Mathur 1984), and they also prefer the yellow flowers. In Australia it is pollinated by honeybees, and butterflies and moths visit it for nectar.

P. canadensis white: Phychiodes pulchella camillus 5x, Pyrgus communis 2x. Honeybees are the only major pollinators of Australian Lippia, and Mexican Lippia graveolens is evidently pollinated by
honeybees Apis mellifera and Apis mandacaia. Other Lippia are visited by a sphenid moth etc., and some can self-pollinate.

**Phyla=Lippia lanceolata** blush-white: Nathalis iole 4x.

**Verbena** is pollinated by honeybees, but is very popular with butterflies.

**Verbena bipinnatifida** purple to rosy to white: Polites peckius lavender 2x + purple 1x, Polites themistocles purple 5x + lavender 1x + rosy 4x + pink 1x + rosy-white 1x + white 1x.

**Verbena bracteata** blush-purple: Argynnis (Speyeria) edwardsii, Pholisora mejicanus 7x, Pieris rapae, Pyrgus communis, Pyrgus communis, Pyrgus scriptura.

**Verbena hastata** purplish-blue: Ancylonypha numitor 13x, Atalopedes campestris 15x, Boloria selene nebraskensis, Celastrina neglecta, Cercyonis pegala, Colias eurytheme 13x, Colias philodice 2x, Danaus plexippus 3x, Hylephila pyleus 5x, Lycaena dione, Lycaena hyllus, Nathalis iole, Ochloides sylvanooides 7x, Papilio glaucus rutulus, Papilio polyxenes, Phyciodes cocya, Phyciodes tharos orantain 2x, Pieris rapae 7x, Plebejus melissa, Polites peckius 3x, Poncia protodice, Pyrgus communis, Strymon melinus 2x. This is pollinated by long-tongued bees (esp. bumblebees) and short-tongued bees, Epoline cuckoo bees, Eucerine miner bees, halictid bees, the specialist Verbena Bee (Calliopepervenae); other visitors that may sometimes pollinate are a thread-waisted wasp, bee flies, thick-headed flies, the golden soldier beetle, and butterflies. It sometimes self-pollinates, and some other Verbena do so frequently. Other Verbena are visited by numerous pollinating bees, many flies, and some wasps and butterflies.

**Verbena Xhybrida** “Imagination” purple: Atalopedes campestris 18x, Pieris rapae 2x, Poanes taxiles 2x, Vanessa cardui 10x.

**Verbena nervosa** purple or purplish-blue: Phoebis sennae? 4x, Vanessa cardui 7x, Pyrgus communis (near-venosa, “Purple Top”), Vanessa cardui “Purple Top” 17x, Danaus plexippus “Purple Top”, Strymon melinus “Purple Top”.

**Verbena rigida** purple/bluish-purple: Polites peckius, Vanessa cardui.

**Verbena stricta** purplish-blue: Amblyscirtes vialis 4x, Anatryone logan logan, Argynnis (Speyeria) aphroditc 5x, Argynnis (Speyeria) coronis 3x, Argynnis (Speyeria) edwardsii 5x, Boloria selene sabulocollis, Cercyonis pegala, Colias philodice 7x, Erynnis afronius 2x, Euphyes vestris 13x, Euptoieta claudia, Papilio machaon brucei, Pieris rapae, Plebejus melissa, Poanes taxiles 3x, Polites origenes 12x, Polites peckius, Strymon melinus. Visited by numerous bees including bumblebees, the Verbena Bee (Calliopepervenae), flies, some wasps, and butterflies that may pollinate.


?Verbena tall 1m blue flower: Atalopedes campestris.

**BIGNONIACEAE**

Bignoniaceae in general are pollinated by bees, wasps, butterflies, hawk moths, birds, and bats (Judd et al. 2008). Colorado species are cultivated and are not visited.

(Catalpa bignonoides) trees have large very showy white flowers but are shunned and I have no records. However there are records of 4 Battus philenor visiting it in Iowa. Catalpa speciosa is reportedly pollinated by bumblebees [Bombus spp.], the large carpenter bee Xylocopa virginica, and various nocturnal moths [Geometridae, Ctenuchidae, Noctuidae, Lasiocampidae, Sphingidae], while other nectar-seeking visitors are honeybees, skipper butterflies, ants, and flies that are less effective at cross-pollination.

(Campsis radicans) red has no records, although Asterocampa clyton sucks nectar? from fallen flowers [Bright and Ogard 2010]. Their giant flowers are pollinated by hummingbirds.

**CONVOLVULACEAE** (includes Cuscucinaceae)
Convolvulaceae are unpopular flowers, including the cultivated *Ipomoea* etc., except some Hesperiinae skippers like *Convolvulus sepium*. Convolvulaceae in general are pollinated by various insects (Judd et al. 2008).

*Convolvulus* (*Calystegia*) *sepium angulata* white 4 cm flowers: *Poanes taxiles* 9x (5x crawled inside 5 cm corolla tube, and female crawled completely into flower and extended proboscis to feed); *Polites mystic* crawled into flower tube. Bright and Ogard (2010) have a photo of *Phoebis sennae* in the tube. This is pollinated by bees (including *Bombus pascuorum*) and hoverflies (and probably not by sphingid moths) in Europe (Baker 1957; Stace 1965). *Systropha* bees are known to use *Convolvulus* pollen.

*Convolvulus arvensis* whitish is very common but unpopular: *Colias eurytheme* 7x (plus 1 sec. for another and <1 sec. for 2x), *Colias philodice* 4x (+ briefly 3x so an unpopular flower), *Erynnis afranium*, *Euptoieta claudia* 3x (+ 2x briefly), *Oarisma garita* 2x, *Pieris rapae* 12x (+ one only 30 sec., one 6 sec., others 1 sec.), *Poanes taxiles* 2x, *Polites themistocles* 7x (another only 1 sec.), *Pontia protodice* 5x (3x only briefly), *Pyrgus communis* 3x, *Vanessa cardui* 2x. In Europe this is pollinated by various insects, primarily bees and a variety of flies (Proctor et al. 1996) including the syrphid fly *Rhingia*.

(*Cuscuta epithymum* pale-pink [formerly in Cuscutaceae] is uncommon, but I have never seen a butterfly on it. It is reportedly pollinated by ants, while bees, wasps and flies visit and could pollinate, and it self-pollinates.)

(*Ipomoea* has no records. Elsewhere, *Ipomoea coccinea* is pollinated by hummingbirds [Grant 1994], as are *I. quamoclit* and *I. hederifolia* even though 80% of visits are by Coliidae butterflies, which also make some visits to *I. hederacea* and *I. trichocarpa* which are pollinated by bees (Wolfe and Sowell 2006). *Melitoma* bees [Anthophoridae] [including *M. taurea*] and the bee *Cemolobus ipomoeae* are specialists and visit only *Ipomoea* flowers.)

**SOLANACEAE**

These flowers are showy but are usually shunned. Solanaceae in general are pollinated by bees wasps flies butterflies and moths; *Solanum* has no nectar and is pollinated by bees and flies seeking pollen (bumblebees can buzz-pollinate it); *Cestrum* and *Datura* have nectar and attract insects (Judd et al. 2008).

(*Capsicum frutescens* [conical chilies] have pretty whitish flowers but are not visited. It can self-pollinate, and is pollinated by 16 sp. of native bees in *Hyalaus* [Colletidae], *Dialictus, Halictus, Augochlora, Augochloropsis* and *Ceratalictus* [all Halictidae], *Exomalopsis* and *Bombus* [Apiidae], and no other insects visited [Raw 2000], while syrphid flies *Eristalis tenax, Bombus impatiens* bumblebees [which buzz-pollinate them], honeybees, *Osmia cornifrons* bees, *Melipona subnitida* bees, even thrips and ants sometimes, are known to pollinate elsewhere. *Capsicum chinense* [Habanero chilis] are pollinated by *Nannotrigona perlitamoides*.)

(*Datura stramonium* has giant white flowers that are shunned. *Datura meteloides* is visited by the sphingid moth *Manduca sexta* [Baker 1961], and *Datura wrightii* is claimed to be pollinated by moths.)

*Lycium barbarum halimifolium* violet is a popular flower elsewhere but is rare in Colo.: *Hesperia leonardus papnnee* 3 sec, *Pieris rapae* 4x a long time. It is evidently usually pollinated by bees, and sometimes by syrphid and other flies and perhaps sometimes by butterflies, and it can self-pollinate.

*Petunia hybrida* pink or rosy or purple or red or white are large cultivated flowers that are seldom visited, by large Papilionidae butterflies: *Papilio multicaudata* pink 10 sec+ in area with few flowers (others flew over it and did not land), *Vanessa cardui* pink 1 sec., and photos show *Battus philenor* (on P. Allan Smith TV show) and *Papilio glaucus* on pink *Petunia* (no butterflies and no *Polites peckius* or *P. themistocles* or *Pieris rapae* visited colored flowers or white flowers on several days) Elsewhere, this is probably pollinated by nocturnal moths as it has few daytime visitors in Britain, and *Petunia axillaris* white is pollinated by the sphingid moth *Manduca sexta* drawn to its odor, while *Petunia exserta* red lacks a scent and is pollinated by bumblebees attracted to its red color (Klahre et al. 2011). Smaller native species including *Petunia integrifolia* pink and Brazilian *Petunia* spp. are pollinated by bees.

(*Physalis hederifolia* and *P. virginiana* etc. yellowish are fairly common on prairies but are shunned. Colorado *P. heterophylla* and *P. virginiana* outcross, but *Physalis* elsewhere with tiny flowers [*P.*...
Campanula rapunculoides [campanula] is not popular, but Lobelia is very popular. Campanulaceae in general are pollinated especially by bees and birds [Judd et al. 2008].

Campanula carpathica blue had no butterfly visits in several days, including no Polistes peckius or P. themistocles. In eastern U.S. Campanula [Campanulastrum] americana is pollinated principally by long-tongued bees, including bumblebees Bombus and large leaf-cutting megachilid bees [including the Campanulaceae specialist bee Megachile campanulata], much less efficiently by halictid bees, while syrphid flies may get nectar but are not effective pollinators, and butterflies and skippers occasionally visit [Hilty 2013]. Other Campanula are pollinated by honeybees etc. Ten species of bees specialize on Campanula flowers in Europe [Naylor 2006], and three of those [Chelostoma campanularum; C. fuliginatum, and Lithurgus chrysura] have been introduced to the U.S. [Cane 2003].

Campanula rapunculoides blue is a common yard weed, not popular: Papilio glaucus rutulus, Poanes taxiles, (Polistes peckius did not visit it).

Campanula rotundifolia blue: Amblysirtes phylace, Erynnis afranius, Hesperia comma briefly, Oarisma garita, Papilio multicaudata 2 sec., Pontia protodice briefly. This is pollinated by bees [Proctor et al. 1996].

Lobelia siphilitica violet-blue is very popular: Amblysirtes eos 2x, Anclyoxyla numita, Argynnis (Speyeria) idalia, Atalopedes campestris, Atalopedes campestris, Atryone argos 2x, Battus philenor, Cercyonis pegala 2x, Colias edwardsi altiplano, Colias eurytheme, Euptoieta claudia 12x, Hypolimnas bolina, Lachesis montela, Lestes emilia, Lethyrus chrysura, and some Megachile pollinates. Other species pollinated by bees: Megachile maculata, M. remata (Proctor et al. 2003), and hummingbirds also visit and may pollinate sometimes (halictid bees gather pollen only and are non-pollinators).

Lobelia cardinalis is rare in Colorado so I have no observations. Its red flowers are pollinated by hummingbirds [Caruso et al. 2003].

(Platycodon grandiflorum blue had no Polistes peckius or P. themistocles or other butterfly visits during 4-5 days. It often self-pollinates.)
Achillea filipendulina “Gold Plate” yellow: Hemiarus isola.

Achillea millefolium wild variety “lanulosa” white is abundant so there are many records, though it is not as popular as many other flowers: Aglaia milberti, Boloria titania helena, Argynnis (Speyeria) aphrodite 2x, Argynnis (Speyeria) atlantis sorocoko, Argynnis (Speyeria) callippe. Argynnis (Speyeria) hesperis 2x, Argynnis (Speyeria) moronia 2x, Callophrys gryneus nelsoni ~18x, Callophrys gryneus siva 2x, Cercoyonis meadii 2x (+ once only ½ sec.), Cercoyonis oetus 4x, Chlosyne leanira leanira 6x, Chlosyne palla australomontana some, Coenonympha haydenii, Coenonympha tullia califonia 5x, Coenonympha tullia inornata, Colias meadii, Colias scudderi 2x, Danaus plexippus, Erebia callias, Erebia epippodea 2x, Erebia stubbendorfii “theano” ethela 4x, Euchloe ausonides ausonides 8x, Euphydryas anicia capella 2x, Euphydryas editha editha, Hesperia comma 2x, Hesperia viridis, Junonia coenia 9x, Lycaena arota, Lycaena flavus 26x (frequently), Lycaena gorgon, Lycaena heteronea 4x, Lycaena rubidus 8x, Lycaena xanthoides “edita” yurali 7x, Nathalis iole, Neominois ridingsii 2x, Neophasta menapia 1x and another only ½ sec., Oarisma garita, Ochloides sylvanoides 2x, Oeneis calalis altacordillera 3x (+ others only 1/3, 1/3, 2 sec.), Paratyctone snowi, Parnassius clodius, Parnassius phoebus smithius 1x, Phyciodes batesii apsaalooke, Phyciodes pulchella camillus camillus 2x, Pieris marginalis mcdonnoughii 3x, Piruna pirus, Plebejus glandon rustica 8x, Plebejus icarioides (mostly ssp. lycae), Plebejus alupini lutzi, Plebejus melissa, Plebejus saepioulus, Poladryas minuta monache 9x, Polites draco, Polites origenes, Polites peckius surrano, Polygonia faunus (mostly ssp. hylas), Pontia callidice occidentalis, Pontia protodice, Pyrurus communis, Satyrium behrii crossi 3x, Satyrium californica, Satyrium saepium 3x, Strymon melinus, Vanessa cardui 4x (+ one only ½ sec.). This is self-incompatible and pollinated by many other bees as well as Hemiptera and syrphid and tachinid flies. In Illinois the flower nectar attracts flies (bee flies, syrphid flies including drone flies, thick-headed flies, Tachinid flies, flesh flies, Anthomyid flies, and others) and wasps, while halictid bees and other short-tongued bees occasionally visit for nectar and pollen; mordellid beetles are sometimes found on flower heads (Hilty 2013).

Achillea millefolium (cultivated var. millefolium) white (some rosy ones were not visited): Colias eurytheme 1 sec., Strymon melinus, Polites peckius (unpopular flower, 2x rested on it but did not feed, and none visited it other days), Pyrgus communis ½ sec.; (Polites themistocles never visited this during several days).

Ageratum houstonianum blue (or pink or purple or white): butterflies ignored the blue flowers of dwarf plants in my yard and local gardens. It is known to be partly self-pollinating, and even thrips going from one flower to another can pollinate Ageratum conyzoides. However the blue flowers of taller more open-
inflorrescence *Ageratum* varieties are much more popular, as internet photos show visiting butterflies
(Zerene cesonia, Danaus plexippus, Heliconius ismenius, Vanessa virginiensis, Junonia coenia, Urbanus proteus, plus honeybees and 2 syrphid flies and a bombyliid fly.)

*Agoseris aurantiaca* orange: Argynnis (Speyeria) atlantis sorocco, Argynnis (Speyeria) callippe, Argynnis (Speyeria) hesperis, Argynnis (Speyeria) mormonia 4x, Parnassius phoebus smintheus.

*Agoseris glauca* dasycephala yellow: Erebia callias.

*Agoseris glauca* var. parviflora yellow: Colias scudderii.

*Agoseris glauca* yellow: Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) atlantis sorocco 19x, Argynnis (Speyeria) edwardsii, Argynnis (Speyeria) hesperis 8x, Argynnis (Speyeria) mormonia 5x and var. parviflora 1x, Boloria titania, Chlosyne gorgone (gray thistle-like leaf), Colias meadii, Erebia epipsodea 2x, Euptoieta claudia, Hesperia uncas 2x, Papilio polyxenes, Parnassius phoebus smintheus 3x (one male caught by foreleg in slit of flower, the petal or stamen wound around his leg), Plebejus glandon, Vanessa virginiensis. This is pollinated by various insects.

(Ambrosia is very common but has no records; the tiny ugly flowers are wind-pollinated.)

*Anaphalis margaritacea* whitish is popular, and cultivated flowers are also popular: Aglais milberti, Argynnis (Speyeria) hesperis 2x, Cercyonis oetus, Euchloe olympia, Euphydryas anicia capellla 2x, Lycæa florus 20x, Lycæa heternea 3x, Lycæa nivalis browni, Lycæa rubidus 4x, Lycæa xanthoides "edita" vurali 4x, Polygonia gracilis zephyrus 4x, Plebejus saepiolus, Satyrium saepium. Outcrossing is maintained by all-male and mostly-female plants, that are reportedly pollinated by insects including butterflies and moths.

*Antennaria* is moderately popular despite its modest appearance. *Antennaria* is pollinated by small bees and flies in Illinois prairies.

*Antennaria parvifolia* whitish: Callophrys dumetorum homoperplexa, Callophrys spinetorum Janet Chu, Celastrina lucia sidara 2x, Chlosyne gorgone, Coenonympha tullia ochracea 8x, Erynnis icelus, Erynnis pacuvius, Erynnis persius, Erynnis telemachus, Euphydryas anicia capella, Lycæa florus, Lycæa nivalis browni, Oeneis calais altacordillera 5 sec., Oeneis chryxus, Parnassius phoebus smintheus, Phyciodes pulchella canillus 11x, Plebejus glandon 4x and 1 sec., Plebejus saepiolus (1x, and another probing seedy dry head), Polites draco ½ sec., Polygonia gracilis zephyrus 4x, Pyrgus xanthus 2x.

*Antennaria rosea* rosy-whitish: Lycæa florus 7x, Pyrgus xanthus.

*Arctium minus* rose or rose-purple: Argynnis (Speyeria) aphrodite 7x, Argynnis (Speyeria) hesperis 42x, Argynnis (Speyeria) nokia 2x, Colias philodice, Erynnis horatius, Euptoieta claudia, Hesperia comma 12x, Lycæa arota, Ochloides sylvanoides 23x, Ochloides yuma, Pholisora catullus, Pieris marginalis mcdunnoughii, Pieris rapae 20x, Piruna pirus, Papilio troilus and Polites thistle (photos), Polygonia satyrus 3x, Pontia protodice, Polygonia communis (photo), Strymon melinus. In Illinois this is visited by numerous long-tongued bees including honeybees and bumblebees and Anthophoridae and Megachilidae, by short-tongued halictid bees, and by syrphid and bombyliid flies and butterflies, most of which probably pollinate it (Hilty 2013).

