Abstract. Hostplants of larvae, based on about 3090 records of observed ovipositions (a total of 1509) or discoveries of eggs, larvae, or pupae in nature, are presented for butterflies (including skippers), mostly from western United States, especially Colorado. The paper presents numerous new life histories, and many notes on egg placement, overwintering stage, behavior, and ecology. A new phenomenon of a butterfly egg mimicking a plant is reported, in which Nathalis iole eggs have changed color to match orange-yellow protruding foul-odor egg-shaped glands on Ovansodia papposa, presumably to benefit from lesser predation because predators think the eggs are inedible foul glands; this phenomenon is the complete opposite of the known cases of egg mimicry, in which plants produce structures mimicking butterfly eggs to deter oviposition (although possibly egg mimicry was the original origin of the D. papposa glands). Dracula Caterpillars were found—larvae of Amblyscirtes—which have unique fangs unknown in other Lepidoptera, as well as ordinary mandibles; apparently the fangs are used in defense rather than nest-building. What was once called one species Cellastrina argiolus in Colorado is now proven to be two species, with different hostplants, flight times, habitats, and pupal color; the localized species has two ecotypes, one feeding on Humulus vines, the other on Lupinus. Only one Hesperini (Deria marita) is truly polyphagous, eating grasses and sedges of many life forms; it has "satyr envy", converging to Satyrinae in its polyphagous, unique lack of larval nest, and cryptic striped larval color pattern. Hesperini species generally eat only a certain life form of grass, and may prefer the biochemicals of certain grass species or genera, so that Hesperiinae are comparatively host-specific. A hay-feeding guild was discovered: 6 Hesperiinae (Pirunca pirus, Ancyloxypha numitor, Schiodes sylvangides, Pennes zabulon nasile, Amblyscirtes viaulis, probably Anartystone logan) that each eat tall wide-leaf grasses. In contrast, many Satyrinae have rather haphazard oviposition, and rather polyphagous lab feeding, so that Satyrinae species are in general rather polyphagous on various grasses, or even on grasses and sedges, and their host specificity is difficult to determine. One satyr (Denseis chrysvus) oviposits on trees. In another case of convergence, Hesperia ottoe and Polites origenes are the only species in their genera to eat a broad-leaf grass and to have aerial larval nests. One skipper (Ancyloxypha) was found to have larval wax glands on four segments instead of the usual two. Bog butterflies seem to have rather polyphagous larvae. Some larvae rest underground: Parnassius (pupae), certain Satyrinae (Neomimosa, perhaps some Demelia and Erchela), Hesperia relatives (Hesperia except ottoe, Polites except orionae, Yvretta, Hylephila, Atalopedes), and "Amblyscirtes" simius. Three species of Polites lay eggs without glue which drop into the litter, and Percyon does this about half the time. Anartystone logan is a very distinct genus from Atrytone arogoes, in contrast to Hesperia, Polites, and Atalopedes, which are basically just one genus. Cases of hostplant switching is reported in which Euphydryas chalcedona/anicia capella now feeds on introduced Linaria dalmatica, and Phyciodes picta has switched from Aster to Convallaria. Two new subspecies are named from lowland valleys of W Colo.—E Utah: Phyciodes tharos/Morpheus riocolorado, the only valid ssp. of tharos, with paler wing colors and Hesperopsis libya confertiblanca, which has a solid white unh and a new hostplant.

INTRODUCTION

Hostplants are known for most northeastern U.S. butterfly species, and for many California species. But there are many more species in the Southern Rockies of western U.S., and far fewer scientists are there to study them, so hostplants are not well known for most western butterflies. This paper adds
greatly to the knowledge of hostplants of these species. Some of the springs
and summers from 1977 to 1992 were spent observing females to obtain oviposition
records, and raising the immatures of some species, mostly in Colorado. Before
this time I had found other hostplants during the course of other work. All my
data on hostplants through 1991 are given, together with associated information
such as the hibernal diapause stage, the location of oviposition or larval
feeding (leaves or fruits), etc. Descriptions of previously unknown eggs,
larvae, and pupae are given (color slides were made also, but color photos
cannot be given here). The hostplants through 1985 were already published
(Scott 1986a, Papilio [New Series] #4), but I decided to include them in the
present paper because recent work more than quintuples the total amount of data,
because inclusion of those records does not lengthen the present paper much,
because the present paper corrects more than a dozen plant misidentifications in
that paper, because in most cases the interpretation of the results is far
better when all the results are grouped together, and because I wish to maintain
a lifetime list of hostplants as a service to readers.

The plant family of most hostplants, and the justification for the
scientific names of the butterflies used, can be found in Scott (1986b). Scott
(1986b) also summarizes the general ecology, distribution, behavior, and
identification of each species. The hostplant records in Scott (1986b) are
either from Scott (1986a), or from the literature; the literature sources for
each hostplant record therein are listed in my card file, and are available to
readers on request for a small fee. Flight periods and other ecological
observations on the Colorado fauna were given by Scott & Scott (1980) and Scott
and Epstein (1986).

Methods

To obtain oviposition records, the observer must train himself to recognize
the fluttering oviposition flight typical of butterflies. One should walk about
the habitat and watch for any female which flutters or hovers slowly from plant
to plant; ovipositing females flutter slowly while searching for an oviposition
site, and frequently land, whereas males and non-ovipositing females fly more
erratically or swiftly. This distinction is very noticeable in most butterflies,
especially in fast-flying skippers; but in Satyrinae (Lethe, Cercyonis,
Neominois, Gexia, Erebia, etc.) the flight of ovipositing females is only
slightly more fluttering than usual. Papilio females continue to flutter while
they oviposit, while other butterflies are generally motionless. Unfortunately,
most lepidopterists only collect adults, and are trained to automatically swing
their net at the first sight of an adult, especially a hovering female that is
so tempting and easy to capture, so they rarely see ovipositions. But if they
just trained themselves to NOT swing if the adult is hovering slowly, they could
follow the female to oviposition, and then they could swing the net AFTER the
egg is laid. By carefully stalking the hovering female and watching where the
egg is laid, one can get both the egg and the female in most cases. Collectors
who catch butterflies that do not hover slowly (the majority of the butterflies
seen), and watch those that do hover slowly, can catch almost as many adults as
collectors who catch every adult seen, and can obtain almost as many
ovipositions as people who watch and do not collect adults at all. (And, very
peculiarly, most modern "Butterfly Watchers", such as those associated with bird
watching societies, are more interested in other things than butterfly biology,
and strangely do not observe or report ovipositions and seldom contribute to
scientific knowledge.) Thus there is no big conflict between collecting and
observing ovipositions, so lepidopterists—even collectors—have no excuse for
not obtaining ovipositions.

Species that oviposit haphazardly require special methods, which take more
effort. Parnassius, Speyeria, Boloria, and grass/sedge feeders (most Satyrinae,
some Hesperiidae) often oviposit haphazardly. Because an egg of these species
may have been laid haphazardly on a plant that the larvae may not feed on, and
the larvae then wander to find a suitable plant, merely recording the
oviposition plant is totally inadequate. Therefore, in the last few years I
recorded all possible hostplants (all monocotyledons for the last two groups)
within 1 m of the egg. Proof that a haphazard-oviposition species uses a given
plant as a hostplant requires effort both in field and lab: adults must be
associated with that plant in nature; females must oviposit on or near that
plant in nature; and larvae must successfully feed on that plant in the lab.
Thus, ideally, many ovipositions should be observed in nature, and lab feeding
tests should be conducted to determine whether the native plants near the eggs
are eaten or rejected by larvae.

All times are given as 24-hour standard time.
I thank the following persons, especially Dr. Weber, for identifying the hosts (abbreviation in parentheses): William A. Weber (—University of Colorado Herbarium, Boulder Colo.), June McCaskill (—University of California Herbarium, Davis, Calif.), James Harding (Ha—same address), Beecher Crampton (C—same address) James L. Reveal (R—Univ. of Maryland, College Park, Md.), John R. Keith, Hansford T. Shacklette, James A. Erdman (all three 6—U.S. Geological Survey, Lakewood, Colorado), Farrel Branson (B—same address), L. R. Heckard (H—Univ. Calif., Berkeley, Calif.), John Strother (same address, no abbreviation), Charles Feddema (F—U.S. Dept. Agriculture, Fort Collins, Colo.).

If no letter is given, I identified the plant; in recent years I have gained considerable expertise in plant identification, so have seldom consulted these botanists.