*Arnica cordifolia* yellow is popular and would be even more so if it did not prefer partial shade: Aglais milberti, Argynnis (Speyeria) mormonia 3x, Boloria freita, Boloria eunomia, Boloria titania 3x, Colias meadii 2x, Colias scudderii 2x, Erebia callias, Erebia epispodea 3x, Euchloe ausonides 2x, Lycaena cupreus snowi, Oeneis calais altacordillera 3x, Pieris marginalis mcdunnoughii 5x, Plebejus glandon 3x, Polygnos saepiolus, Polygonia gracilis zephyrus 4x, Pyrgus centaureae 7x, Vanessa cardui. Arnica cordifolia usually self-pollinates so most plants are clones, but it is occasionally pollinated by bees and flies etc.

*Arnica* [cordifolia or fulgens] yellow: Euptoieta claudia 2x Anne U. White and Janet Chu.

*Arnica fulgens* yellow: Chlosyne gorgone. This is reportedly pollinated by bees flies and butterflies.

*Arnica mollis* yellow (some of these records could actually be *Arnica rysbergii* yellow): Aglais milberti 15x, Argynnis (Speyeria) atlantis sorocco, Argynnis (Speyeria) callippe calgariana, Argynnis (Speyeria) hesperis lurana, Argynnis (Speyeria) mormonia 74x, Argynnis (Speyeria) ermine 6x, Boloria eunomia 3x, Boloria titania 73x, Cercyonis oetus ~20x, Colias eurystheme, Colias meadii 6x, Colias scudderii 6x, Erebia callias, Erebia epispodea (incl. 2 form brucei) 21x, Euphydryas bernadetta bernadetta small,
Aster fendleri, Aster, Aster chilensis, Artemisia frigida, Arnica parryi, Aster ~ glaucon melissa tharos orantain var. Colias philodice (Scott, Shields, Hesperia uncas = Polyxenes), Lycaena eurytheme included names Andrena throughout its range.

Distances

Arnica parryi (rayless) yellow: Argynnis (Speyeria) mormonia 2x. Lycaena florus 7x + 1 sec.

Arnica rydbergii yellow: Aagls milberti 29x, Argynnis (Speyeria) mormonia 14x, Boloria titania 3x.

Chlosyne whitneye damoetas 4x, Coenonympha tullia, Colias meadii 17x, Colias scudderii 4x, Erebia epipodea 9x, Hesperia Nevada, Lycaena cupreus snowi, Lycaena florus 2x, Oeneis jutta, Oeneis jutta 5x, Parnassius phoebus hermodur 5x, Polites draco, Polygonia gracilis zephyrus 2x, Pontia protodice 2x, Pyrgus centaurea 2x, Satyrium fuliginosum semiluna ~10x, Vanessa atalanta 7x, Vanessa cardui 28x, Vanessa carze 2x. This is pollinated by insects, probably mostly by bees and flies but surely sometimes by butterflies.

Artemisia frigida pale greenish: Paratytony snowi 4x. Artemisia are wind-pollinated [the pollen blows long distances], sometimes self-pollinated, and evidently only occasionally pollinated by insects.)

(Artemisia ludoviciana greenish is wind-pollinated.)

(Artemisia (Oligosporus) including A. dracunculus greenish is wind-pollinated.)

(Artemisia (Seriphidium) including A. tridentata grayish is wind-pollinated; its pollen is prominent in soils throughout its range.)

Aster spp. are reportedly pollinated by Colletes bees, though they are also popular with butterflies. The bees Andrena asteris and A. asteroides specialize on Aster, and the bees Andrena hirticincta, A. nubecula, A. simplex, A. solidaginis, and A. simulans armata specialize on Aster and Solidago (including Euthamia and Oligoneuron), while A. placata specializes on Solidago (incl. Oligoneuron). (The splitting-orgy names Almutaster, Brachyactis, Eucephalus, Herrickia, Symphyotrichum, Virgulaster, and Virgulus are included as subgenera of Aster here, while Leucelen is a genus treated below.)

Aster ascendens blurish: Argynnis (Speyeria) hesperis electa, Cercyonis oetus 4x, Cercyonis pegala, Colias eurytheme, Colias philodice 2x, Hesperia comma 5x, Hesperia comma colorado 2x, Lycaena florus, Lycaena rubidus, Oarisma garita, Ochloides sylvanoides 4x, Papilio polyxenes, Phyciodes pulchella camillus 15x, Pieris marginalis mcclunoughii, Plebejus melissa 3x, Poladryas minuta arachne 6x, Polites sabuleti, Polites sonora utahensis 2x, Polygonia gracilis zephyrus, Pyrgus communis.

(Aster brachyactis=Brachyactis ciliata has tiny flowers and is evidently rarely visited by butterflies.)

Aster chilensis blurish: Atalopedes campestris, Junonia coenia, Lerodea eufala, Ochloides yuma several, Phyciodes pulchella deltarufa some, Polites sabuleti.

Aster blue: Atalopedes campestris, Hesperia comma, Hesperia leonardus pawnee several (Paul A. Opler), Hesperia uncas, Hesperia woodgatei, Lycaena heteronea some, Ochloides sylvanoides, Ochloides yuma 2x (Scott, Shields, and Ellis 1976), Polygonia faunus some, Satyrium sylvius nootka.

Aster campestris lavender: Hesperia comma.

Aster ericoides var. falcatus white: Cercyonis oetus, Junonia coenia, Plebejus alupini texanus.

Aster ericoides white: Atalopedes campestris 3x, Cercyonis pegala, Colias eurytheme 27x + var. falcatus 2x, Colias philodice 49x, Danaus plexippus, Euploeta claudia, Hemiarus isola (6x + var. ericoides 4x + var. falcatus 1x), Hesperia comma 2x, Hesperia leonardus pawnee 2x, Hesperia uncas 2x incl. var. ericoides, Lycaena heliolepis 10x, Lycaena hyllus, Ochloides sylvanoides 2x, Phyciodes cocya 2x, Phyciodes pieta, Phyciodes pulchella camillus 68x + var. ericoides 1x + var. falcatus 28x, Phyciodes thamos orontain 12x, Phyciodes thamos thamos ~5x, Pieris rapae (10x and var. falcatus 3x), Plebejus melissa 22x + var. ericoides 1x + var. falcatus 5x, Polites peckius, Polites sabuleti 26x, Pontia callichidice occidentalis 4x + var. falcatus 1x, Pontia protodice 12x + var. falcatus 4x, Pyrgus communis 11x + var. falcatus 2x, Strymon melinus 6x, Vanessa cardui 9x, Vanessa carze 2x.

Aster white: Atrytonopis pittacus 11x, Atrytonopis vierecki, Calephelis rawsoni arizonensis 2x, Euphilotates glaucum centralis, Hesperia leonardus ssp. occasionally (Scott and Stanford 1981), Lycaena heliolepis.

Aster fendleri blue-violet: Brephidium exilis, Phyciodes pulchella camillus, Polites peckius (white flowers of Aster ~fendleri), Strymon melinus.
Aster foliaceus purple: Argynnis (Speyeria) atlantis sorocco, Argynnis (Speyeria) hesperis electa, Argynnis (Speyeria) zerene, Ochloides sylvanoides 15x, Polygonia faunus [for form silvisus].

Aster foliaceus var. apricus blue-violet sometimes purple: Argynnis (Speyeria) mormonia 2x, Boloria titania, Colias meadii 4x, Colias scudderii 2x, Erebia epipsodea form brucei 2x, Lycaena floris 3x, Lycaena rubidus, Plebejus glandon 10x, Plebejus saepiolus, Polites draco 2x.

Aster (Eucephalus) glaucodes white to violet: Argynnis (Speyeria) callippe 3x, Argynnis (Speyeria) coronis, Argynnis (Speyeria) hydaspe rhodope 2x, Colias philodice, Euphydryas bernadetta rorina 2x, Hesperia comma, Lycaena helioleuca, Lycaena rubidus, Oaisra garita, Ochloides sylvanoides, Phyciodes batesii anasazi 2x, Phyciodes batesii apsaaloke, Phyciodes pulchella camillis, Pieris marginalis mcdunnoughi, Polygonia gracilis zephyrus, Pontia callidice occidentalis 2x, Satyrius behrii.

Aster laevis var. geyeri blue: Argynnis (Speyeria) aphrodite 11x, Argynnis (Speyeria) coronis 2x, Argynnis (Speyeria) hesperis 29x, Argynnis (Speyeria) mormonia, Cercyonis oetus 23x incl. Janet Chu, Cercyonis pegala 4x, Colias eurytheme 3x, Colias philodice 3x, Danaus ilippus, Hemiargus isola, Hesperia comma 44x, Limenitis weidemeyerii 2x, Lycaena arota 5x, Lycaena floris common, Neophasia menapia 9x, Oaisra edwardsii big, Ochloides sylvanoides 68x incl. Janet Chu, Phyciodes cocyta, Phyciodes pulchella camillis 4x, Phyciodes thaors orantain 2x, Piruna pirus, Plebejus melissa, Polites themistocles, Polygonia faunus 3x, Polygonia gracilis zephyrus, Satyrius saepiolus 2x, Satyrius titus, Strymon melinus 5x incl. Janet Chu, Vanessa atalanta 2x, Vanessa virginieiniss, Zeere cesonia.

Aster lanceolatus hesperius bluish-white: Cercyonis pegala, Chlosyne gorgone, Colias eurytheme 67x (they prefer this to A. ericoides), Colias philodice 145x, Colias philodice Xeureytheome, Danaus plexippus 2x, Euptoieta claudia, Hesperia comma 6x, Hesperia leonardus montana 2x, Lycaena helioleuca 24x, Lycaena hyllus 2x, Ochloides sylvanoides 53x, Phyciodes pulchella camillus 24x, Phyciodes thaors orantain 6x, Pieris rapae 33x, Plebejus alupini texanus, Plebejus melissa 3x, Polites saubreleti 8x, Polites themistocles 10x, Pontia callidice occidentalis 3x, Pontia protodice 5x, Pyrgus communis, Strymon melinus, Vanessa carye 7x.

Aster novae-angiae purple: Argynnis (Speyeria) nokomis 3x, Colias eurytheme 4x, Danaus plexippus, Danaus plexippus, Ochloides sylvanoides 9x, Papilio polyxenes, Pieris rapae 6x, Vanessa atalanta 2x, Vanessa cardui 4x. This is pollinated by bees, flies, beetles, Lepidoptera including moths, and by selfing.

Aster novi-belgii purple: Atalopedes campesstris, Vanessa cardui (+ white-flowered variety 10x).

Aster “Pixie Park” purple: Vanessa cardui 2x.

Aster pauciflorus blue-violet: Colias philodice, Colias eurytheme 3x.

Aster porteri white: Argynnis (Speyeria) aphrodite 3x, Argynnis (Speyeria) coronis, Argynnis (Speyeria) hesperis 3x, Colias philodice, Cupido amylntula, Cercyonis meadii 34x, Cercyonis oetus 50x, Cercyonis pegala 5x, Colias eurytheme 7x, Euptoieta claudia 2x, Hemiarus isola 4x, Hesperia comma 48x, Hesperia juba, Hesperia leonardus montana 3x, Hesperia leonardus pawne 2x, Lycaena arota 9x, Lycaena heteronea, Lycaena rubidus, Neophasia menapia 3x, Ochloides sylvanoides 64x, Phyciodes pulchella camillus 112x, Pieris rapae 5x, Plebejus alupini texanus, Plebejus melissa 5x, Polygonia gracilis zephyrus, Pontia protodice 5x, Pyrgus communis 4x, Satyrius saepiolus 6x, Satyrius titus, Strymon melinus 4x, Vanessa atalanta.

Aster simplex whitish: Celastrina neglecta, Colias eurytheme 4x, Colias philodice, Danaus plexippus 8x, Phyciodes thaors tharos, Pieris rapae 5x.

“Aster” sunflower with wavy leaves yellow: Chlosyne whitneyi whitneyi.

Asteraceae blue: Junonia coenia 1x.

Asteraceae (rayless) with long heads of flowers on bush: Lymnas cephise cephise and many other species.

Asteraceae shrub yellow: Asterocampa leilia, Cercyonis meadii 6x, Coenonympha tullia california, Danaus ilippus, Junonia coenia 3x, Leptotes marina, Libythea carinenta larvata, Microtia dymas, Ministrymon leda, Ochloides sylvanoides 4x, Phyciodes texana, Plebejus acmon 6x, Pyrgus communis, Satyrius sylvius megapallidum, Satyrius titus, Strymon melinus 3x.

Asteraceae shrub white: Chlosyne leanira fulvia many.

Asteraceae yellow species: Apodemia virgulit durty, Argynnis (Speyeria) callippe, Argynnis (Speyeria) egleis oweni, Chlosyne definita, Chlosyne gorgone 2x, Chlosyne leanira fulvia 6x, Chlosyne leanira leanira,
Coenonympha tullia california common, Colias behrii, Colias philodice abundant, Erynnis tristis tatius, Euphydryas editha lehmani (body covered with Asteraceae yellow pollen), Euphydryas editha rubicunda, Hesperia pahaska, Hesperia uncas, Hylephila phyleus 2x, Lerodea eufala, Lycaena cupreus snowi 2x, Lycaena florus several, Nathalis iole, Oeneis calais ivalda male covered with yellow pollen evidently from Asteraceae, Parnassius phoebus smintheus, Philotiella speciosa small (pressed), Phyciodes pulchella pulchella, Plebejus shasta pitkinensis usually, Poladryas minuta arachne, Poladryas minuta near-minuta 8x, Polygonia faunus many (preferred), Polygonia gracilis zephyrus 2x, Pyrgus communis, Satyrium titus, Strymon melinus, Vanessa virginiensis several.

Baccharis salicifolia=viminea whitish: Adelpha californica, Atlides halesus 3x, Brephidium exilis, Hylephila phyleus 2x, Junonia coenia 10x, Lycaena helleoides, Phyciodes mylitta, Plebejus acmon 30x, Satyrium saepium many. Elsewhere, Baccharis spp. are pollinated by ants, parasitic Hymenoptera, and honeybees (Steffan 1997). Megachild bees gather pollen from Baccharis emoryi and pack it among long hairs on the underside of their abdomen.

~Baccharis sarothroides whitish: Caleza nemesis, Emesis zela, Danaus gilippus 4x, Libythea carinenta larvata very common, Ministrymon leda 7x, Phyciodes texana many, Strymon melinus.

Baccharis whitish: Amblyscirtes elissa, Apodemia palmerii, Apyrrothrix araxes arizonae ~47x, Atlides halesus, Autochton cellus 2x.

Baccharis: Battus philenor, Caleza nemesis arizonensis, Callophrys gryneus siva, Codactactus arizonensis 3x, Copaoedes aurantiaca, Danaus gilippus, Emesis zela cleis 3x, Hesperia pahaska, Leptotes marina, Libythea carinenta larvata, Microtia dymas 20x, Microtia (Texola) elada 30x, Ministrymon leda 2x, Papilio polyxenes, Staphylus ceos, Strymon melinus.

Bahia dissecta yellow: Euptoieta claudia.

(Balsamorhiza sagittata was insufficiently observed. In Utah, Osmia californica and O. montana bees prefer the larger B. macrophylla over B. sagittata and mostly specialize on Balsamorhiza but also visit Taraxacum officinale and Wyethia amphioxalis) (Cane 2011).

Bidens cernua yellowish: Atalopedes campestris 2x, Chlosyne gorgone, Colias eurytheme, Euptoieta claudia 2x, Limenitis archippus, Lycaena helleoides 5x, Phyciodes cocya, Phyciodes pulchella camillus, Phyciodes thoras orantain 4x, Pieris rapae 3x, Polites themistocles, Strymon melinus 4x, Vanessa virginiensis. (Some Bidens are pollinated by bumblebees [Aluri and Robart 1991])

Bidens frondosa yellowish: Colias eurytheme 5x, Lycaena helleoides 35x, Lycaena hyllus 8x, Nathalis iole 11x, Phyciodes cocya, Pieris rapae 2x, Pontia protodice 2x.

Boltonia asteroides white: Libythea carinenta bachmanii. The bee Perdita boltoniae specializes on Boltonia asteroides and possibly other Boltonia spp.

Brickellia californica greenish-white: Pieris rapae. These flowers are fragrant at night so may be pollinated by moths.