Pressed plant specimens documenting many of the hostplant records are in the collection of J. Scott. Because most of the plants are not in perfect condition, they would no doubt be thrown away by herbaria, which generally retain only perfect specimens. I have heard valid stories of famous herbaria throwing out even new county record specimens of plants if the plants are not in absolutely perfect condition. Because butterfly females very often choose juvenile plants, or plants without inflorescences, or plants not in perfect condition, and because entomologists are less skilled than botanists at drying and pressing plant specimens, butterfly hostplants rarely turn into ideal herbarium specimens. Making perfect botanical specimens takes considerable experience, demands great care in changing the blotters frequently and using cumbersome heaters/driers etc., and requires the selection of perfect wild specimens. Even if the current herbarium curator is sympathetic to the retention of non-ideal specimens that represent hostplant records, a later curator may not be. Also, most butterfly hostplants are rather common plant species (because any butterfly species that prefers a rare plant would soon become extinct), and herbarium curators want rare plants or odd varieties, not common plants. Therefore, I strongly believe that insect hostplants should NOT in general be placed in herbaria; they should be placed with the associated insect collection. Retaining plant specimens also makes resubmitting plants to other botanists with new knowledge of the plant group much easier; very few botanists care about insects that feed on plants, and if a Lepidopterist tries to reexamine a certain plant it is too much of a nuisance to try to relocate the plant in scattered herbaria and ask the curator to have it reidentified. These curators want to do taxonomy of their favorite plant group and do not wish to be bothered by mundane identifications. As I gained expertise regarding the identification of plant groups used as butterfly hostplants, I reexamined preserved oviposition plants from prior years that had been identified by various botanist "experts", or I sent the plants to other experts; too often, I have been disappointed to find that the first "experts" had misidentified the plants. In a few cases, the misidentifications were obvious and blatant. About a dozen of these misidentifications are corrected herein, including some longstanding misidentifications that have crept into popular books. Insect hostplant specimens should be kept with the insect collection; in general, herbaria neither need nor want these specimens.

The hostplant should be pressed and preserved unless its identification is very obvious. Most lepidopterists are rather sloppy regarding plant identifications; of course, anyone without expert knowledge of the oviposition plant genus should collect it (roots and all, plus nearby plants with inflorescences in another newspaper if the oviposition plant lacks inflorescence) and place it between folded newspapers and write locality date and species on the newspaper so an expert can identify it. A frequent problem in identifying plants is that a person may have identified what looks like the current plant in the past, and therefore assumes that the current plant is that species; but botanists—like all taxonomists—tend to split their species to the limit of resolution (new microscopes and new techniques lead to the mixing of new species and varieties), so a plant that looks like a known plant could be a closely related plant species. Many closely-related plant species can be confused; many plants look very similar to the non-experts; the floras generally lack drawings or photos of the plants; the keys in floras are often written in vague terminology that makes a decision difficult; complete descriptions of the plant are often lacking; descriptions are written in technical terminology that is difficult for the beginner and often imprecise; and plants in general are more variable in morphology than animals, causing more difficulty in identification. What is needed are floras that contain identification tables, in which each character is described for every species (or genus), so that plant specimens that contain missing parts can still be identified (keys make use of very few traits, so can lead to very gross
misidentifications, a problem solved by tables); floras should also contain drawings or photos. Such ideal florases are unfortunately lacking for the Rocky Mountain region (Colorado florases also lack adequate habitat and range and blooming information).

Nomenclature of plants is in a state of flux, just as is the nomenclature of insects. Plant varieties may even change species (for instance var. xanthum went from Eriophorum flavum to E. jamesii). The most recent local Colorado plant identification guides in particular place numerous plant species in new genera. A bizarre rule of plant nomenclature sometimes causes the species name to change when a different genus name is adopted (for instance Potentilla fruticosa became Pentachylothidae floribunda, ad nauseum). Generic reassignments that represent a correction of evolutionary relationships are valuable progress, but mere generic splitting is of little value. I have used generic names from national plant checklists and famous multi-state florases (such as the recent Great Plains Flora) rather than rudimentary local identification guides (lacking habitat and range and descriptive information) that are orgies of splitting.