Carduus nutans rose-purple [nearly all my “Cirsium vulgar” records up to 1988 were actually Carduus nutans so were corrected]: Anatrytone logan lagus 3x, Argynnis (Speyeria) aphrodite 73x, Argynnis (Speyeria) callippe 47x, Argynnis (Speyeria) coronis 29x, Argynnis (Speyeria) cybele cybele 3x, Argynnis (Speyeria) edwardsii 47x, Argynnis (Speyeria) hesperis 28x, Argynnis (Speyeria) hesperis nausicaa, Argynnis (Speyeria) idalia often, Argynnis (Speyeria) mormonia, Argynnis (Speyeria) nokomis 34x, Atrytone aragos 11x, Atrytone aragos 62, Callophrys gryneus siva, Cercyonis oetus, Cercyonis pegala 4x, Cercyonis pegala 16a, Colias alexandra, Colias eurytheme 32x, Colias philodice 5x, Danaus gilippus, Danaus Plexippus 2x, Danaus Plexippus 5x, Epargyreus clarus, Epargyreus clarus, Erynnis horatius, Euphydryas chalcedona chalcedona several, Euphyes vestris 8x, Euptoieta claudia 5x, Hesperia comma 51x, Hesperia comma, Hesperia dacotae 41x, Hesperia leonardus montana 86x, Hesperia leonardus pawnee 6x (incl. Paul A. Opler), Hesperia otoe 167x, Hesperia pahaska 3x, Hesperia uncas 17x, Hesperia viridis 7x, Limenitis weidemeyerii 2x, Lycaena dione 4x, Lycaena hyllus, Neophasia menapia, Oarisma garita 2x, Oarisma powesheik “Cirsium vulgar” surely, Ochloides sylvanoides 70x, Papilio eupymdon 4x, Papilio glaucus rutulus 9x, Papilio indra, Papilio machaon bairdii (f. bairdii and f. brucei), Papilio multicaudata 25x, Papilio polyxenes 14x, Pieris rapae 3x (another only hovered over), Poanes taxiles 8x, Polites mystic 9x, Polites orogenes 21x, Polites peckius 2x, Polites sabuleti, Polites
Chrysothamnus
Chrysanthemum morifolium
Chrysanthemum Xsuperbum=maximum
Chrysanthemum leucanthemum
Chaenactis alpina
Centaurea
cultivated "mums":
Danaus gilippus
Cercyonis meadii alamosa
Atalopedes campestris
(Papilionidae)
Chrysochroa
Strymonthemis
Carduus nutans
Vanessa cardui
Colias eurytheme
Ochlodes sylvanoides
Megachile
Argynnis
Vanessa cardui
Colias eurytheme
Ochlodes sylvanoides
Megachile
Argynnis
Vanessa cardui
Colias eurytheme
Ochlodes sylvanoides
Megachile
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Argynnis
Vanessa cardui
Colias eurytheme
Ochlodes sylvanoides
Megachile
Argynnis
Vanessa cardui
Colias eurytheme

Centuaera americana white and pink: Asterocampa celtis
Centuaera cyanus blue: Polites themistocles 3x, Pyrgus communis
Centuaera dealbata pinkish or purple: Papilio multicaudata 5 sec., Polites themistocles.
Centuaera diffusa lavender: Argynnis (Speyeria) aphrodite 6x, Argynnis (Speyeria) edwardsii, Argynnis (Speyeria) hesperis 10x (+two <1/2 sec.), Cercyonis pegala 5x, Colias eurytheme 7x, Colias philodice 2x, Lycaena rubidus, Ochloides sylvanoides 8x, Phyciodes pulchella camillus 4x, Plebejus melissa 1x, Pontia protodice, Satyrium sylvanum, Vanessa cardui 10x. The flowers outcross and are visited by Bombusumblebees, honeybees, solitary bees, Anthophora and Megachile bees, which all visit both the purple and white flowers. The bee Megachile apicaulis is a specialist on Centuaera.
Centuaera diffusa white: Argynnis (Speyeria) aphrodite 2x, Argynnis (Speyeria) callippe, Argynnis (Speyeria) coronis 2x, Argynnis (Speyeria) hesperis 27x, Cercyonis oetus 31x, Cercyonis pegala 8x, Colias eurytheme 17x, Colias philodice 13x, Cupido amygula, Euptoieta claudia, Hesperia comma 4x, Neophasia menapia 7x, Ochloides sylvanoides 19x, Phyciodes pulchella camillus 7x, Pieris rapae 14x, Plebejus melissa 8x, Polygonia gracilis zephyrus, Pyrgus communis 8x, Satyrium calanus, Strymon melinus, Vanessa atalanta, Vanessa cardui 67x, Vanessa virginiensis.
Centuaera maculosa lavender is very popular: Colias eurytheme 2x, Colias philodice 3x, Euptoieta claudia 2x, Hesperia comma 55x, Ochloides sylvanoides, Plebejus melissa, Pyrgus communis 15x, Vanessa cardui 6x.
Centuaera near rthenica white: Papilio multicaudata 3x (one only 3 sec.).
Centuaera repens blue: Hesperia comma, Hesperopsis libya lena 4x, Ochloides sylvanoides, Pontia beckerii.
Centuaera scabiosa blue: Pontia protodice, Vanessa cardui. This is pollinated by bumblebees (Bombus lapidarius) and honeybees.
Chaenactis alpina white: Euptoieta claudia. Bee visitors that probably pollinate are Halictus ligatus, green sweat bees (Agapostemon sp.), bumblebees (Bombus huntii), mason bees (Osmia sp.), Micranthophora flexipes, and honeybees (www.plants.usda.gov/plantguide).
Chaenactis douglasii white: Strymon melinus.
Chrysanthemum leucanthemum white: Chlosyne gorgone, Ochloides sylvanoides 2x, Pieris rapae, Plebejus glandon rustica. Chrysanthemum is pollinated by honeybees.
Chrysanthemum Xsuperbum=maximum white: Atalopedes campestris 1x (and once on "white sunflower" [C. Xsuperbum?, Gerbera?]!), Colias eurytheme 2x (+another only 4 sec.), Nathalis iole, Ochloides sylvanoides, Pieris rapae, Polites themistocles 3x, Pyrgus communis, Strymon melinus 1x (another several times but flew after sipping for a few sec.), Vanessa cardui 5x.
Chrysanthemum morifolium (cultivated "mums"): Danaus plexippus [~white], Vanessa cardui [1x "Corinne" white, 1x "Megan" purple, 1x "Melanie" ?white, 6x yellow, yellow with orange center 1x, yellowish 2x], Polygonia comma [hybrid, ~white], Pontia protodice [orange], Pyrgus communis 1 sec., Vanessa carye [yellow].
Chrysanthemum parthenium white (yellow center): Polites peckius 2x, Vanessa carye.
Chrysothamnus nauseosus yellow is very popular: Aglais milberti 23x, Apodemia mormo mormo, Argynnis (Speyeria) aphrodite 45x, Argynnis (Speyeria) coronis 19x, Argynnis (Speyeria) edwardsii 21x, Argynnis (Speyeria) hesperis, Argynnis (Speyeria) mormonia 2x, Argynnis (Speyeria) nokomis 11x, Argynnis (Speyeria) zereze 4x, Argynnis (Speyeria) zereze gunderi 2x, Argynnis (Speyeria) zereze malcolmii 2x, Atalopedes campestris ~9x, Brephidium exilis 2x, Callophrys gryneus siva 14x, Cercyonis meadii 4x, Cercyonis meadii alamosa 29x, Cercyonis oetus 32x, Cercyonis pegala 15x, Cercyonis sthenele masoni 12x, Coenonympha tullia, Colias edwardsii edwardsii, Colias eurytheme 324x, Colias philodice 98x, Danaus gilippus, Danaus plexippus 67x, Euphilotes ancilla ancilla 4x, Euptoieta claudia 25x.
Glaucopsyche piasus 3x, Hemiargus isola 6x, Hesperia comma 295x, Hesperia juba 161x, Hesperia leonardus pawns 59x, Hesperia uncas 8x, Junonia coenia 2x, Leptotes marina, Limenitis weidemeyerii, Lycaena arota 28x, Lycaena florus, Lycaena heliolepis 3x, Lycaena heteroea 16x (a dozen had pollen on thorax uns), Lycaena rubidus, Lycaena xanthoides “edita” vulrai 4x, Nathalis iole several, Neominois ridingsii 3x, Neominois ridingsii wyomingo 5x, Nymphalis antiopa 10x, Ochloides sylvanoides 36x, Ochloides yuma 5x (Scott, Shields, and Ellis 1976), Papilio polyxenes 4x, Parnassius phoebus smintheus 1x, Phyciodes pulchella camillius 35x, Pieris rapae 23x, Plebejus alpini luti 10x, Plebejus alpini texanus, Plebejus melissa 28x, Polygonia faunus 10x [incl. form silvius], Polygonia gracilis zephyrus 194x, Polygonia interrogationis, Polygonia oreas satellot popular (Scott 1984), Polygonia satyrus, Pontia beckerii, Pontia callidice occidentalis 2x, Pyrgus communis 23x, Strymon titus 2x, Strymon melanis 39x, Vanessa atalanta 35x, Vanessa cardui 1062x, Vanessa carle 33x, Vanessa virginiensis 17x.

Chrysothemus viscidilus yellow: Colias edwardsi altiplano.

Cichorium intybus blue: Pyrgus communs.

Cichorium intybus blue: Colias philodice, Ochloides sylvanoides, Hesperia comma 2x. This is reportedly pollinated mostly by beees (megachilids, Halictids) and syrphid flies including Eristalis tenax also visit, and it also self-pollinates.

Cirsium ~arizonica big reddish: Atrytonopsis cestus, Atrytonopsis hianna deva, Atrytonopsis ovinia edwardsi.

Cirsium arvense purple: Aegla milberti (1x, and var. incanum), Amblyscirtes oslambda, Anathyrotone logan lagus 2x, Anolyxoa numitor 5x, Asterocampia celtis jeffermont several, Argynnis (Speyeria) aphrodite 12x (+ var. incanum 4x), Argynnis (Speyeria) callipe 5x, Argynnis (Speyeria) coronis, Argynnis (Speyeria) edwardsii M. Fisher, Argynnis (Speyeria) hesperis 21x (+ var. incanum 11x), Argynnis (Speyeria) hesperis electa nikias 2x, Argynnis (Speyeria) hesperis nausicaa (small blue head ?arvense), Argynnis (Speyeria) moronina luski (small blue head ?arvense), Argynnis (Speyeria) zere 2x, Atalopedes campestris 3x, Atrytone arogos ~129x, Calliphrys gryneus siva 4x, Cercyonis meadii (1x, var. incanum 1x), Cercyonis oetus (purple 16x, white 1x, var. incanum purple 3x), Cercyonis pegaia 34x, Cercyonis pegala var. incanum 5x, Chlorose gorgone (var. incanum), Chlorose nycteis, Colias eurytheme 15x (+ var. incanum 23x), Colias philodice (3x + var. incanum 4x), Cupido comynatas (var. incanum), Danaus gilippus, Danaus plexippus 10x, Erynnis agranii 7x (+ var. incanum 2x), Euchloe austinidae austinidae 8x [does not visit Cirsium arvense in Colo.], Euphyes bimaculata 3x, Euphyes vestris 4x, Euptoieta claudia 8x, Hemiargus isola 2x, Hesperia comma 3x (+ var. incanum 2x), Hesperia ottos 2x, Hesperia pahaska 17x, Hesperia uncas 5x, Hesperia viridis 22x, Junonia coenia 48x, Leptotes marina, Lethe eurydice (var. incanum 6x), Lycaena dinea 24x (+ var. incanum 1x), Lycaena florus, Lycaena heliolepis 3x (+ var. incanum 1x), Lycaena heteroea >102x, Lycaena hyllus 3x, Lycaena rubidus 8x, Neophasia menapia 7x, Notamblyscirtes simius 1x, Nymphalis antiopa, Oarisma garita 7x (and var. incanum 2x), Ochloides sylvanoides 21x (+ var. incanum 18x), Ochlodes yuma, Papilio glaucus rutulus 2x (+ var. incanum 1x), Papilio macon airdii, Papilio multicaudata, Papilio polyxenes 9x (+ var. incanum 1x), Papilio zelicaon (blue), Pholisora mejicana, Phicyides batesii asansazi 3x, Phicyides cocya, Phicyides picta (var. incanum), Phicyides pulchella camillus 2x, Phicyides pulchella pulchella blue, Phicyides thoros orantain (var. incanum), Phicyides thoros thoros, Pieris rapae 60x (+ var. incanum 10x), Piruna pirus 39x (+ var. incanum 2x), Plebejus acmon 1x, Plebejus melissa (var. incanum 3x), Poanes taxiles 18x (+ var. incanum 1x), Poladryas minuta arachne, Polites mystic 8x (+ var. incanum 2x), Polites peckiis 11x, Polites sabuleti, Polites sonora ~8x, Polites themistocles 6x, Polygonia comma, Polygonia faunus 2x, Polygonia graciilis zephyrus 2x, Polygonia satyrus 1x (+ var. incanum 1x), Pontia protodice 12x (+ var. incanum 1x), Pyrgus communis 3x, Satyrium acadica 3x, Satyrium behrii 3x, Satyrium calanus, Satyrium calanus falacer, Satyrium californica 5x, Satyrium liparops 4x, Satyrium saepium 5x (+ var. incanum 2x), Speyeria cybele 5x, Satyrium titus 3x, Strymon melanis 18x, Thymelicus lineola 150x, Vanessa atalanta 26x (+ var. incanum 78x), Vanessa cardui 32x (+ var. incanum 10x), Vanessa carle 2x, Vanessa virginiensis 4x (+ var. incanum 1x), Wallengrenia egermet. Cirsium arvense is pollinated mostly by honeybees, has high visitation by other bees (Halictus and
Cirsium canescens whitish: Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) atlantis sorocco, Argynnis (Speyeria) callippe. Argynnis (Speyeria) coronis 2x, Argynnis (Speyeria) edwardsii 4x, Argynnis (Speyeria) hesperis chitonse several, Argynnis (Speyeria) nokomis 6x, Danaus plexippus, Euphydryas chalcedona chalcedona, Hesperia leonardus montana, Hesperia pahaska, Hesperia uncas 2x, Papilio eurymedon, Papilio glaucus rutulus, Papilio multicaudata, Papilio polyxenes, Papilio zelicaon, Poanes melane, Paratrytone snowi 2x, Parnassius phoebus smimtheus 2x, Phyciodes mylitta, Plebejus acmon, Poanes taxiles.

Cirsium centaureae yellowish-white: Argynnis (Speyeria) aphrodite byblis, Argynnis (Speyeria) atlantis sorocco, Argynnis (Speyeria) callippe calgariana, Argynnis (Speyeria) coronis, Argynnis (Speyeria) cybele charlotti, Colias alexandra, Colias scudderii, Lycaena florus, Lycaena xantheidae “edita” vurali, Ochlodes sylvanoides 2x, Papilio machaon brucei.

Cirsium discolor pinkish-violet: Atalopedes campestris 3x, Colias eurytheme 3x, Colias philodice 4x, Danaus plexippus 14x, Papilio glaucus glaucus, Papilio polyxenes 45x, Polites peckius 2x, Vanessa cardui 95x.

Cirsium eatoni tweedy purplish: Vanessa cardui.

Cirsium neomexicanum ~pink or ~pink-cream: Argynnis (Speyeria) cybele leto, Papilio multicaudata.

Cirsium ochrocentrum rose-purple (some lavender-white): Amblyscirtes aenus 2x, Amblyscirtes oslari (on “Cirsium probably”, Anatrytone logan lagus, Argynnis (Speyeria) callippe, Argynnis (Speyeria) edwardsii 3x, Atrytone arogos, Colias eurytheme, Danaus plexippus, Hesperia ottoe, Hesperia pahaska 4x, Hesperia uncas 2x, Hesperia viridis several, Oarisma garita, Papilio glaucus rutulus, Papilio multicaudata, Papilio zelicaon, Paratrytone snowi purple-violet 2x, Poanes taxiles 3x, Polites mystic 3x, Polites origenes purple-violet 5x, Vanessa atalanta.

Cirsium parryi yellow: Vanessa cardui, Danaus plexippus.

Cirsium scariosum=coloradense whitish or lavender-white: Aglais milberti, Argynnis (Speyeria) callippe, Argynnis (Speyeria) zerene, Colias scudderii, Euphydryas anicia brucei, Plebejus saepiolus 2x, Polites mystic?, Polites sonora (on “Cirsium 2”-tall whitish-blue”), Vanessa cardui.

Cirsium scariosum (=coloradense=drummond) var. acaulescens whitish: Polites sonora utahensis 71x (its favorite flower), Hesperia uncas.

Cirsium scopulorum yellowish-white: Boloria titania, Vanessa cardui, Polygonia gracilis zephyrus.

Cirsium undulatum rose-purple (some lavender): Anatrytone logan logan 3x, Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) callippe, Argynnis (Speyeria) cybele charlotti, Argynnis (Speyeria) edwardsii 2x, Argynnis (Speyeria) idalia 6x, Atrytone arogos, Atrytonopsis python, Atrytonopsis vierecki several, Cercyonis pegaia, Hesperia dacotae, Hesperia leonardus montana [for “Cirsium pink"], Hesperia ottoe 3x, Hesperia pahaska uncas, Hesperia viridis, Papilio multicaudata 2x, Papilio polyxenes 2x, Paratrytone snowi [lavender] 3x, Poanes taxiles, Polites mystic, Polites origenes, Pontia protodice, Vanessa cardui.

Cirsium spp. rose-purple or sometimes purple: Aglais milberti, Argynnis (Speyeria) hesperis near dorothea, Argynnis (Speyeria) hydaspe, Argynnis (Speyeria) nokomis, Argynnis (Speyeria) nokomis [tall whitish-blue], Argynnis (Speyeria) nokomis near-apacheana 2x, Argynnis (Speyeria) zerene gunderi, Atrytonopsis hanna deva 3x, Atrytonopsis python, Atrytonopsis vierecki 2x, Danaus plexippus, Hesperia comma 3x, Hesperia leonardus pannew (Paul A. Opler), Hesperia leonardus spp. occasionally (Scott and Stanford 1981), Hesperia pahaska, Hesperia viridis 3x, Lycaena rubidus, Notamblyscirtes simius, Ochlodes sylvanoides, Ochloes yuma (Scott, Shields, and Ellis 1976), Papilio machaon bairddii 2x, Papilio polyxenes, Polites origenes, Polites sonora, Thorybes pylaedes 3x, Vanessa cardui.

Cirsium vulgare rose-purple: Anatrytone logan logus, Ancylxophya numitor, Argynnis (Speyeria) aphrodite 5x, Argynnis (Speyeria) coronis, Argynnis (Speyeria) hesperis, Argynnis (Speyeria) nokomis 64x, Asterocampa celtis jeffermont Janet Chu, Atalopedes campestris, Atrytone arogos 3x, Cercyonis pegaia, Colias eurytheme, Colias philodice 2x, Danaus plexippus 5x, Dione vanillae, Hesperia comma 3x,
**Erigeron divergens**

**Eriger**

**Erigeron canus**

**Echinacea purpurea**

**Echinacea angustifolia**

**Dimorphotheca sinuata=aurantiaca**

**Dahlia**

**Crepis occidentalis**

**Crepis acuminata**

**Cosmos bipinnatus**

**Coreopsis verticillata**

**Coreopsis grandiflora**

**Conyza canadensis**

2x

2x; C) white to rose

and butterflies.

**Illinois protodice**

sec./brief),

cy

efficient pollinators (Colias philodice ferruginea)

Vanessa archippus argos

This is pollinated efficiently by bumblebees and uncommon honeybees and other bees (Leuszler et al. 1996), while bee flies Systoechus vulgaris were common but inefficient, Epicauta ferruginea beetles were efficient but preferred other yellow flowers, and pierid butterflies [obviously Colias philodice and its yellow or white females based on their descriptions] were regular visitors and efficient pollinators (Vanessa cardui also visited) (Wist 2005).

**Echinacea angustifolia** (native) purple: Anatrytone logan logan, Argynniss (Speyeria) idalia 2x, Atrytone argos 7x, Cercyonis pegala, Danaus plexippus, Hesperia dacotae 12x, Hesperia ottoe 6x, Limenitis archippus, Oarisma powesheik 9x, Phyciodes tharos tharos, Polites origenes, Polites themistocles 2x, Vanessa cardui 11x. This is pollinated efficiently by bumblebees and uncommon honeybees and other bees (Leuszler et al. 1996), while bee flies Systoechus vulgaris were common but inefficient, Epicauta ferruginea beetles were efficient but preferred other yellow flowers, and pierid butterflies [obviously Colias philodice and its yellow or white females based on their descriptions] were regular visitors and efficient pollinators (Vanessa cardui also visited) (Wist 2005).

**Echinacea purpurea** (cultivated) purple: Argynniss (Speyeria) aphrodite 2x, Argynniss (Speyeria) cybele cybele, Atalopedes campestris 2x, Colias eurytheme 5x, pink 1x for albino, Danaus plexippus 4x, Euptoieta claudia 3x, Papilio glaucus rutulus 2x, Papilio multicaudata 31x (but three were 1-2 sec./brief), Papilio polyxenes 8x, Poanes taxiles, Polites peckius 7x, Polites themistocles 3x, Pontia protodice, Pyrgus communis, Strymon melinus 3x, Vanessa atalanta, Vanessa cardui 188x, Vanessa carae. This is reportedly pollinated by bumblebees, and butterflies; it is visited by dozens of bee species in Illinois (Robertson 1929). The bee Andrena helianthiformis specializes on Echinacea.

**Erigeron** species are pollinated by bumblebees (Aluri and Robart 1991) and reportedly by bees, wasps, flies, and butterflies.

**Erigeron canus** blue-white: Hesperia pahaska 2x.

**Erigeron compositus** A) blue to pinkish or white: Chlosyne whitneyi whitneyi; B) white: Plebejus glandon 2x; C) white to rose-blue: Polygonia gracilis zephyrus, Euphydryas anicia capella 2x, Vanessa cardui 3x.

**Erigeron coulteri** white: Argynniss (Speyeria) mormonia, Pieris marginalis mcdunnoughii, Plebejus glandon 2x.

**Erigeron divergens** A) blue: Pyrgus communis; B) rose-purple to white: Coenonympha tullia 2x, Euphyes vestris, Phyciodes pulchella camillus 2x; Pontia protodice; C) white: Oarisma garita Erigeron divergens 2x.
Erigeron elatior: A) pink-purple: Argynnis (Speyeria) mormonia 3x, Boloria titania 8x, Colias meadii, Colias eurytheme, Lycaena florus 8x, Lycaena rubidus 8x, Phyciodes pulchella camillus, Pieris marginalis medunnoughii 2x, Plebejus glandon 26x, Plebejus saepiolus 2x, Polites draco; B) bluish-white (some lavender): Lycaena arota 11x (not on Aster novae-angliae).

Erigeron flagellaris white: Phyciodes pallida.

Erigeron formosissimus lavender: Phyciodes cocyta.

Erigeron ~glabellus blue hairy: Cercyonis oetus, Oarisma garita.

Erigeron leiomeris blue: Chlosyne whitneyi damaetas 5x.

Erigeron melanoccephalus (black phyllaries) white (or pinkish): Erebiana callias, Hesperia comma colorado.

Erigeron philadelphicus white: Ancylorhiza numitor 2x, Cupido comynatas, Phyciodes diminutor 14x, Polites peckius.

Erigeron pinnatisectus blue/purple yellow-centered: Chlosyne whitneyi damaetas; Colias medii 11x, Erebiana callias 3x, Euphydryas anicia brucei, Hesperia comma colorado [violet], Plebejus alpini cotundra, Plebejus glandon 2x, Plebejus shasta pitkinensis[violet] 4x.

Erigeron pumilus whith/bluish-white: Argynnis (Speyeria) callippe, Cercyonis oetus, Chlosyne gorgone 5x, Coenonympha tullia 10x, Colias edwardii altiplano, Colias philodice, Erebia epipsodea 1x, Erynnis icelus, Erynnis persius 8x, Euphydryas anicia capella, Euptoieta claudia 5x, Glaucopsyche piasus, Hesperia juba 5x, Hesperia nevada 5x, Hesperia pahaska 4x, Hesperia uncas 3x, Hesperia viridis, Hesperopsis alpheus 10x, Lycaena arota, Notamblyscirtes simius 13x, Oarisma garita 11x, Parnassius phoebus smintheus 24x, Phyciodes pulchella camillus 104x, Plebejus alpini texanus, Plebejus glandon 1x, Plebejus icarioides, Plebejus melissa 8x, Plebejus saepiolus 5x, Poladryas minuta arachne 19x, Polites (Yvretta) rhesus, Polites draco 9x, Polites sabuleti, Polites themistocles, Pontia callidice occidentalis, Pontia protodice 3x, Pyrgus communis 5x, Strymon melinus.

Erigeron sp. white: Parnassius phoebus smintheus 7x.

Erigeron pygmaeus blue/purple: Chlosyne whitneyi damaetas.

Erigeron simplex blue: Argynnis (Speyeria) mormonia, Boloria improba harryi, Boloria titania (violet), Chlosyne whitneyi damaetas (violet), Colias medii 2x, Erebiana magdalenae, Lycaena cupreus snowi (purple), Parnassius phoebus smintheus 2x, Plebejus glandon 2x, Pontia protodice (violet), Pyrgus centaureae 2x.

Erigeron speciosus blue: Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) atlantis sorocko 2x, Argynnis (Speyeria) coronis, Argynnis (Speyeria) cybele charlottii, Argynnis (Speyeria) hesperis 5x, Argynnis (Speyeria) hesperis electa 2x, Argynnis (Speyeria) mormonia 16x, Argynnis (Speyeria) zerene 4x, Boloria titania, Cercyonis oetus 34x, Cercyonis pegasa 4x, Chlosyne palla calydon, Chlosyne palla flavula, Colias alexandra 1x, Colias philodice, Emes zela, Euphyes vestris, Hesperia comma 7x, Hesperia leonardus montana?, Lycaena arota common, Lycaena florus (frequently, Scott 1978), Lycaena florus 34x, Lycaena heteronea 6x, Lycaena rubidus 2x, Nathalis iole, Neophasia menapia 5x, Oarisma garita 3x, Ochlodes sylvanoides 13x, Phyciodes batesii anasazi 2x, Phyciodes cocyta 4x, Phyciodes pulchella camillus 7x, Pieris rapae, Plebejus glandon 2x, Plebejus saepiolus, [Polites peckius none seen on], Polygonia faunus, Pontia callidice occidentalis, Pontia protodice-pink 2x, Satyrion saepium 2x, Strymon melinus, Vanessa atalanta, Vanessa cardui 3x, Vanessa viirginiensis.

Erigeron urssinus blue-purple/Blue: one of the most popular subalpine flowers: Aglais milberti 4x, Argynnis (Speyeria) hesperis electa, Argynnis (Speyeria) mormonia 69x, Boloria euonima 14x, Boloria improba acrocnema, Boloria alaskensis halli sometimes, Boloria selene tollandensis, Boloria titania 79x, Cercyonis oetus, Colias meadii 21x, Colias philodice 2x, Colias scudderii 35x, Erebida callias, Erebida epipsodea 14x (including f. brucei 5x), Erynnis funerarum, Euphydryas anicia brucei 2x, Euptoieta claudia, Hesperia comma 2x, Hesperia comma colorado 3x, Lycaena florus (some violet) 76x, Lycaena heteronea 19x, Lycaena phlaeas arctodon “Aster”, Lycaena rubidus 11x, Lycaena xanthoides “editha” vurali 8x, Oarisma garita 5x, Oeneis calais altacordillera 4x, Parnassius phoebus smintheus, Phyciodes pulchella camillus 7x, Pieris marginalis medunnoughii 9x, Plebejus glandon 93x, Plebejus melissa pseudosamuelis, Plebejus saepiolus 13x, Plebejus shasta, Poladryas minuta arachne 2x, Polites draco 5x, Polites peckius peckius, Polites sonora 4x, Polites sonora 5x, Polygonia gracilis zephyrus,
Gaillardia, Euryops pectinatus, Eupatorium rugosum, Eupatorium perfoliatum, Eupatorium maculatum. Some Erigeron species are commonly pollinated by insects in Europe.

Some Eupatorium species including E. solidaginifolium, E. solidaginoides, E. monanthum, etc. are wind-pollinated and 11 species have short-spined pollen that blows away better than long-spined pollen (Grashoff and Beaman 1970), and the Chinese E. adenophorum only self-pollinates (Lutt et al. 2008). But Eupatorium cannabinum is pollinated by bees and visited and perhaps pollinated by flies, a beetle, Lepidoptera (Proctor et al. 1996 table 4.2 lists it as butterfly pollinated), and selfing. The following species are popular and are pollinated by insects:

Eupatorium maculatum reddish: Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) edwardsii 2x, Phyciodes pulchella camillus (blue flower), Danaus plexippus 5x. This is reportedly pollinated by honeybees, bumblebees, long-tongued moths, green bottle flies, butterflies, and stink bugs, even hummingbirds.

Eupatorium perfoliatum white: Euphyes conspicua 2x, Vanessa cardui. Reportedly visited by long-tongued moths, etc.

Eupatorium purpureum pink-purple: Atrytone arogos, Hesperia leonardus ssp. occasionally [includes “bonehead” meaning Boneset] (Scott and Stanford 1981), Strymon melinus. This is reportedly pollinated by bees and butterflies, and it self-pollinates.

Eupatorium rugosum white: Danaus plexippus 2x, Pieris rapae.

Euryops pectinatus “viridis” yellow is evidently popular but I have seen few of these garden plants: Pontia protodice, Vanessa cardui. It is reportedly pollinated by bees including honeybees, and visited by beetles and flies.

Gaillardia aristata Xgrandiflora petals red with yellow tips: Colias eurytheme.

Gaillardia aristata yellow with red-purple base: Argynnis (Speyeria) aphrodite 19x, Argynnis (Speyeria) callippe 14x, Argynnis (Speyeria) coronis, Argynnis (Speyeria) edwardsii 2x, Argynnis (Speyeria) hesperis 25x (incl. 1x ray bases orange then yellow beyond and 10x red-centered), Argynnis (Speyeria) mormonia, Atalopedes campestris 2x, Atrytone arogos, Cercyonis pegala, Chlosyne gorgone 3x, Chlosyne nycteis, Colias alexandra 7x, Colias edwardsii altiplano, Colias eurytheme 10x, Colias philodice 2x, Euphydryas anicia capella 38x (6 had yellow thorax due to Gaillardia pollen), Euptoieta claudia 11x incl. Janet Chu, Hesperia viridis, Oarisma garita 4x incl. Janet Chu, Parnassius phoebus smintheus 4x, Phyciodes cocya 2x, Phyciodes tharos orantain, Poladryas minuta near-minuta (yellow with orange base), Polites mystic.

Gaillardia pulchella reddish with yellow apex (cultivated): Colias eurytheme 2x, Colias philodice, Polites mystic (long pink center and pink petals) 6x, [Polites peckius none seen on it], Pyrgus communis. Reportedly pollinated by bees, other insects, and butterflies.

Gazania longiscapa yellow with uv center: Vanessa cardui. Whitish flower: Pyrgus communis. Orange-yellow flower: Pieris rapae landed on and flew (poor nectar). Gazania krebsiana is reportedly pollinated by bees, bee flies, beetles, butterflies, and ants, so at least the bees surely pollinate.

(Gnaphalium palustre white is uncommon and unpopular, with no records. Gnaphalium uliginosum is pollinated by insects in Europe. Gnaphalium [Pseudognaphaliu] canescens is pollinated by many small bees and other insects. Gnaphalium [Pseudognaphaliu] obtusifolium nectar attracts primarily short-tongued bees (mainly Halictidae), wasps [Eumenids, Crabronids, paper wasps, spider wasps, cuckoo wasps, weevil wasps, and many others], and flies [Hilty 2013].)

Grindelia squarrosa yellow: Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) callippe, Argynnis (Speyeria) edwardsii, Argynnis (Speyeria) hesperis, Atrytone arogos 2x, Cercyonis meadii (two for only 1 sec.), Cercyonis oetus Janet Chu, Colias eurytheme 3x, Colias philodice 21x. Erynnis afranius, Euphyes vestris, Euptoieta claudia 6x incl. Janet Chu (but one approached it but did not land), Hesperia comma 80x, Hesperia leonardus pawnee 4x, Hesperia uncas 4x, Lycaena helleoides, Neophasia menapia 2x, Ochloides sylvanoides 29x, Papilio indra, Phyciodes batesii apsaaloke, Phyciodes cocya, Phyciodes
Helianthus pumilus, Helianthus petiolaris, Helianthus annuus.

Grindelia stricta yellow: Lycaena xanthoides nigromaculata ~135x, Junonia coenia yellow 3x.

Grindelia subalpina yellow: Poladryas minuta arachne.

Grindelia yellow: Ochlodes yuma (Scott, Shields, and Ellis 1976).

Gutierrezia sarothrae and specialist bees are more effective pollinators pollinated by specialist and generalist bees Opler 1990 and 1991.

Visitors of lesser importance include bee flies, butterflies, skippers, and some andrenid bees; specialist bees that visit only Helianthus (Andrena accepta, A. helianthi, [A. aliciae elsewhere], Dufourea marginata, Melissodea agilis, and Pseudopanurgus rugosus) also pollinate it; visitors of lesser importance include bee flies, butterflies, skippers, and Chauliognathus pennsylvanicus beetles (Hilty 2013). The bee Eumegachile (Sayapis) pugnata specializes on Asteraceae and helps pollinate Helianthus (Frolich and Parker 1983).

Helianthus is not a very popular flower despite its abundance. In Illinois long-tongued bees are the most important pollinators of Helianthus spp., including honeybees, bumblebees Bombus, digger bees (Melissodea) and leaf-cutter bees (Megachile), short-tongued bees including halictid bees, alkali bees, and some andrenid bees; specialist bees that visit only Helianthus (Andrena accepta, A. helianthi, [A. aliciae elsewhere], Dufourea marginata, Melissodea agilis, and Pseudopanurgus rugosus) also pollinate it; visitors of lesser importance include bee flies, butterflies, skippers, and Chauliognathus pennsylvanicus beetles (Hilty 2013). The bee Eumegachile (Sayapis) pugnata specializes on Asteraceae and helps pollinate Helianthus (Frolich and Parker 1983).

Helianthus annuus yellow: Argynnis (Speyeria) nokomis 2x, Chlosyne gorgone 2x, Colias edwardsii alitiplano 2x, Colias philodice, Danaus plexippus 2x, Hesperia leonardus pawnee 2x (incl. Paul A. Opler), Papilio multicaudata briefly, Phyciodes thoras tharos 2x, Vanessa cardui. In Texas it is pollinated by specialist and generalist bees; large bees are more effective than small ones, and wild bees and specialist bees are more effective pollinators than honeybees and bumblebees (Neff and Simpson 1990; Parker 1981).

Helianthus divaricatus yellow: Anclyoxypa numitor [not Hel. tuberosus?], Boloria selene nebraskensis, Colias eurytheme, Colias philodice 4x, Colias philodice Xeurytheme, Phyciodes diminutor.

Helianthus nuttalii yellow: Lycaena hyllus, Strymon melinus, Vanessa cardui, Zerene cesonia, Chlosyne chinatiensis 2x.

Helianthus petiolaris yellow: Argynnis (Speyeria) callippe ~10x, Argynnis (Speyeria) cybele charlottii, Chlosyne gorgone 2x, Colias eurytheme 6x, Colias philodice 3x and 1x only 1/2 sec., Hemiariguus isola 1 sec., Hesperia comma 3x, Hesperia leonardus pawnee 2x, Limenitis weidemeyerii?, Lycaena rubidus 4x, Phyciodes pulchella camillus, Plebejus icarioides, Pyrgus communis 1/2 sec., Vanessa cardui, Wallengrenia egeremet. The bee Martinapis visits this.

Helianthus pumilus yellow: Argynnis (Speyeria) callippe, Asterocampa celtis jeffermont 3x, Atrytone arogos 11x, Chlosyne gorgone 5x, Chlosyne palla calydon, Colias eurytheme, Colias philodice, Erebia epipsodea, Euphydryas anicia capella 15x, Euptoieta claudia 6x, Hemiariguus isola, Hesperia comma,
Hesperia viridis 4x, Lycaena arota 5x, Neominois ridingsii 3x, Ochlodes sylvanoides, Oeneis chryxus 3x, Papilio glaucus rutulus, Papilio indra, Papilio polyxenes 1x + 2 sec., Papilio zelicaon, Pholisora catullus, Phyciodes cocyta, Phyciodes myliitta arizonensis (like Helianthus humilis yellow but leaves hairless), Phyciodes pulchella camillus, Piruna pirus, Plebejus icarioiides, Polites origenes 6x, Pontia protodice 2x.

Helianthus tuberosus yellow: Ancyloxypha numitor 6x, Colias eurytheme 23x, Colias philodice 4x, Danaus plexippus 3x, Euptoieta claudia 3x, Lycaena hylas 2x, Papilio polyxenes, Phyciodes diminutor, Phyciodes tharsos tharos 31x, Pontia protodice 2x, Vanessa atalanta, Vanessa cardui 8x, Vanessa virginiana.

Helianthus yellow: Colias eurytheme, Ochloides yuma (Scott, Shields, and Ellis 1976).

Heliopsis helianthoides yellow: Ancyloxypha numitor, Atrytone arogos, Colias eurytheme, Lycaena hylas, Nathalis iole 2x, Phyciodes diminutor 47x.

Heterotheca yellow is one of the best butterfly flowers in Colorado, as it it very abundant almost everywhere and is popular. (There may just be one species instead of the three Heterotheca “species” listed below.) H. subaxillaris [in Colorado as H. latifolia] is visited by numerous bees that pollinate it, notably the specialist colleted bee Colletes mandibularis (which evidently visits only Asteraceae), and occasionally by Hesperia butterflies in Texas; 97% of visits are bees, by that Colletis mandibularis specialist, plus Andrenidae (Andrena flexipes, Halictidae (Dialictus, Augochloropsis mandibularis metallic), Megachilidae (Heriades variolosa, Megachile albitarsus), Apidae (Apis mellifera honeybees, Ceratina diodonta, Bombus pennsylvanicus bumblebees), and Xylocopidae (Xylocopa micans) (Olsen 1997).

Heterotheca canescens yellow: Amblyscirtes eos, Atalopedes campestris ~17x, Chlosyne gorgone, Colias eurytheme 4x, Colias philodice 5x, Euptoieta claudia 2x, Hemiarus isola, Hesperia comma 2x, Hesperia ottoe, Liberata eufala 12x, Nathalis iole ~20x, Nathalis iole 2x, Phyciodes tharsos orantain, Phyciodes tharos tharos, Pieris rapae, Plebejus alpinus texanus 5x, Polites sauleti, Pontia protodice 2x, Pyrgus communis 5x, Strymon melius.