Old florases treated the grasses Agropyron, Elymus, and Sitanion as distinct genera, but recent morphological and chromosome studies synonymized Sitanion into Elymus, reshuffled the species between the first two genera, and outlined several groups within Agropyron that have equal rank with Elymus. Some recent florases split these grasses into as little as two or as many as ten genera, but it is obvious that they form one phylogenetic unit in which the species frequently hybridize (for instance "Pascopyrum smithii" has a large chromosome number due to its hybrid ancestry Agropyron dasystachyum X "Elymus triticoides"), so I treat them all as Agropyron, and list the subgenus to reduce inevitable confusion. The most recent local identification manual places dasystachyum into Elytrigia, which is contrary to its genome (SH, like Elymus); I treat it as A. (Elymus) dasystachyum.

PAPILIONIDAE

Papilioninae

Papilionini

Females usually continue to hover when ovipositing. Eggs are generally laid on the hostplant.


Pestorious, EMMel

FIRST-STAGE LARVA black, with slight


because the few glaucus that do fly in (I have caught only two adult glaucus

Site, Sympatry between any two taxa without overwhelming interbreeding, and the fact

Considering the vast amount of data documenting the intergradation of canadensis

Can., Douglas Co. Colo., April


assoc. with C. douglasii, (Most families produce fewer females, but some produce fewer males) the cross glaucus male x canadensis female produces a 1:1 sex ratio. Considering the vast amount of data documenting the intergradation of canadensis and glaucus including clines over vast areas in many traits, and the lack of sympathy between any two taxa without overwhelming interbreeding, and the fact
that the electrophoretic traits are not diagnostic, the conclusion has to be
that these taxa are more subspecies--adapted to one generation in canadensis
versus 2 or more in glaucus--than separate species.

P. euryMedon Lucas. Oviposition on small shrub of Prunus emarginata (M), Loon
Lake, El Dorado Co. Calif., June 30, 1974. Oviposition 11:00 Deoathus fendleri
leaf top (female hovered during laying), Crawford Gulch, Jefferson Co. Colo.,
June 24, 1992.

P. multicaudata Kirby. Larvae found on leaves of Prunus (Paeus) virginiana
var. melanocarpa and Fraxinus pensylvanica var. lanceolata, Flintwood Hills,
on upper side of leaf of P.v. var. melanocarpa, Apex County Park, Jefferson Co.
Colo., June 24, 1980. Oviposition 11:15 on top of P.v. var. melanocarpa leaf,
multicaudata) found on P.v. var. melanocarpa by Richard M. Peigler, Lakewood,
Jefferson Co. Colo., July 21, 1989. 1st-stage larva found on Fraxinus
P.v. var. melanocarpa must be the main hostplant, except in towns where
Fraxinus is the main host. Also a common suburban Denver resident with several
flights. EGG bright green, later turning reddish-brown as larva develops.
FIRST-STAGE LARVA mostly black, with a slight cream saddle in middle of body,
body with scoli; head black with 2 hornlike scoli. HALF-GROWN LARVA mottled
dark-brown, the underside white, true legs tan, a white band starting up from
underside on A1-3 at start and angling back to A5-5 on top of body, with rows of
bumps on brown areas (longest bumps on thorax esp. T1, and on A9), two rows of
blue spots (subdorsal spot on T3, A1, A5-7, dorsolateral spot on T3, A1, A4-7;
head brownish-red (tan above labrum). MATURE LARVA yellow-green on top,
blending to greenish-white on prolegs & legs and white on underside, anterior
rim of T1 yellow, intersegmental area black on dorsal half of body between A1-2,
this black line edged by yellowish-white anteriorly, on front of T3 a
dorsolateral greenish-yellow doughnut-shaped "eyespot", outlined inside and
outside by a black line, the doughnut thickest ventrally, the doughnut center
yellow-green with a blue center spot, above the doughnut are two more small
black-rimmed greenish-yellow satellite spots, one above the other, many blue
spots (each ringed with black) occur (on T3 one spot in lower eyespot & one tiny
spot between the two yellow satellite spots, on A1 and A4-7 are 1 subdorsal spot
[tiny on A4] & 1 dorsolateral spot & 1 tiny spot below spiracle, on A2-3 a tiny
subspiracular spot, on A8 a tiny dorsolateral spot & a tiny subspiracular spot),
osmeteria orange, lower half of body has tiny white circles around tiny hairs;
head brownish-orange. PUPA (Douglas Co. Colo.) light mottled brown, with a
broad mottled-green lateral band esp. on abdomen, a broad whitish-tan area above
that, a broad tan middorsal band above that (edged by brown spots and containing
a middorsal brown line on middle abdominal segments), a dark-brown midventral
line on abdomen, and green mottling on legs and posterior margin of wing. Pupae
hibernate.