Heterotheca pumila yellow: Argynnis (Speyeria) monomoria 32x, Colias meadii 5x, Erebia callias, Erynnis fundalis, Euptoieta claudia, Hesperia comma colorado 18x, Lycaena florus 39x, Lycaena heteroea 16x, Oeneis calais alticordillera 2x, Parnassius phoebeus smintheus 3x, Parnassius phoebeus hermodur 6x, Pieris rapae, Plebejus glandon 12x, Plebejus saepiolus 2x, Polites draco 2x, Pontia callidices occidentalis 3x, Vanessa cardui.

Heterotheca villosa yellow is extremely common and also popular: Aglais milberti, Amblyscirtes vialis, Anartystone logan lagus, Apodemia mormo puebla 2x, Apodemia nais several, Argynnis (Speyeria) aphrodite 5x, Argynnis (Speyeria) altis sorocco, Argynnis (Speyeria) callippe 21x, Argynnis (Speyeria) coronis 3x, Argynnis (Speyeria) edwardsii 3x, Argynnis (Speyeria) hesperis 14x + 1x briefly, Argynnis (Speyeria) hydaspe, Argynnis (Speyeria) zere, Argyynnis (Speyeria) coronis carolas several, Atrytone arogos 9x, Calliphryus dumetorum homoperplexa, Callophryus gryneus siva 4x, Cercyonis meadii 350x, Cercyonis oetus 148x (they prefer Aster porteri white), Cercyonis pegala 2x, Chlosyne gorgone 7x, Chlosyne leonira fulvia several, Coenonympha tulla 5x, Colias almeida 3x, Colias edwardsii alitiplo, Colias eurytheme 36x, Colias meadii 2x, Colias philodice ~32x, Erynnis afranius 4x, Erynnis maritalis, Erynnis maritallis, Erynnis pacuvius, Erynnis persius 3x, Eucloe aeusnides, Euphilotes ancilla barnesi 3x, Euphydryas anicia capella 25x, Euphyes vestris 8x, Euptoieta claudia 20x incl. Janet Chu, Hemiargus isola 2x, Hesperia comma 203x, Hesperia comma colorado 15x, Hesperia juba 3x, Hesperia leonardus montana 11x, Hesperia leonardus pownee 4x (incl. Paul A. Opler), Hesperia pahaska 1x, Hesperia uncas 6x, Hesperia viridis 9x, Lycaena arota 17x, Lycaena florus, Lyceana heteroea? 15x, Lyceana rubidus 9x, Lyceana xanthonides “edita” vurali, Neominois ridingsii 5x, Neominois ridingsii wyoming, Neophasia menapia 6x, Oarisma garita 7x, Ochloides sylvanoides 54x, Papilio polyxenes, Papilio polyxenes rudkini, Papilio zelicaon, Parnassius phoebeus smintheus 4x, Pholisora catullus 2x, Phyciodes cocyta 7x, Phyciodes pallida 2x, Phyciodes picta 4x, Phyciodes pulchella camillus 37x, Pieris rapae 3x, Piruna pirus 2x, Plebejus alpinus texanus 3x, Plebejus glando, Plebejus icarioiides 2x incl. Janet Chu, Plebejus melissa 14x, Plebejus shasta minnehaha ~5x, Poanes taxiles 2x, Poladryas minuta arachne 91x,
Poladryas minuta near-minuta, Polistes mysticus, Polistes origenes 3x, Polygonia gracilis zephyrus?, Pontia callidice occidentalis 3x, Pontia protodice 11x incl. Janet Chu, Pyrgus communis 12x, Pyrgus scriptura 4x, Satyrium behrii 4x, Satyrium saepium 5x, Satyrium titus 3x, Strymon melinus 7x, Vanessa cardui 11x.

Hymenopappus filifolius yellow: Callophrys eryphon, Callophrys gryneus siva 3x, Coenonympha tullia 3x, Euptoieta claudia 2x, Eurema nise female on, Glaucopsyche lygdamus, Hemiarus isola, Hesperia pahasaka 2x, Hesperia uncas 4x, Neominois ridingsii 4x, Notamblyscirtes simius 1x, Phyciodes pulchella camillus 2x, Plebejus melissa, Poladryas minuta arachne 4x, Pontia protodice 3x, Pyrgus communis 1x, Satyrium californica.

Hymenoxys (Tetraneuris) acaulis yellow: Callophrys eryphon, Erynnis afrarius 3x, Glaucopsyche lygdamus, Hemiarus isola, Neominois ridingsii male, Phyciodes pulchella camillus, Plebejus melissa 2x, Poladryas minuta arachne, Polistes (Yvette) rhesus 3x, Pontia callidice occidentalis, Pyrgus communis.

Hymenoxys (Tetraneuris) brevifolia yellow: Argynnis (Speyeria) mormonta, Euphydryas anicia brucei, Papilio zelicaon, Parnassius phoebus hermodur.

Hymenoxys grandiflora yellow: Boloria improba acrocemna (Scott 1982), Argynnis (Speyeria) mormonta 2x, Boloria titanias, Colias meadii 2x, Erebia callias 2x (one male of these covered with pollen), Euphydryas anicia brucei 7x (and male thorax uns covered with its pollen), Euphydryas anicia capella, Hesperia comma colorado, Parnassius phoebus smintheus 2x, Plebejus glandon, Polistes draco, Pyrgus centaureae, Vanessa cardui. This is pollinated by bumblebees (Bombus appositus, B. flavifrons, B. huntii, B. melanopus) and the syphid fly Eristalis hirta (Rocky Mountain Biological Lab, Gothen Colorado), and surely by Euphydryas anicia sometimes.

Hymenoxys richardsoni yellow: Lycaena arota (pollinating it, covered with the pollen), Paratrytone snowi [not Hymenopappus filifolius] 4x, Vanessa cardui.

(Iva xanthifolia has small ugly flowers and is not visited. It is wind-pollinated and the pollen is a major cause of hay fever.)

(Krigia is very rare in Colorado so I have no records. The bee Andrena krigiana specializes on it.)

Kuhnia eupatoroides white: Plebejus melissa. This is insect-pollinated.

Lactuca serriola yellow is not popular: Pholisora catullus, Piers rapae 4x. This (and Lactuca sativa the domesticated version of L. serriola) self-pollinate most of the time, but are also pollinated by visiting generalist insects, mostly Hymenoptera and flies. A bee Andrena humilis specializes on the Lactuceae subgroup of Asteraceae in Europe (Franzen and Larsson 2007).

(Lepidotheca suaveolens) weeds in my yard have tiny yellow flowers that are not visited.

Leucelene ericoides=Aster arenosus white: Chlosyne leanira alma, Hesperia pahasaka, Pontia callidice occidentalis.

Liatris is surely pollinated in part by butterflies. Liatris olinggae is reportedly pollinated by butterflies. Liatris cylindracea is visited by long-tongued bees, butterflies, skippers, and bee flies (short-tongued bees visit but are not effective pollinators); and Liatris aspera pollinator visitors are primarily long-tongued bees (honeybees, bumblebees, little carpenter bees, miner bees, leaf-cutting bees), butterflies (Danaus plexippus, Vanessa cardui, Papilio polyxenes), skippers, and bee flies, while green metallic bees also visit and Halictine bees collect mostly pollen but are not effective pollinators (Hilty 2013). In Florida, Liatris pauciflora (and the closely-related Carphophorus corymbosus) are pollinated by butterflies and their flower heads bend to face upward favoring butterflies, while Liatris gracilis, L. tenuifolia, and L. laevigata are pollinated mostly by bees (Lopera-Blair 2011).

Liatris ligulistylis purplish: Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) hesperis 10x, Hesperia leonardus ssp. occasionally on this and other Liatris species (Scott and Stanford 1981).

Liatris punctata purplish is very popular: Amblyscirtes eos 6x, Argynnis (Speyeria) aphrodite 54x, Argynnis (Speyeria) coronis 3x, Argynnis (Speyeria) edwardsii 9x, Atalopedes campestris 4x, Atrytone arogos 15x, Battus philenor 4x, Cercyonis pegala 18x, Colias edwardssii alitiplano 8x, Colias eurysteme 28x, Colias philodice 14x, Danaus plexippus 3x, Erynnis horatius, Euptoieta claudia 15x, Hemiarus isola, Hesperia attalus, Hesperia comma 274x, Hesperia juba 2x, Hesperia leonardus leonardus many (Steve Spomer and Tim Warwick), Hesperia leonardus montana 595x, Hesperia leonardus pawnee 256x (main flower, Scott and Scott 1978), Hesperia leonardus ssp. abundant on in Colo., Neb., Minn., Mich., N.J. (Scott and
Stanford 1981), Hesperia uncas 5x, Hesperia viridis, Lerodea eufala 2x, Ochlodes sylvanoides 22x, Papilio glaucus rutilus, Papilio machaon brucei, Papilio multicaudata very briefly, Papilio polyxenes 11x (one for f, pseudoamericanus), Phoebis agarithe, Phyciodes pulchella camillus, Pieris rapae, Plebejus melissa 3x, Polites peckius 59x, Polites themistocles 9x, Pyrgus communis 10x, Strymon melinus 10x, Vanessa cardui 21x, Vanessa virginiensis.

Lygodesmia juncea pink: Hesperia uncas tommich 1 sec., Notamblyscirtes simius, Plebejus melissa, Pontia protodice. This is pollinated by many insects including bees and perhaps even beetles.

Machaeranthera bigelovii purple/violet: Danaus plexippus [?Machaeranthera bigelovii, blue], Hesperia comma 2x, Hesperia pahaska 2x, Neophasia menapia [“Aster” prob. M. bigelovii], Polygonia faunus 3x, Vanessa carye.

Machaeranthera canescens deep blue/purple: Colias eurytheme 32x, Colias philodice 151x (and var. rubrotinctus 1x blue), Hesperia comma 3x, Lycaena helioides 15x, Ochlodes sylvanoides, Phyciodes pulchella camillus blue 2x and var. rubrotinctus blue 2x, Phyciodes tharos oran-tain, Pieris rapae, Polites sabuleti 2x, Pontia protodice, Pyrgus communis 3x, Argynnis (Speyeria) aphrodite. Reportedly pollinated by honeybees, bee flies Bombyliidae, and the butterfly Pieris rapae.

Machaeranther a grindelioides yellow: Phyciodes Batesi anasazi.

Machaeranthera pattersoni purple/violet: Argynnis (Speyeria) aphrodite, Colias eurytheme blue 19x, Colias philodice blue 55x, Euphotia claudia, Hesperia comma 55x, Hesperia leonardus montana blue 13x, Lycaena helioides blue 9x, Nathalis iole. Neophasia menapia 3x, Ochlodes sylvanoides 12x (+2x for M. “pattersoni/canescens”), Phyciodes pulchella camillus 17x, Pieris rapae blue 5x, Plebejus glandon, Poladryas minuta arachne 1 sec., Pontia callidice occidentalis 2x, Pontia protodice, Pyrgus communis 7x, Vanessa atalanta, Vanessa cardui 4x.

Machaeranthera annua=phyllocephala yellow: Colias eurytheme, Pieris rapae, Pyrgus communis 3x.

Machaeranthera pinnatifida=Haplopappus spinulosus yellow: Euphydryas anicia weecoeut, Notamblyscirtes simius, Phyciodes pulchella camillus, Plebejus melissa, Pyrgus communis 3x. Cuckoo bees (Anthophorinae) and megachilid bees (Anthidium) and other bees visit this.

Machaeranthera tanacetifolia blue-purple: Colias eurytheme, Colias philodice, Pontia protodice, Pyrgus communis.

Matricaria inodora white: Pieris rapae.

Onopordum acanthium rose-purple is spreading and still uncommon but popular: Argynnis (Speyeria) edwardsii, Vanessa cardui. Reportedly pollinated by bumblebees and probably some other bees.

Osteospermum near “Buttermilk” whitish petals lavender at base: Vanessa cardui. Osteospermum is pollinated by honeybees and other bees, and butterflies and flies also visit.

?Pectis angustifolia (doubtfully Dysso-dia papposa which has dissected leaves) yellow tiny Asteraceae 10 cm tall with filamentous leaves: Nathalis io 2x.

Pericome caudata yellow: Cercyonis pegala 4x, Hesperia viridis, Lycaena arota 130x, Ochlo-des yuma anasazi 12x, Vanessa cardui 3x.

(Podsospermum laciniatum yellow weeds near my yard are not visited.)

Psilostrophe sparsiflora yellow: Euphotia claudia 5x, Eurema nicippe.

Ratibida columnifera yellow: Atrytone aro-gos 2x, Colias eurytheme 2x, Danaus plexippus, Lycaena dione, Polites orogenes (purple flower), Vanessa atalanta. The most frequent pollinator in Kansas is the bee Andrena rudbeckiae (www.fs.fed.us/database) (which is a specialist pollinator of Rudbeckia and Ratibida), and honeybees pollinate garden varieties; numerous bees species visit it in Illinois (Robertson 1929).

Ratibida pinnata yellow: Colias philodice 2x, Euphotia claudia.

Rudbeckia hirta yellow: Apodemia nais, Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) atlantis sorocket 31x, Argynnis (Speyeria) callippe, Argynnis (Speyeria) hesperis 40x, Argynnis (Speyeria) hesperis nausicaa, Argynnis (Speyeria) mormonia 2x, Argynnis (Speyeria) mormonia luski, Argynnis (Speyeria) nokomis, Atrytone aro-gos, Callophrys dumetorum homopterplexa, Callophrys gryneus siva, Cercyonis oetus 12x, Cercyonis pegala 2x, Chlosyne gorgone 3x, Chlosyne nycteis 9x, Chlosyne palla calydon 3x, Colias alexandra 3x, Colias eurytheme 6x, Danaus gilippus, Euphydryas anicia capella 4x, Euphotia claudia.
Senecio aureus

Buddleja ardens 

Lycaena phlaeas, Euphyes vestris, Cercyonis oetus, Erynnis telemachus, Coenonympha silvicola pollinated by butterflies amplectens the nodding species Colorado, which surely pollinate cardui Polygonia smintheus, Euphydes yorksi, and Andrena in Illinois likely pollinators are native bees in particular Andrena aliciae and halictid bees (Diamond et al. 2006). In Illinois Rudbeckia triloba attracts bumblebees, numerous bees (Ceratina, Melissodea, Triepeolus, Coeloxyx, Megachile, Andrena, Heterosarua, and halictid bees including green metallic bees, plus Andrena Rudbeckiae which is a specialist pollinator of Rudbeckia and Ratibida flowers; it also attracts sphцcids and vespid wasps, many flies (syrrhids, bee flies, thick-headed flies, Tachinidae) plus butterflies, and Chauliognathus pennisylvanicus beetles (Hilty 2013). Butterflies and honeybees also visit Rudbeckia fulgida. The bee Heterosarua rudbeckiae specializes on Rudbeckia.

Rudbeckia laciniata ampla yellow: Apodemias nais, Argynniss (Speyeria) aphrodite 9x, Argynniss (Speyeria) atlantis soroko 6x, Argynniss (Speyeria) callippe 33x, Argynniss (Speyeria) edwardisii (=Rudbeckia laciniata hortensis yellow with yellowish centers), Argynniss (Speyeria) hesperis 134x (favorite), Argynniss (Speyeria) hesperis tanaitis 21x, Argynniss (Speyeria) nokomis, Argynniss (Speyeria) zere 8x, Cercyonis oetus 40x, Cercyonis pegala, Chlosyne nycteis 23x, Colias alexandra, Eparygeus clarus, Euphyes vestris, Euptoieta claudia, Hesperia comma, Lycaena arota 11x, Lycaena heteroea, Neophasia menapia 6x, Ochridipsa sylvanoiodes 5x, Oeneis chryxus, Papilio glaucus rutulus, Parnassius boebeus smintheus, Phyciotes batesii anusazi 11x, Phyciodes pallida, Polyogynia graecilis zephyrus 4x, Pyrgus communis, Satyrium behrii, Satyrium calanus 5x, Speyeria americana 6x, Speyeria zelicaon 5x, Vanessa cardui 4x, Vanessa carre 2x, Vanessa virginiensis 5x. Rudbeckia auriculata “most likely” pollinators are native bees in particular Andrena aliciae and halictid bees (Diamond et al. 2006).

(Senecio occidentalis montana) is frequently visited by bumblebees Bombus bifarius and B. fravifrons in Colorado, which surely pollinate it.

Senecio are common and very popular flowers, except that subgenus/genus Ligularia is not visited because the flowers droop downward and evidently attract other insects (Dodson and Dunmire 2007 claims that the nodding species Senecio [Ligularia] bigelovii is pollinated by “flies, beetles, butterflies and moths”, but I have no records of butterflies visiting the nodding species even where Senecio [Ligularia] amplectens is common, although Schmitt [1980] saw them [see below]). Senecio are reportedly pollinated by butterflies, but also by bees as the bee Andrena gardineri specializes on Senecio. The three Senecio species that Schmitt (1980) studied in Colorado (noted below) were visited by bumblebees also, so bumblebees were surely the most important pollinators, although butterflies dispersed the genes (pollen) farther than bumblebees.

(Senecio [Ligularia] amplectens yellow was studied by Schmitt [1980], who observed visits by Bombus silvicola bumblebees and the butterflies Parnassius, Colias, and Argynniss [Speyeria].)

Senecio atratus yellow: Argynniss (Speyeria) mormonia 13x, Boloria titania, Colias meadii, Lycaena floraus 21x, Lycaena heteroea 9x, Lycaena rubidus 2x, Vanessa cardui 2x, Erebia epipsodea 1x + form brucei 1x, Oeneis calais altacordillera 5x, Parnassius boebeus hermodur ½ sec., Pieris marginalis mcannoughii, Plebejus glandon 11x, Plebejus saepiolus.

Senecio aurus yellow: Phyciotes diminutor.

Senecio (Packera) canus yellow: Aglaia milberti 2x, Argynniss (Speyeria) callippe 2x, Argynniss (Speyeria) mormonia, Boloria euonoma, Callophrys dumetorum homoprelaxa 2x, Callophrys augustinus, Callophrys erynhus, Calliphryg Gryneus siva 2x, Celastrina lucia sidara, Chlosyne gorgone 22x, Coenonympha tullia 2x (plus one only ½ sec.), Colias eurytheme 2x, Colias philodice 2x, Erebia callias, Erebia epipsodea 2x, Erynnnis brizo 2x, Erynnnis martialis 5x, Erynnnis pacuvis 11x, Erynnnis persius 16x, Erynnnis telemachus 4x, Euchloe ausonides 2x, Euphydryas anicia brucei, Euphydryas anicia capella 14x, Euphydryas bernadetta bernadetta 5x, Euptoieta claudia 2x, Hesperia juba 2x, Hesperia nevada (another
left after \( \frac{1}{4} \) sec.), Oarisma garita, Oeneis chryxus 3x, Papilio polyxenes 2x, Papilio zelicaon 7x, Parnassius phoebus smintheus 30x, Parnassius phoebus hermodur 3x, Phyciodes pallida, Phyciodes pulchella camillus 19x, Plebejus saepiolus, Poladryas minuta arachne 2x, Polites draco, Polygonia gracilis zephyrus 13x (one male had yellow pollen on uns), Pontia calilidice occidentalis, Pyrgus communis, Sringa morrisoni, Srymon melinus 2x.

Senecio crassulus yellow: Aglais milberti, Argynnis (Speyeria) mormonia 9x, Boloria eunomia, Boloria titania (orange or yellow-orange) 7x, Colias eurytheme, Colias meadii 21x, Colias scudderii 24x, Erebia epipsodea 32x (incl. form brucei 2x), Euchloe ausonides, Euphydryas anicia brucei 2x, Oeneis calais altacoldillera 2x, Pieris marginalis mdcunnoughii 8x, Plebejus glandon, Plebejus saepiolus 2x, Plebejus saepiolus 4x, Polites draco 2x, Pontia callidice occidentalis, Pyrgus centaureae 5x, Vanessa atalanta, Vanessa cardui 34x, Vanessa caraye. Schmitt (1980) saw Bombus frigidus, B. flavifrons, B. kirbevellis, and B. silvicola bumblebees, and the butterflies Parnassius, Colias, Pieris, Vanessa, and Argynnis (Speyeria) visit it.

Senecio (Packera) crocophyllus orange-red to yellow: Boloria titania.

Senecio (Packera) dimorphophyllus yellow: Argynnis (Speyeria) mormonia 3x, Boloria eunomia, Boloria titania 11x, Coenonympha tallia, Colias meadii 3x, Colias scudderii 2x, Erebia epipsodea 2x, Erebia stubbendorfi "theano" demmia, Lycaena cupreus snowi 3x, Parnassius phoebus hermodur, Plebejus saepiolus, Pyrgus centaurea 6x, Vanessa cardui.

Senecio eremophilus kingii pinnate yellow: Argynnis (Speyeria) zerene platina.

Senecio (Packera) fendleri yellow: Aglais milberti, Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) callippe 5x (incl. much pollen on body), Argynnis (Speyeria) coronis 2x, Argynnis (Speyeria) edwardsii, Argynnis (Speyeria) hesperis, Callophrys dumetorum homoperplexa 4x, Callophrys gryneus siva 9x, Celastrina lucia sidara, Chlosyne gorgone 51x, Chlosyne palla calydon 2x, Coenonympha tallia 15x, Colias eurytheme 4x, Colias philodice, Erebia epipsodea, Erynnis afranius 2x (plus one \( \frac{1}{2} \) sec.), Erynnis brizo (Senecio fenderi Xcanus yellow), Erynnis icelus, Erynnis martialis, Erynnis pacuvius 6x, Erynnis persius 22x, Erynnis telemacllus 2x, Euchloe ausonides, Euphydryas anicia capella 63x, Euphydryas editha, Euptoieta claudia 9x, Glaucoptysche lydamus, Hesperia pahaska, Hesperia uncas, Oarisma garita 4x, Oeneis chryxus 4x, Oeneis uhleri 3x, Papilio indra, Papilio polyxenes, Papilio zelicaon, Parnassius phoebus smintheus 43x (a male has much pollen from it, a female covered with its pollen, so they must pollinate it) and Parnassius phoebus smintheus [probably Senecio fenderi or S. canus] 97x (one pollinating it covered with yellow pollen), Phyciodes cocyta 5x, Phyciodes pallida, Phyciodes pulchella camillus 53x, Plebejus alupini texanus 4x, Plebejus glandon 2x, Plebejus icarioides 6x, Plebejus melissa 2x, Pyrgus communis 2x, Poladryas minuta arachne 16x, Polites (Yvretta) rhesus, Pontia callidice occidentalis 3x, Pontia protodice 7x, Sringa morrisoni, Vanessa cardui 17x.

Senecio fremontii var. blitoides yellow: Argynnis (Speyeria) mormonia 2x, Boloria eunomia, Boloria titania 3x, Chlosyne whitneyi damaetes 5x, Colias scudderii 4x, Erebia epipsodea 4x (incl. form brucei 1x), Lycaena cupreus snowi 14x, Parnassius phoebus smintheus, Plebejus glandon, Pyrgus centaureae.

Senecio integerrimus yellow: Aglais milberti, Argynnis (Speyeria) hydaspe 2x, Argynnis (Speyeria) mormonia 19x, Argynnis (Speyeria) zerene 3x, Boloria selene tollandensis 2x, Boloria titania, Chlosyne gorgone 5x, Colias edwardsii altiplano, Erebia eurytheme, Erynnis persius 5x, Euchloe ausonides, Euphydryas anicia capella 2x, Glaucoptysche piasus, Papilio zelicaon, Parnassius phoebus smintheus, Phyciodes pulchella camillus 2x, Plebejus saepiolus, Poladryas minuta arachne, Polygonia gracilis zephyrus, Pyrgus centaureae 2x, Sringa morrisoni, Vanessa cardui 3x. Schmitt (1980) saw Bombus bifarius bumblebees, and observed the butterflies Colias, Pieris, Erebia [epipsodea], Papilio, Danaus, Euphydryas, Coenonympha [tullia], and Vanessa visiting it.

Senecio ~pauperculus yellow, leaves coarsely serrate: Danaus plexippus.

Senecio (Packera) platennis yellow: Plebejus icarioides, Plebejus melissa, Polites (Yvretta) rhesus 2x.

Senecio (Packera) pseudaureus orange-red: Argynnis (Speyeria) mormonia, Phyciodes cocyta selenis (yellow flowers).

Senecio spartioides yellow: Apyrrothrix araxes (~S. spartioides), Cercyonis meadii 1x, but ignored it 3x, Cercyonis meadii, Chlosyne gorgone, Colias eurytheme, Colias eurytheme 7x, Colias philodice 5x,
Solidago (Euthamia) gymnospermoides, Hesperia comma 5x, Hesperia leonardus pawnee 3x, Libythea carinenta bachmannii, Limenitis weidemeyeri, Lycaena hallowides 2x, Phyciodes pulchella camillus 2x, Phyciodes thoros orantain 2x, Pieris rapae 3x, Poladryas minuta near-minuta, Pontia protodice, Pyrgus communis 3x, Satyrium titus, Strymon cestri (~S. spartioideis), Vanessa atalanta.

Senecio (Packera) streptanthifolius yellow: Coenonympha tullia.

Senecio triangularis yellow: Aglais milberti 2x, Argynnis (Speyeria) atlantis sorrocko ~4x, Argynnis (Speyeria) callipe, Argynnis (Speyeria) coronis 3x, Argynnis (Speyeria) hesperis irene, Argynnis (Speyeria) hesperis many 2x, Argynnis (Speyeria) hydaspe 3x, Argynnis (Speyeria) mormonia 4x, Argynnis (Speyeria) zere ne 21x, Boloria alaskanensis halli, Boloria epiphore 2x, Boloria titania 2x, Callophrys dumentorum homoperplexa, Callophrys eryphon, Cercyonis gryneus nelsoni, Cercyonis oetus, Chlosyne gorgone 3x, Chlosyne hoffmanni, Chlosyne whitneyi damaetas 4x, Coenonympha haydenii, Coenonympha tullia, Colias meadii, Colias pelidne skinneri, Colias scudderi 2x, Colias scudderi harroweri 11x, Euphydryas anicia eurytont 2x, Eurema proterpia, Lycaena cupreus snowi, Lycaena floridens tall 2x, Lycaena heteroea, Lycaena mariposa, Lycaena nivalis, Microtia (Texola) elada, Neominois ridingis, Papilio zelicaon, Parnassius clodius, Phyciodes orseis orseis, Phyciodes pulchella camillus 2x, Phyciodes pulchella montana, Pieris marginalis mcdunnoughii ~15x, Plebejus glandon 2x, Plebejus saepiolus, Polygonia faunus ceveray, Polygonia gracilis zephyrus 2x, Vanessa cardui 4x, Vanessa carye.

Senecio (Packera) tridenticulatus yellow: Hesperia uncas, Phyciodes pulchella camillus, Plebejus melissa, Polites (Yvretta) rhesus, Pontia protodice, Pyrgus communis.

Senecio (Packera) werneriaefolius yellow: Colias scudderi, Lycaena cupreus snowi, Parnassius phoebus smintheus 2x, Pyrgus centaerae.

Senecio spp. yellow: Aglais milberti, Argynnis (Speyeria) callipe, Argynnis (Speyeria) coronis 3x, Argynnis (Speyeria) egleis 12x, Argynnis (Speyeria) hesperis irene, Argynnis (Speyeria) hesperis many 2x, Argynnis (Speyeria) hydaspe 3x, Argynnis (Speyeria) mormonia 4x, Argynnis (Speyeria) zere ne 21x, Boloria alaskanensis halli, Boloria epiphore 2x, Boloria titania 2x, Callophrys dumentorum homoperplexa, Callophrys eryphon, Cercyonis gryneus nelsoni, Cercyonis oetus, Chlosyne gorgone 3x, Chlosyne hoffmanni, Chlosyne whitneyi damaetas 4x, Coenonympha haydenii, Coenonympha tullia, Colias meadii, Colias pelidne skinneri, Colias scudderi 2x, Colias scudderi harroweri 11x, Euphydryas anicia eurytont 2x, Eurema proterpia, Lycaena cupreus snowi, Lycaena floridens tall 2x, Lycaena heteroea, Lycaena mariposa, Lycaena nivalis, Microtia (Texola) elada, Neominois ridingis, Papilio zelicaon, Parnassius clodius, Phyciodes orseis orseis, Phyciodes pulchella camillus 2x, Phyciodes pulchella montana, Pieris marginalis mcdunnoughii, Poladryas minuta arachne, Polygonia gracilis zephyrus 3x, Vanessa cardui many, Vanessa virginiensis.

Senecio? yellow: Erebia callias, Hesperia uncas, Hesperia viridis several, Oarisma garita, Poladryas minuta arachne 10x, Poladryas minuta near-minuta.

Solidago altissima “canadensis” yellow: Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) callipe 2x, Argynnis (Speyeria) coronis, Argynnis (Speyeria) hesperis 11x, Argynnis (Speyeria) mormonia, Asterocampa celtis jefferesi, Attryone aragos 56x, Callophrys gryneus siva 4x, Celastrina humulus hop-ecotype, Cercyonis oetus 14x, Cercyonis pegala 21x, Chlosyne gorgone 3x, Colias eurytheme 3x, Colias philodice 5x, Danaus plexippus 2x, Erynnis atrius, Euphydryas vestris 4x, Hesperia comma, Hesperia ottoe, Hesperia viridis, Limenitis weidemeyeri, Lycaena arotla, Lycaena florus, Lycaena hallowides, Lycaena heteroea 17x, Lycaena hyllus, Lycaena xanthoides “editha” vurali, Ochlodes sylvanoides 20x, Papilio eurymedon, Papilio polyxenes, Phyciodes coeya, Phyciodes pallida 2x, Phyciodes thoros orantain, Phyciodes thoros thoros, Pieris rapae 4x, Piruna pirus 4x, Polites origenes few, Polites peckius none, Polites sabuleti 2x, Polygonia faunus, Polygonia gracilis zephyrus 3x, Satyrium behrii 4x, Satyrium calanus 10x, Satyrium callinum 14x, Satyrium liparops 13x, Satyrium saepium 25x, Satyrium titus 42x, Strymon melinus, Vanessa atalanta 4x, Vanessa cardui 2x. Solidago species are most often bee pollinated. Solidago “canadensis” is pollinated by the wasp Polistes fuscatus and locust borer Megacyllene robiniae in Ohio (Blackwell and Powell 1981). In Illinois it is visited by 380 species of insects, and a wide variety visit for pollen or nectar including long- and short-tongued bees, wasps, flies, beetles, and a few butterflies and moths (Hilty 2013). The bees Andrena hirticincta, A. nubecula, A. simplex, A. solidaginis, and A. simulans armata specialize on Solidago (including Euthamia and Oligoneuron) and Aster, while A. placata specializes on Solidago (incl. Oligoneuron).

Solidago (Euthamia) gymnospermoide yellow: Colias philodice, Pieris rapae, Polites sabuleti.
Solidago missouriensis yellow: Argynnus (Speyeria) aphrodite 2x, Argynnus (Speyeria) hesperis, Atrytone arogos, Callophrys gryneus siva, Cercyonis meadii 2x, Cercyonis oetus 3x, Cercyonis pegala 7x, Chlosyne gorgone 2x, Colias eurytheme 3x, Colias philodice 7x, Euptoieta claudia, Hemiarus isola 2x, Hesperia comma 6x, Hesperia leonardus pawnee, Lycaena heteroea 13x, Lycaena hyllus 2x, Lycaena rubidus, Nathalis iołe, Neophasia menapia 3x, Ochloides sylvanoides 4x, Phyciodes picta, Phyciodes pulchella camillus, Phyciodes tharos orantain, Pieris rapae, Plebejus melissa 2x, [Polites themostocles and P. peckius did not visit this, except Polites peckius landed on it but did not feed], Polites sabuleti 4x, Polygonia gracilis zephyrus, Satyrium behrxx 3x, Satyrium calanus, Satyrium liparops 2x, Satyrium saepium 12x, Satyrium titus 12x, Syrmon melinus, Vanessa alantana.

Solidago multiradiata yellow: Argynnus (Speyeria) mormonia, Boloria titania 2x, Colias meadii, Erebia epipsodes, Lycaena florus 4x, Lycaena rubidus, 2x Lycaena xanthoides “editha” vurali, Plebejus glandon 6x.

Solidago nana yellow sprawling low mat: Cercyonis oetus 6x, Syrion melinus.

Solidago (Euthamia) occidentalis yellow: Chlosyne gorgone 2x, Colias eurytheme 2x, Colias philodice, Danaus plexippus 4x, Lycaena arota 395x, Lycaena helloides 4x, Lycaena hyllus 2x, Phyciodes pulchella camillus, Phyciodes tharos orantain 3x, Pieris rapae, Poladryas minuta arachne, Polites sabuletii 19x, Pontia protodice, Syrmon melinus 2x, Vanessa carye 2x.

Solidago (Oligoneuron) rigid yellow: Colias eurytheme, Colias philodice 13x, Danaus plexippus, Lycaena hyllus, Satyrium titus yellow, Syrmon melinus 2x, Vanessa cardui.

Solidago simplex var. nana=decumbens yellow: Aglais milberti, Argynnus (Speyeria) mormonia 6x (one after passing over 10 Achillea millefolium “lanulosa” white), Boloria titania 2x, Colias alexandra, Colias meadii 7x, Colias scudderii 5x, Erebia callias, Erebia stubbendorfii “theano” ethela 60x, Hesperia comma colorado, Lycaena florus 5x + another only 1-2 sec., Lycaena heteroea, Lycaena rubidus, Oeneis calais altacinellera 2x, Pieris marginalis mcdunnoughii 2x, Plebejus glandon 20x, Plebejus alupini lutzi, Plebejus shasta piikensis 5x, Poladryas minuta arachne 3x, Polygonia gracilis zephyrus, Pontia protodice, Syrmon melinus, Vanessa cardui.

Solidago yellow: Argynnus (Speyeria) hesperis, Argynnus (Speyeria) coronis carolae many, Atalopedes campestris, Atrytone arogos 2x, Boloria selene mtn.-sabilocollis Las Animas Co. CO, Callophrys gryneus siva, Celastrina neglecta cinerea, Cercyonis oetus, Colias eurytheme, Colias philodice, Danaus plexippus, Hesperia comma, Hesperia leonardus ssp. occasionally (Scott and Stanwood 1981), Libythea carinenta bachmanii 2x, Lycaena heteroea, Nathalis iołe many, Neophasia menapia 2x, Ochloides yuma, Phyciodes tharos tharos, Plebejus icarioides, Pontia protodice Janet Chu, Satyrium californica 2x, Satyrium saepium, Syrmon melinus, Vanessa carye.

Sonchus arvensis [oleraceus?] yellow: Euphyes dion. This is reportedly pollinated by honeybees and solitary bees and flies; it sometimes self-pollinates.

Sonchus uliginosus yellow: Danaus plexippus 2x, Ochloides sylvanoides, Polites peckius, Vanessa cardui.

Stephanomeria? yellow: Poladryas minuta near-minuta. Some Stephanomeria are self-pollinating, but most are pollinated presumably by insects.

Sunflower yellow (many undetermined genera and species): Aglais milberti 2x, Anatrytone logan lagus (rattie?), Apyrrothrix araxes (sunflower very-large-leaf), Argynnus (Speyeria) cybele carpenterii, Argynnus (Speyeria) hesperis electa (orange and yellow sunflowers) many, Argynnus (Speyeria) mormonia, Argynnus (Speyeria) nokomis 2x, Atalopedes campestris, Atalopedes campestris, Atlides halesus, Atryone arogos 2x Janet Chu, Boloria improba acrocnema 1x, Boloria titania 2x, Calephelis rawsoni arizonensis, Calephelis rawsoni arizonensis hispid-leaved, Chlosyne endeis several, Chlosyne jainais several, Chlosyne whitneyi damaetras 1x, Colias eurytheme, Colias meadii, Copaeodes aurantiaca, Danaus plexippus, Emesis ares (like Helianthus pumilus yellow but leaves hairless) 2x, Erebia stubbendorfii “theano” ethela two species, Euphydryas anicia capella, Euphydryas chalcedona mglashani-wheeleri, Euphydryas editha hutchinsi 4” [not Psilostrophe bakerti? a guess], Hylephila phyleus, Junonia coenia, Lerodea eufala, Microtia (Texola) elada, Neophasia menapia 2x, Ochloides sylvanoides, Oeneis bore taygete, Phoebis sennae, Plebejus glandon, Polites sabuleti, Polygonia faunus
11x, *Polygonia gracilis zephyrus*, *Pontia beckerii*, *Pontia protodice*, *Pyrgus philetas* (with dissected leaves), *Strymon melinus*, *Vanessa carye* 2x, *Vanessa virginiensis*.

*Tagetes erecta* yellow-orange: *Atalopedes campestris* 25x, *Hesperia leonardus pawnee*, *Polistes peckius* 4x, *Pyrgus communis*, *Vanessa carye*. *Tagetes* is reportedly pollinated by honeybees, bees, flies, beetles and butterflies.