Troidini

Battus philenor (L.). Larvae on Aristolochia reticulata (small 5 cm tall
grasslike shoots), 2 mi. W. Austin, Texas, Apr. 29, 1972. Wandering mature
larva found (entirely orange-red in color! versus black in the rest of the

Parnassiinae

Parnassiini

Females do not flutter when ovipositing, and usually crawl on the ground
for a few cm before ovipositing. Eggs are usually laid near the hostplant
rather than on it.

Parnassius phoebus hermodur H. Edw. About 60 larvae found near or eating
Sedum (Rhodiola) rosea intercifolia, Mt. Evans, 13,500', Clear Creek Co. Colo.,
July 14, 1980. Alpine populations may be biennial, hibernating as eggs and also
as pupae; pupal diapause is not yet proven, but there is so little time for
larvae to develop that bienniality is probable there. Larvae at lower altitude
often pupate in a slight silk nest under grass clumps (B. Drummond, pers.
comm.), and other persons observed slight silk nests spun by pupating larvae,
but my 40 lab larvae spun no silk. I observed a larva at Mt. Evans worming
itself into pebbly soil like a charmed cobra. Edwards (1868-1897) saw larvae
squeezing through tiny holes, and adults ovipositing haphazardly. Thus larvae
may also pupate in loose soil; pupal nests would be useful IF pupae hibernate.
Two forewing base hooks (fig. by Scott 1986) probably hook onto grass, silk,
Koeleria macrantha (a grass) on two other species of grasses were searched at this site because of their abundance in the grassland, on one species of sedge, on Antennaria parvifolia, and on two other species of dicotyledons; all eggs laid near but not on S. lanceolatum which is the presumed hostplant at this locality; NE of Rosita, Custer Co. Colo., June 25, 1986. Oviposition 10:08, 10:40, 10:48, 11:51, 12:03, 12:04, 12:06, 12:08, 12:48, and 13:45 on soil, dead twigs, Koeleria macrantha (a grass), on two other species of grasses (grasses were the commonest oviposition site because of their abundance in the grassland), on one species of sedge, on Antennaria parvifolia, and on two other species of dicotyledons; all eggs laid near but not on S. lanceolatum which is the presumed hostplant at this locality; NE of Rosita. 3 eggs found on Carex sp.

Egg dirty white. MATURE LARVA: body and head black, body with supralateral yellow spots (2 on T1, 3 the posteriormost largest the middle spot smallest) on T2-A8) and subdorsal yellow spots (one on each T2-A8 segment); the one mature larva I found had the yellow subdorsal spots almost as large as the largest lateral yellow spots.


Colias alexandra or philodice. 2 eggs on Thermopsis divaricarpa leaves, Box Elder Creek, Elbert Co. Colo., May 28, 1991.


Pupa (prob. eurytheme) found 10 cm up on grass leaf, near Melilotus, Astragalus garrvi, & Psoralea tenuiflora; N Oak Creek Cqd., Fremont Co., Colo., Sept. 11, 1990. Egg (philodice or eurytheme or alexandra) found Trifolium pratense leaf underside; Fraser, Grand Co. Colo., Aug. 1, 1990. 1 red egg found on Astragalus shortianus leaftop (larva died in lab), S. Table Mtn., Jefferson Co. Colo., May 30, 1991.

Collas philodice X philodice. Oviposition (female fw 1/3 orange) 11:15


Colias pelidne minisani Bean (=skinneri Barnes). Oviposition Vaccinium sp. with 5 mm wide leaves (probably cespitatum), Round Lake, Wind River Mts., Wyo., Aug. 9, 1980. Adults often fly through slightly open forest (other Colias avoid forest) where this host grows.