*Tagetes patula* orange-yellow: *Atalopedes campestris* (orangish 4x, yellow 3x), *Colias eurytheme* 2x, *Colias philodice*, *Danaus plexippus* 1x (+ another 3 sec.), *Euptoieta claudia* 3x, *Hemiargus isola*, *Ochloides sylvanoides*, *Poladryas minuta arachne*, *Polistes peckius* orange 2x, *Polistes themistocles* (yellow-orange) 11x (but not very popular for this), *Pontra protodice* 1x + yellow with red center 2x, *Pyrgus communis* 8x (2 orange-yellow, rest orangish/orange), *Vanessa cardui* (yellow-orange) 13x.

*Tagetes tenuifolia* yellow: *Pyrgus communis* 2x.


*Thelesperma filifolium* yellow: *Hesperia uncas*, *Plebejus alupini texanus*, *Pontia protodice*, *Pyrgus communis*.


*Townsendia excasa* white: *Colias edwardsii aliplano*, *Colias philodice*. (*Townsendia aprica* is pollinated by solitary bees [9 sp. of metallic blue and green megachilid *Osmia* bees, and the anthophorid bee *Tetralonia fulvitarsus*, and other visitors are Apidae bees [*Ceratinia nanula*, *Nomada*, *Sylvahonia fulvitarsus*], the halictid bee *Lasiglossum*, the bees *Diaxys pomonae* and *Stelis parona*, plus a few flies [*Tepedino et al. 2004*]. *Townsendia spathulata* is reportedly pollinated by bumblebees.)

*Townsendia grandiflora* bluish-white: *Callophrys erophyn*, *Erynnis persius* 6x, *Euptoieta claudia*, *Papilio zelicaon* 2x.

*Townsendia hookeri* white: *Euchloe ausonides* 2x, *Oarisma garita*.

Verbesina encelioides golden-orange: Argynnis (Speyeria) aphrodite, Argynnis (Speyeria) edwardsii, Cladosyne gorgone 7x, Colias eurysthe 2x, Colias philodice 4x, Hesperia leonardus pawnee ~30x, Hesperia uncas, Polites sabuleti, Pontia protodice 2x, Pyrgus communis, Strymon melinus, Vanessa cardui. It sometimes self-pollinates. (This Verbesina is a major source of nectar for all butterflies in Texas, and it and other Asteraceae are commonly visited by the butterfly Chlosyne lacinia in Texas, which also visits Verbesina virginica, Heterotheca latifolia, Viguiera dentata, Gaillardia pulchella, Zexmenia hispida, Eysenhardtia texana, and seldom visits the unpopular Helianthus annuus, Lantana horrida, L. macropoda, and Rubus trivialis, and also visits mud, watermelon rind, carrion, and dung; Neck 1977).

Vernonia angustifolia purple: Hesperia leonardus ssp. occasionally (Scott and Stanford 1981). Internet photos show Vanessa cardui and Papilio glaucus on it. It is reportedly pollinated by bees and butterflies, and the bees Melissodea denticulata and M. vernoniae specialize on Vernonia. Vernonia baldwinii in Illinois is pollinated primarily by long-tongued bees including bumblebees (short-tongued bees collect nectar but are non-pollinating), butterflies (including Papilio and Colias) and skippers that visit for nectar, while other bee visitors are Epeoline cuckoo bees, and miner bees (Hilty 2013).

Viguiera (Heliomeris) multiflora yellow: Argynnis (Speyeria) hesperis 3x, Argynnis (Speyeria) hesperis electa, Argynnis (Speyeria) hesperis near ratonensis, Cercyonis oetus 3x, Colias philodice, Hesperia comma 9x, Lycaena arota, Ochloides sylvanoides 11x (+6x only 1-2 sec. each), Phyciodes batesii anasazi?, Pieris rapae, Plebejus melissa 2x, Pyrgus communis 2x, Strymon melinus.

Wyethia amplexicaulis yellow: Polygonia gracilis zephyrus. Wyethia amplexicaulis is reportedly pollinated by flies, bumblebees, native bees, and butterflies; it is frequently pollinated by Osmia californica and O. montana bees (which are specialists on Asteraceae flowers) (Cane 2005, 2011). Wyethia reticulata is pollinated chiefly by native bees (Ayres and Ryan 1999).

Wyethia –angustifolia yellow: Chlosyne whitneyi whitneyi. Bumblebees visit this.

Wyethia helenoides yellow: Coenonympha tullia california 3x, Euchloe auronides auronides, Junonia coenia 52x, Papilio zelicaon.

(Xanthium has tiny ugly greenish flowers and is wind-pollinated, so has no records.)

Zinnia angustifolia red: Polites peckius (not popular, and had no visits of Polites themistocles in several days.)

Zinnia elegans usually pink but varies from red to white to orange to yellow: Apyrrothrix araxes many, Argynnis (Speyeria) aphrodite (orange), Atalopedes campestris 38x (including yellow around pink, pink 10x, yellow 3x, small hybrid white 5x), Battus philenor several, Colias eurysthe (1x, pink 1x, red "Thumbelina Series" 1x), Danaus plexippus (?pink 1x, pink 1x), Epargyreus clarus (pink 1x, yellow with orange center 30 min. 1x), Euptoieta hegesia several, Hesperia pahaska small 9x, Hylephila phyleus 9x, Junonia coenia (small hybrids white), Lerema accius 4x, Ochloides sylvanoides (pink) common, Papilio multicaudata (orange and red) 5x, Papilio polyxenes (usually pink) 5x, Pieris rapae (pink 2x red 1x), Polites peckius 27x (crimson for 1x, red and orange 2x, pink for 7x, orange for 4x, yellow with orange center 1x, white for 1x), Polites themistocles 84x (crimson for 1x, violet-rose-red 3x, rose-white for 7x, pink for 57x, orange for 15x, yellow for 15x, yellow around pink 1x, white for 14x), Pontia protodice Thumbelina (pink), Pyrgus communis 7x (incl. yellow 3x, orange 2x), Strymon melinus 2x, Vanessa cardui 72x (incl. yellow 11x, yellow Thumbelina 1x, orangish-yellow 1x, orangish 2x, orange Thumbelina 1x, pink 7x, pink Thumbelina 12x, red 10x, red with yellow centers [yellow and white ones ignored] 3x, red center yellow outer 2x, purple 1x, white 1x), Vanessa carye (white with yellow center) 2x, Zerene cesonia. Honeybees pollinate Zinnia. Some internet sites say this flower is pollinated by butterflies more than by bees.

Zinnia grandiflora 5-10 cm roadside yellow-with-orange-center: Erynnis funeralis, Euptoieta claudia, Junonia evarete nigrosuffusa 10x, Vanessa cardui, Vanessa virginiensis (yellow with brown-red center). Zinnia ?pink or yellow: Copaeodes aurantiaca.

Zinnia small hybrids white: Vanessa cardui.

APIACEAE=UMBELLIFERAE
In general these are unpopular, although *Harbouria* and *Conium* and *Heracleum* are somewhat popular. Apiaceae usually have small scented flowers in large heads (umbels) that are visited by a wide range of small generalist pollinators (flies, mosquitoes, gnats, bees, beetles, butterflies and moths) (Dodson and Dunmire 2007, Judd et al. 2008). Sawflies and other wasps are frequent on the flowers. Honeybees and *Musca domestica* and *Calliphora* flies are used to pollinate Apiaceae in greenhouses (Angelica, and the edible genera *Anethum*, *Daucus*, *Petroselinum*, *Pimpinella*), while *Calliphora* is used to pollinate edible *Apium* and *Pastinaca* in greenhouses. *Zizia* (rare in Colorado) and *Thaspium* are pollinated by a specialist bee *Andrena ziziae* that visits mostly *Zizia trifoliata* and *Thaspium barbinode* and *T. trifoliatum* (Lindsey 1984) and also visits *Pastinaca*, *Polytaenia*, *Sanicula*, and *Taenidia*.

(*Aegopodium podagraria* “Variegata” white is common around houses but is shunned.)

*Aletes acaulis* yellow: *Callophrys dumetorum homoperplexa* 2x, *Callophrys augustinus iroides*, *Callophrys gryneus siva*, *Celastrina lucia sidara* 2x, *Oeneis chryxus*, *Polistes draco* (for *Aletes ~acaulis* [?anisatus] yellow). This is visited by bees (*Apis mellifera*, *Paregle*, *Dialictus*) (Sandy Friedley, Pollinator Conservation Digital Library).

*Aletes anisatus* yellow: *Oeneis chryxus*.

*Anethum graveolens* yellow: *Celastrina evidently neglecta* (Lakewood, Jeff. Co. CO). This is pollinated by bees and flies.

(*Angelica* is uncommon and I have not seen butterflies on it.)

*Conium maculatum* white: *Argynnis (Speyeria) hesperis*, *Callophrys eryphon*, *Hesperia viridis*, *Limenitis weidemeyerii*, *Lycaena heteronea*, *Callophrys gryneus siva*, *Papilio polyxenes* 4x, *Glaucopsyche piasus* 5 sec., *Satyrium behrii* big umbel 2x.

*Cryptotaenia canadensis* white: *Celastrina neglecta*. Pollinated by various insects.

*Cymopterus acaulis* white: *Callophrys sheridani* 2x. *Cymopterus beckii* is visited by numerous potential pollinating insects but halictid bees may be the most important pollinators (Tepedino and Messinger 2004).

*(*Daucus carota*) has no records, but its white flowers are rare in Colorado (carrots are eaten before they flower). 334 species of insects of 37 families were recorded visiting it in Utah [Hawthorn et al. 1956], and the most efficient pollinators were honeybees, *Halictus* and *Lasiosglossum* bees, the sphecid wasp *Tachytess*, *Eristalis* and *Syritta* hoverflies, and the soldier fly *Stratiomys* (Koul et al 1989; Perez-Banon et al. 2007). In greenhouses even *Musca domestica* houseflies pollinate."

*Foeniculum vulgare* yellow: *Lycaena xanthoides nigromaculata*. Pollinators of this in India were *Apis mellifera* Italian honeybees (the most important), *A. cerana*, *A. dorsata*, *A. florea*, and flies (*Episyrphus balteatus*, *Sphaerophoria scripta*, *Eristalis arvorum*, *E. sp.*, *Musca*), while *Andrena* minitula and *Osma rufo* bees and the butterflies *Lampides boeticus*, *Pieris brassicae*, *Colias fieldi*, and *Danaus chrysippus* also visited (Chaudhary 2006).

*Heracleum spondylium montanum=lanatum* white: *Argynnis (Speyeria) coronis*, *Argynnis (Speyeria) edwardsii*, *Argynnis (Speyeria) hesperis* 7x, *Chlosyne gorgone*, *Chlosyne nycteis*, *Euphydryas chalcedona chalcedona*, *Limenitis lorquinii*, *Limenitis weidemeyerii* (photo in “Colorado’s Best Wildflower Hikes, The Front Range” 1998), *Oeneis chryxus*, *Papilio multicaudata* ¼ sec, *Satyrium calanus*. In Poland 108 insect species visited it, especially syrphid flies (*Thricops nigrifrons*, *Eristalis*) and the calliphorid fly *Lucilia* (those two are the important pollinators), the Chloropidae fly *Eriozona syrphoides*, the Fanniidae fly *Meliscaeva cinctella*, muscid and Sepsidae flies, *Phaonia angelicae* flies, bumblebees *Bombus terrestris*, the Apidae bee *Arge ustulata* sometimes, beetles (the cerambycid *Stenurella* had big pollen loads, and *Dasytes*, *Melyridae*, *Nitidulidae*), most of which pollinated a little but only 53% of visitors carried pollen; even a few Neuroptera and butterflies (*Papilio machaon*, * Gonepteryx rhamni*, *Pieris brassicae*) visited rarely (Zych 2002, 2007).

*Harbouria trachyleura* yellow: *Argynnis (Speyeria) callippe*, *Argynnis (Speyeria) edwardsii* *Callophrys dumetorum homoperplexa* 6x, *Callophrys eryphon* 3x (one briefly), *Callophrys gryneus siva* 3x, *Celastrina lucia sidara*, *Coenonympha tullia* 5x, *Erynnis persius?*, *Euphydryas anicia capella* 2x, *Euptoieta claudia* 2 sec, *Glaucopsyche lygdamus*, *Hesperia juba*, *Hesperia nevada*, *Papilio zelicaon* (1x
+ 1x f. nitra), Dipsacus phoebus smintheus 11x, Phyciodes pulchella camillus 2x, Plebejus icarioides, Poladryas minuta arachne, Polistes draco.

Ligusticum? porteri white umbel: Boloria titania. Flies frequent this.

Ligusticum tenuifolium white: Pontia callidice occidentalis.

Lomatium marginatum yellow or reddish-purple: Pontia sisybrii. Lomatium bradshawii is visited by 38 species of bees (incl. 7 sp. of solitary bees), 7 sp. of syrphid and 11 sp. of other flies, 4 sp. of wasps, 4 sp. of beetles, and occasional caddisflies, planthoppers, true bugs, and ants; 26 species mostly bees and syrphids carried pollen on body or legs (Kaye and Kirkland 1994). Several specialist bees Andrena and Micrandrena gather pollen from Lomatium dissectum, and cultivated fields of L. dissectum are frequented by honeybees and Halictus and LasioGLOSSUM bees (USDA research, www.fs.fed.us).

Lomatium orientale white: Callophrys sheridanii, Pontia sisybrii 2x.

Musineon divaricatum yellow: Colias eurystema, Phyciodes pulchella camillus, Polistes (Yvretta) rhesus. Polinated by various insects.

Oreoxis alpina yellow: Boloria freija. This cushion plant is pollinated by ants in the Cascade Mts., and it often self-pollinates.

Oxypolis fendleri white: Limenitis weidemeyerii, Pieris marginalis mcdunoughii a short time.

Pastinaca sativa yellow: Danaus plexippus, Phyciodes diminuttor. This attracts numerous beetles in Europe (Jury 1996).

Pseudocymopterus montanus yellow: Callophrys spinetorum Janet Chu, Lycaena floratus 1x + 1 sec. This is visited by andrenid and halictid bees, and anthomyid, muscoid, syrphid and tachinid flies in Colorado (Schlessman and Graceff 2002).

ADOXACEAE (includes Sambucus and Viburnum formerly placed in Caprifoliaceae)

These have large showy umbel-like clusters of whitish flowers (that produce nice berries) but are mostly shunned. Adoxaceae in general are pollinated by insects esp. bees wasps and flies (Judd et al. 2008).

Sambucus canadensis white: Celastrina neglecta. Sambucus have no nectar and pollination is mostly by wind, with some selfing, but they are visited sparingly by flies and pollen-collecting bees, and honeybees reportedly help pollinate (Charlebois et al. 2010).

Viburnum carlesii white: Vanessa cardui 2x.

(Viburnum various cultivated spp. including V. opulus bushes have showy mostly whitish flowers but attract few butterflies. Viburnum spp. have nectar and reportedly attract many bees flies beetles and Lepidoptera. Cetonia beetles [Scarabeidae] are good long-distance pollinators of Viburnum opulus flowers [Englund 1993])

CAPRIFOLIACEAE (includes Dipsacaceae)

Dipsacus and Scabiosa were formerly included in Dipsacaceae, and are moderately popular. Centranthus and Valeriana were formerly included in Valerianaceae; they are uncommon but are fairly popular. The remaining flowers that were always placed into Caprifoliaceae are mostly not popular (including Lonicera), except Symphoricarpus and Valeriana seem to be moderately popular. Caprifoliaceae in general are pollinated by nectar-gathering insects (mainly bees and wasps) and birds (Judd et al. 2008).

Centranthus ruber (red or bluish-red or red-blue) is moderately popular (some other garden flowers are more popular): Junonia coenia 25x, Lycaena xanthoides nigromaculata 6x, Papilio multicaudata 2x, Papilio zelicaon 2x, Pieris rapae 4x, Poanes taxile, Polistes peckius 4x, Polistes themistocles 6x, Vanessa cardui. Proctor et al. (1996, table 4.2) list this as butterfly-pollinated.

Dipsacus fullonum var. sylvestris: A) blue-white: Lycaena xanthoides nigromaculata 15x; B) violet-pink: Danaus plexippus 4x, Ochloides sylvanoides 8x incl. Anne U. White, Papilio polyxenes 13x; C) white to lilac: Argynnis (Speyeria) aphrodite Anne U. White, Argynnis (Speyeria) hesperis Anne U. White, Argynnis (Speyeria) nokomis 2x, Cercyonis pegala, Eparygreus clarus 5x, Hesperia comma, Pieris rapae, Vanessa cardui 15x. This plant has leaves that broadly join to the stem and trap water there, and those water pools trap insects like pitcher plants and likewise may absorb their nutrients. It is pollinated mostly by bumblebees, and visited by numerous insects esp. bees and other Hymenoptera and some
Diptera and butterflies. In Europe the bee *Andrena hattorfiana* specializes on gathering pollen of “Dipsacaceae” (including *Dipsacus*) flowers.

*Lonicera involucrata* yellow or red-tinged: *Glaucopsyche lygdamus* Janet Chu. Reportedly pollinated by hummingbirds. *Lonicera alpigena* is pollinated by wasps, *L. caprifolium* and *L. periclymenum* by nocturnal sphingid moths, and other *Lonicera* spp. by bees and bumblebees. The red *Lonicera* (*L. cardinalis*, *L. sempervirens*, *L. laxiflora*) are pollinated by hummingbirds (Grant 1994).

*Lonicera tatarica* pink: *Danaus plexippus*, *Papilio glaucus* glaucus 2x, *Vanessa cardui* many. (*Lonicera japonica* flowers open at dusk and are pollinated by nocturnal moths *Theretra japonica* and bumblebees *Bombus lucorum* and diurnal bees *Tetralonia nipponensis* and *Lasiosglossum* sp.)

*Scabiosa caucasicosa* whitish: *Papilio multicaudata*.

*Scabiosa columbaria* blue-lilac: *Colias eurytheme*, *Papilio multicaudata*, *Papilio polyxenes*, *Pieris rapae* 2x, *P. peckius* 9x, (no visits were seen by *Pollites themistocles*), *Vanessa cardui* 6x, *Vanessa caraye* much (likes it). This is visited by bees including *Andrena*, bombylliid and syrphid flies, and sawflies. Bumblebees visit *Scabiosa* spp.


*Symphoricarpus occidentalis* pink: *Argynnis* (*Speyeria*) aphrodite, *Cercyonis pegala* several, *Danaus plexippus*, *Epargyreus clarus*, *Euphyes vestris*, *Lycaena dione*, *Polites peckius*, *Thorybes pylades*, *Vanessa atalanta*, *Vanessa cardui* 2x.

*Symphoricarpus rotundifolius* pink: *Argynnis* (*Speyeria*) edwardsii 2x, *Epargyreus clarus*, *Erebia epispoda* 7x, *Vanessa atalanta*, *Vanessa cardui*.