Colias scudderii scudderii Reak. Oviposition 9:30 on small 4 cm juvenile Salix planifolia plant (immature of the very common .5 m tall shrub S. planifolia in valley bottoms there), Loveland Pass, Summit Co. Colo., July 17, 1977. Premovipositions 14:00 around juvenile plants of bog S. planifolia, Loveland Pass, Summit Co., July 27, 1978. Oviposition 13:29 leaf of .5 m S. planifolia seedling, Loveland Pass, Summit Co. Colo., Aug. 6, 1988. Premoviposition 13:00 near seedling S. planifolia, preoviposition 13:30 she landed on low bank with seedling S. planifolia, Salix reticulata nivalis, Viola labradorica (=bellidifolia), Vaccinium cespitatum; Loveland Pass, Summit Co. Colo., Aug. 7, 1990. Premoviposition 8:59 on Erigeron ursinus? under S. planifolia bush; oviposition 9:15 Vaccinium cespitatum leaftop of 4 cm tall plant on open area (S. planifolia 40 cm away, V. cespitatum common nearby); oviposition 9:28 V. cespitatum leaftop of 3 cm tall plant, in lush area a few m from S. planifolia; preoviposition 9:30 V. cespitatum; female landed 9:32 on S. reticulata nivalis; oviposition 9:37 on top of large leaf of 5-7 cm tall V. cespitatum; oviposition 9:40 (same female as ovip. 9:28) leaftop of V. cespitatum 7 cm tall; oviposition 10:05 V. cespitatum leaftop of plant ~3 cm tall (V. cespitatum, Viola labradorica, & Polygonum viviparum common nearby); oviposition 10:40 (yellowish female) on top of Salix reticulata nivalis mature leaf (only S. r. nivalis and Thalictrum nearby); preoviposition 10:52 V. cespitatum; oviposition 11:49 V. cespitatum leaftop of 2 cm plant between S. planifolia bushes; Loveland Pass, Summit Co. Colo., Aug. 8, 1990. Oviposition 8:47 on side (underside) of tiny Vaccinium scoparium leaf (no other suitable hosts nearby); oviposition 11:09 V. cespitatum leaftop of 2-3 cm plant; oviposition 12:38 on top of 7-mm-long leaf of Polygonum viviparum seedling (P. viviparum 1, 2, 3, 4, 5, 5 cm etc. very common to 1 m, S. planifolia seedlings 5-8 cm tall 3, 4, 7, 8, etc. common to 6 m, no Vaccinium within several m); same female oviposited 12:40 V. cespitatum leaftop of ~2-3 cm tall plant; 5 eggs found V. cespitatum leaftops; Loveland Pass, Summit Co. Colo., Aug. 8, 1990.

HOSTPLANTS: Females prefer to oviposit in well-vegetated spots, just downslope of Salix bushes on low herbs 2-5 cm tall (esp. V. cespitatum bunches ~3-7 cm wide), especially where the arrangement of bushes funnels the flying female into a cul-de-sac; using this search image and the fact that eggs are laid on leaf uppersides allows one to find eggs in nature fairly easily. C. scudderii is evidently semi-polyphagous, the hosts being V. cespitatum (evidently most frequent), S. planifolia, S. r. nivalis, V. scoparium, P. viviparum. S. planifolia is the main willow in the subalpine willow bogs occupied by C. scudderii, so is undoubtedly a frequent hostplant (see also Boloria frigga, which eats it). Lab larvae ate Polygonum viviparum well, Vaccinium cespitatum well, Salix planifolia well, S. babylonica well, S. amygdaloides well, S. exigua some, Viola labradorica poorly, V. sororia affinis (=mephyphylia) ate 1 cm², refused Trifolium pranigorum. Lab immatures do not diapause. EARLY STAGES (Loveland Pass): EGG cream, turning orange-red after a day. FIRST-STAGE LARVA olive-green with white setae; head black with cream setae. HALF-GROWN LARVA grass-green, with a greenish-white lateral band, seta bases pale green; head grayer green. MATURE LARVA grass-green, a pale-green dot at base of each seta, with a lateral uniform-width band that appears yellow from far away (up close, the band is white but the white is replaced ventrally by a yellow-orange margin which is narrowest in intersegmental areas and widest in the middle of each segment), a faint subdorsal yellow-green line; underside and head grayer-green. PUPA green (yellowish-green on abdomen), a lateral yellowish band (consisting of cream color with orangish-yellow ventral half) running from A2 to side of cremaster, with a wide sublateral purplish-red dash on each of A4, S, B and front of A7.