*Valeriana* *sitchensis* in Olympic Mts. Wash. is pollinated by bumblebees (Aluri and Robart 1991).

*Valeriana officinalis* is listed as butterfly pollinated by Proctor et al. (1996, table 4.2).

*Valeriana capitata* acutiloba pinkish-white: *Boloria frigga* 5 min.

**UNKNOWN FLOWER FAMILY**

bell flowers that are tiny white on plant 6” tall with leaves like elm: *Argynnis* (*Speyeria*) coronis.

blue flower: *Hesperia newada*.

“catkins” large Ariz. shrub in stream with erect brown “catkins”: *Callophrys gryneus* siva, *Ministrymon leda*.


cushion plant blue flower: *Argynnis* (*Speyeria*) mornonia.

dull whitish-cress flower: *Callophrys spinetorum*.

flower: *Callophrys spinetorum*, *Erebia callias* often.

orange flower: *Coenonympha tullia california*, *Euchloe auronides*.

orange winged flower: *Leptotes marina*.

Pinguinca tree flower (Sinaloa Mex.): *Ascia monuste*, *Chioides zilpa*, *Eurema nise*.


red color: *Asterocampa claton* (probing my red truck), *Lethe eurydice* (probing red ribbon with proboscis).

vine weedy with alternate gray-green willow-shaped leaves every 3 cm along stem + spiny-white flower ball, in Mexico: many species listed but none specifically stated to be on this flower.

white-flowered shrub: *Callophrys gryneus* siva, *Hesperia woodgatei*, *Thorybes pylades*, *Vanessa cardui*, *Vanessa virginiensis*.

erectorum many, Leptotes marina, Libythea carinenta larvata, Limenitis arthemis arizonensis, Plebejus alpini texanus, Pontia protodice, Satyrium favonianus ilaviana abundant, Zernene cesonia.

white flowers: Apodemia normo pueblo, Erynnis brizo, Eurema nicippe (tiny flower), Hesperia comma, Junonia coenia (tall flower) 1x, Pontia beckerii (tiny flower), Satyrium favonianus autolycus 22x, Satyrium sylvanus nootka tiny, Vanessa cardui dense.

white-flowered small vine: Lerodea eufala.

white-yellow-flowered tiny-leaf tiny “Cercocarpus”: Libythea carinenta larvata common, Phoebis sennae tiny.

yellow flower: Calophrus spinetorum, Erynnis telemachus, Hesperia comma, Lycaena cupreus snowi, Ochlodes sylvanoides several, Poladryas minuta arachne 2x.

yellow-flowered low bush: Hemiargus isola, Leptotes marina, Nathalis iole, Pyrgus communis.

yellow-flowered tiny plant like long-leaf Artemisia dracunculus: Erynnis funealis.

yellow-flowered tiny-leaf “Cercocarpus”: Danaus gilippus.

OTHER FOODS (sap, mud, honeydew, rotten fruit, dung, etc.)

Blood: Cupido comyntas many fed on blood of chicken on ground.

Carriion: Argynnis (Speyeria) aphrodite (dead deer), Cercyonis oetus (dead deer leg) 3x, Limenitis weidemeyerii sucking inside of a dead pupa, Phyciodes batesii anasazi (dead cow in shade), Phyciodes diminutor (dead all-brown hawk 3x).

Compost: Pyrgus communis male fed repeatedly on fresh vegetable-compost spread in garden.

Dung: Amblyscirtes aenus (bird dung, sucking drops dripping from anus onto dung); Argynnis (Speyeria) aphrodite (dog and horse dung); Argynnis (Speyeria) Edwardsii 2x; Argynnis (Speyeria) hesperis (horse dung); Argynnis (Speyeria) zere ne (dog turd); Celastrina humulus lupine-ecotype (dog? dung); Celastrina lucia sidara (horse dung) 2x; Cercyonis oetus (horse dung); Cercyonis pegala dung 3x (incl. horse dung); Chlosyne gorgone dung 11x (1-2 dung of human, 1 of horse, but usually of dog [3 males found dead on one dog dung that evidently killed them perhaps because of some de-worming? chemical fed to the dog]); Cupido amyntula (horse dung); Cyllopsis pertepida (male on dry cow dung); Eaprgyreus clarus (dung of bird fed on in shade); Erebia callias many; Erynnis telemachus; Euphilotes glaucon centralis; Euphyses vestris (white bird droppings 3x [2 of them observed sucking on dung on leaf after diluting it with drop from abdomen]); Glaucopsyche lygdamus (dog? dung); Glaucopsyche lygdamus (white bird dung); Lethe eurydice; Limenitis weidemeyerii (coyote dung Janet Chu); Papilio cresphontes (cow manure); Plebejus alpini texanus (manure); Poanes taxiles (bird dung [abdomen dips down to put a drop onto dung, proboscis extends under body nearly to midpoint of abdomen and sucks up diluted dung]); Polites sonora (manure); Polygonia gracilis zephyrus (dog dung); Pyrgus communis (human dung); Pyrgus scriptura (manure); Pyrgus xanthus (manure, Scott 1975b); Vanessa cardui (dog dung); Vanessa virginensis (male near horse turds).

Fruit of Aesculus glabra var. arguta: Limenitis arthemis astyanax.

Fruit rotten Pyrus malus apple: Nymphalis antiopa 2x, Vanessa atalanta 2x.

Fruit broken apple: Vanessa cardui.

Fruit rotten crabapple: Polygonia interrogationis.

Fruit (immature) of Crataegus erythopoda: Limenitis weidemeyerii.

Fruit Rubus deliciosus purple berries: Asterocampa celtis jeffermont, Cercyonis pegala, Lycaena arota 13x, Polygonia gracilis zephyrus often.

Fruit of green raspberry (old flower-young berry): Poanes hobomok.

Fruit bait (mixed using rotten bananas/rotten peaches/sugar): Asterocampa celtis jeffermont 6x, Cercyonis oetus female, Cercyonis pegala 7x, Nymphalis antiopa 6x, Polygonia faunus 33x, Polygonia faunus celenor 50x, Polygonia gracilis zephyrus 45x, Polygonia oreas (ssp. satellow, nigrozeaphyrus, and oreas) 33x, Polygonia satyrus near-satyrus 208x, Vanessa atalanta 4x.

Fungus?, diseased black small Cirsium ochrocentrum unexpanded flower head: Vanessa atalanta sucking unknown juices from this diseased flower.
Fungusy yellow stuff exuding from *Salix irrorata* trunk base: *Nymphalis antiopa*.

Honeydew of aphids/leafhoppers: *Adelpha californica*, *Argynnis* (*Speyeria*) *cybele charlottii* sucked sugary viscous stuff on *Quercus gambelii* leaves (maybe aphid honeydew?), *Asterocampa celtis jeffermont* (proboscis repeatedly touching aphids on *Cirsium vulgare* seeking ‘aphid-honeydew’, Janet Chu), *Celastrina humulus* hop-ecotype (honeydew from cream-colored small leafhoppers=*Cicadellidae* on ups of leaf bases of two *Lactuca serriola* plants), *Celastrina lucia sidara* (fed on sugar? ~honeydew? on leaves of *Conium maculatum*), *Plebejus icarioides* (female sucked leafhopper honeydew from tops of *Monarda fistulosa* and top of *Heterotheca villosa* plants), *Polygona gracilis zephyrus* (sucking aphid honeydew on *Salix lemmonii* ~5x), *Satyrium liparops* (female probing young 2 cm *Prunus virginiana* white leaf for ?aphid honeydew? for a minute or two [a little black beetle was on leaf too] but no honeydew seen). In eastern U.S. *Feniseca tarquinius* frequently sips honeydew from the woolly aphids that its larvae eats, and *Megisto cymela* and *Limenitis archippus* are also known to visit aphid honeydew.

Honeydew from coccids (sucking something from fungus-infested [orange-yellow spots] leaf of *Crataegus macracantha* that had curled edge and white coccids in curl of underside): *Limenitis weidemeyerii*.

Sap drops on leaves: *Gambel's oak* (*Quercus gambelii*), *Eastern red cedar* (*Juniperus virginiana*), *Alder* (*Alnus rubra*), etc. Female butterflies like *Strymon melinus* and *Plebejus alupi* fly near the sap, and then usually land ABOVE the sap as a protective measure.

“Mud” algae-water: *Polygonia multicaudata* 7x, *Vanessa atalanta* 13x, *Vanessa cardui* 8x, *Vanessa virginiensis* 3x, *Zerene cesonia* 17x, *Zestusa dorus* 26x.

Raindrops on leaves: *Hypaurotis crysalus* some fed on.

Sap usually from wounds on the trunks of trees is popular with some Papilioidea butterflies such as Nymphalinae, *Anaea*, *Apaturini*, *Limenitis*, and *Theclini*. Butterflies in taxa that frequent sap (such as Nymphalinae butterflies *Nymphalis*, *Polygonia*, etc.) fly near the sap, and then usually land ABOVE the sap and walk down to it and suck. They do this evidently to avoid becoming stuck in the viscous sap that gets thicker the farther it drips down the trunk of the tree. Thus they avoid becoming fossilized in amber like the numerous insect fossils in Baltic amber. The sap is thick, so they evidently extrude a little fluid from their proboscis to dissolve a little sap, then suck up the diluted sap.

Sap of *Acer negundo*: *Asterocampa celtis* jeffermont.

Sap? from *Cirsium ochrocentrum* rose-purple phyllaries: *Vanessa cardui*.

Sap? of *Pinus edulis* cones: *Vanessa atalanta*.

Sap of *Populus angustifolia*: *Nymphalis antiopa*.

Sap of *Populus deltoides monilifera*: *Anaea andria* (Scott and Scott 1978), *Nymphalis antiopa*, *Polygonia satyrus*.

Sap of *Populus tremula tremuloides*: *Limenitis weidemeyerii* (upside down on), *Nymphalis antiopa* 6x (at least one observed upside down on thus approaching from above), *Polygonia faunus* 5x, *Vanessa atalanta*.

Sap of *Quercus gambelii*: *Hypaurotis crysalus* 18+ adults of both sexes sucking sap oozing from *Quercus gambelii* twigs (seeping knobs including one where a leaf fell off) and sap from new acorns, many on one 5m tree (Scott 1974c, Scott and Scott 1978); *Limenitis weidemeyerii* probed twigs for sap; *Satyrium calanus* female sucking a *Quercus gambelii* acorn evidently to get sap.

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“Sap” juices from expanding Quercus gambelii leaf buds: Erynnis telemachus 4x.
Sap, probed Pseudotsuga menziesii twigs for sap: Limenitis weidemeyerii.
Sap of Rhus aromatica trilobata: Argynniss (Speyeria) aphrodite repeatedly landing on it, perhaps getting sap on yellowish seed bunches (Janet Chu).
Sap of Robinia neomexicana: Asterocampa celtis jeffermont (Janet Chu).
Sap of Salix amygdaloidea: Aglaia milbertii, Anaea andria (Scott and Scott 1978), Argynniss (Speyeria) aphrodite, Argynniss (Speyeria) hesperis, Asterocampa celtis jeffermont 29x, Cercyonis pegala 3x, Limenitis weidemeyerii 3x, Lycaena heteronea, Nymphalis antiopa 6x, Parnassius phoebus smintheus females, Polites origenes, Polygonia gracilis zephyrus 2x, Polygonia satyrus 2x, Satyrium behrii, Vanessa atalanta 4x.
Sap of Salix bebbiana: Polygonia faunus, Polygonia satyrus.
Sap of Salix exigua: Nymphalis antiopa 3x (one aimed down, one sideways, one landed head-up then flew), Polygonia satyrus 2x.
Sap of Salix: Cyllopsis pertepida female on sap.
Sap of Ulmus pumila: Asterocampa celtis jeffermont 73x, Cercyonis pegala 83x, Nymphalis antiopa, Polygonia satyrus, Vanessa atalanta 2x.
Spit of human: Argynniss (Speyeria) callippe.
Sweat on net handle: Plebejus icarioides. Asterocampa celtis and A. clyton also suck sweat in search of salts (Bright and Ogard 2010).
Urine: Cercyonis pegala, Cupido amyntula, Plebeius melissa.
Wood (wet rotting wood): Celastrina lucia sidara 2x, Erynnis telemachus many.

Acknowledgements


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APPENDIX A. USING MICROSOFT WORD TO CALCULATE THE TOTAL NUMBER OF ADULT BUTTERFLY VISITATIONS TO FLOWERS AND OTHER FOODS FROM A MS WORD FILE OF VISITATIONS

Microsoft Word has a Replace All feature, which automatically counts the number of replacements every time the Replace All feature is used. You can use those counts to determine the number of visitations. Begin with the basic data-entry file in which each record consists of one paragraph listing one butterfly species visiting one flower species (or mud or whatever) and the number of visits seen and the date (example “Notamblyscirtes simius Cryptantha jamesii white 15x 11vi69”). Make a copy of the basic file and rename it as AAA-Counts or whatever, because you will trash it in the following process. The x will be used for the counts (example 15x means 15 visits to the flower Cryptantha jamesii were seen on that day), so if you also used x to mean October etc., you must first change a date such as 10x04 (meaning October 10, 2004) to 10Oct04 (the simplest way is to search for x0 and replace it by Oct0, and search for x8 and replace it by Oct8 to change 9x84 to 9Oct84, etc. for each decade of records). Do this also for November and December if those months have x’s in your file (September should be no problem because it is abbreviated ix which will not cause trouble in the process below). If you used vague words (rare, scarce, uncommon, infrequent, occasional, sparse, few, some, several, couple, often, many, frequent, frequently, common, numerous, abundant, dozens, swarming, superabundant, plentiful, etc.) to describe the number of visits, you may want to quantify those and replace them by your estimate of the numbers, such as 10x for many etc.). If you used 1x for only one observed visit in the entries in your basic file, you will have to replace it with the word “once” in your records; the easiest way is to replace (blank-space)1x by the word once. When the x’s are fixed the file is ready. In the following process, after every Replace All, you must record the number of replacements made by the computer. Now make the paragraph marks visible, and Replace All the paragraph marks with *(paragraph mark) (in Microsoft Word, the paragraph mark symbol is ^p so replace ^p with ^*p); the number of replacements is the number of paragraphs which is the total number of basic butterfly/plant/day records. Now Replace All 0x with #x, and Replace All 1x to 9x also (all nine) by #x. These latter counts should be multiplied by the number (1 to 9) to determine how many visits there were in the single-digit column of each of the x numbers. Now Replace All 0#x by $#x, and Replace All 1#x to 9#x also (all nine) by $#x. These latter counts should be multiplied by the number (10 to 90) to determine how many visits there were in the tens-digit column of each of the x numbers. Continue the process in the thousands column if you have x numbers that large (I do not). Now Replace All #x by @x which tells you the total number of records that have an x number in the entry. Subtract that number from the total number of basic butterfly/plant/day records (the total number of paragraph entries) which you determined above, to get the total number of records with just one visit. To that number we need to add the number of visits recorded in the records with more than one visit per record (the x numbers), so add the number of visits that you already calculated above in the single-digit column of the x numbers and the tens-digit column of the x numbers and the hundreds-digit column of the x numbers, to determine the total number of butterfly visits that you observed to flowers/mud etc. If you have trouble with this process at any time, simply exit Microsoft Word without saving and try again.
APPENDIX B. CHANGING A FILE ALPHABETIZED BY BUTTERFLY GENERA AND SPECIES INTO A FILE ALPHABETIZED BY PLANT GENERA AND SPECIES

Begin not with the file of original chronological records; use instead a compressed file in which each line is a record of the butterfly species, the flower/food species visited, and the total number of records/visits for that butterfly on that food listed summed over many days and localities (for example one line of my file is “Notamblyscirtes simius Opuntia polyacantha yellow 77x”, because there are 77 total recorded visits of that butterfly to that yellow-flowered O. polyacantha cactus). To alphabetize the flower species, I went through that entire file and inserted a tab mark at the starting first letter of each flower genus (these tab stops were quickly inserted by using the index of a local flora/flower book to proceed through the flower genera from A to Z, by replacing each flower genus by a tab stop-flower genus: for example Aster was replaced [Replace All] by ^tAster, which places a tab in front of every word Aster in the file), then I went through the file to add tab stops in front of those genera that were missed by those replacements. I then attempted to alphabetize the resulting entire Microsoft Word file by sorting the whole file using Field 2; however MS Word failed to alphabetize any file using Field 2 that was longer than 2 pages. So, the whole file had to be converted to a single table. Before doing this, make sure the butterfly records are alphabetized (select the entire file, and on the Home menu choose the Sort box [the AZ down-arrow box] where you sort by paragraphs and click ok to alphabetize the entire file by butterfly genus/species). Now, to convert the entire file to a single table, select the whole file (light up the whole file in blue), then click the Insert menu, click the Table menu to go to the Convert Text to Table menu, where you choose Tab to separate the text and choose 2 columns, then click ok to convert the entire file to a table. Now, to alphabetize the flower species, select the entire table, then go to the Home menu and click the Sorting menu and choose Sort by column 2 (type in “column 2” where it says “column 1”), and MS Word will alphabetize the whole file by the flower genus-species in column 2. Now the entire file must be reconverted to text form again, so select the entire table, and the words “Table Tools” will pop up on top middle of screen (perched on top of the Home menu bar). Click “Layout” which pops into view just below “Table Tools”, then go to the far right and click Convert to Text, then in that menu make sure that the text will be separated with tabs, then click ok. MS Word will then convert the file to text, so now the file lists each flower/food species alphabetically after the tabs, and to the left of the tabs the butterfly species records visiting each flower are all listed alphabetically. Save this file with a new name. Then I laboriously went through the file to compress the records for each flower into one paragraph, placing the flower at the head of the paragraph (when there are many butterfly species visiting each flower, to save time place (type or copy) the flower genus-species at the head of those records, use the Replace feature [the Replace All is faster] to replace space ^t[meaning tab mark] flower genus-species with nothing, then use the Replace feature [do NOT use Replace All here] to replace ^p[meaning paragraph mark] with comma space.

(Use of spreadsheet or database. Some people may want to place their records into a spreadsheet or database program, in which case Appendix A and B would not be needed, but I have found that those programs take too much time to enter the raw data, much longer than a simple word processor file, in which you can simply type the butterfly name and plant name and number of visits (if more than one) and enter key (paragraph mark), and at the end of that day’s records you can copy the date onto the end of each paragraph entry. And if there are multiple flowers species in your notebooks for that butterfly on that locality/day, you can simply leave off the butterfly name from the additional records and copy the name to those records after you finish with that butterfly species on that locality/day.)