C. scudderii harroweri Klots. Adults in Wind River Mts. Wyo., like Colo. C. a. scudderii, associated with .5 m-tall shrub willows in open valley
Colias cesonia (Stoll). Oviposition 10:15 on Cassia? (1/2 m tall bush, with thousands of 2 X 5 mm grayish-green hispid leaflets, about 30 leaflets per leaf), Sycamore Can., Pima Co. Ariz., July 31, 1986.


Eucrema nicippe Cramer. Oviposition 9:10 on Cassia (Senna) hirsuta var. leptomorpha (W) bush, and 20 eggs of either E. nicippe or Phoebis sennae found on this bush, Pena Blanca Lake, Santa Cruz Co. Ariz., July 30, 1986.


Nathalis iole Bdv. 5 eggs laid 9:45-10:30 on 4-cm seedlings of Thelesperma macapotamicum (W), 4 eggs laid 9:45-10:30 on 4-cm seedlings of Dysosmia papposa (W), but no eggs laid on Macheanthera pinnatifida (W) or Ratibida columnifera (W) (all four are Asteraceae), all at Storrie Lake 6600', San Miguel Co. New Mex., Aug. 23, 1978. About 7 eggs found on top of of leaves of D. papposa seedlings, 3 mi. E Vineland, Pueblo Co. Colo., Aug. 28, 1983. Ovipositions 11:18, 11:40 on top of upper leaves (near flowers) of large (6 cm tall) D. papposa plants, Cherry Creek Reservoir, Arapahoe Co. Colo., Sept. 3, 1987. 4 eggs found on edge of upper leaf, 1 egg found on phyllary, all on D. papposa, Bandimore Speedway NE Morrison, Jefferson Co. Colo., Sept. 19, 1987. 7 ovipositions 11:40-11:44 on 7 plants (on top of leaf, on phyllary, on underside of bract beneath head, on tail of seed, on top of phyllary below head, on edge of upper leaf, on edge of leaf below head), all on small Bidens frondosa plants, adults feed on the flowers very often also, Barr Lake, Adams Co. Colo., Sept. 8, 1987. Adults common associated with B. frondosa, Barr Lake, Adams Co. Colo., Aug. 30, 1987. 2 larvae (8 mm and 1 cm long) found resting head-downward on flower heads (they rest on these flower heads in lab also) of B. frondosa, eat phyllaries and part of upper leaves, reared to pupae, Soda Lakes SE Morrison, Jefferson Co. Colo., Sept. 9, 1987. B. frondosa has no egg mimics. Adults associated with Chaenactis douglasii (W), 9 mi. NW South Platte town, Jefferson Co. Colo., Sept. 1, 1977. D. papposa is the favorite host on grassland, B. frondosa the favorite host along lakes/creeks. EGGS MIMICKING PLANT GLANDS. D. papposa has elongate spots on the phyllaries and part of upper leaves, reared to pupae, Soda Lakes SE Morrison, Jefferson Co. Colo., Sept. 9, 1987. B. frondosa has no egg mimics. Adults associated with Chaenactis douglasii (W), 9 mi. NW South Platte town, Jefferson Co. Colo., Sept. 1, 1977. D. papposa is the favorite host on grassland, B. frondosa the favorite host along lakes/creeks. EGGS MIMICKING PLANT GLANDS. D. papposa has elongate spots like the spots that are interpreted as egg-mimics on other Pieridae hostplants: each of the green phyllaries enclosing the flowers has 3-7 elongate 1.5 mm long orange-yellow (sometimes green) egglike ridges, and each leaf has 20-40 oval 1-mm-long orange-yellow translucent egglike spots that extend completely through the leaf; the leaf is pinnatifid, and each leaflet has one to several spots. These spots, called "glands" by botanists, apparently produce the plant's strong odor that gave the plant its common name "Fetid Marigold". Egg mimics are parts of plants that mimic the eggs of a phytophagous insect. A female attempting to lay an egg on the plant sees the egg mimic, is fooled into thinking that the mimic is a real insect egg, and the female does not lay an egg on the plant to avoid subjecting the hatching larva to competition resulting from an older larva hatching from the already-laid egg. Several examples are known. Heliconius females are deterred from laying by prior eggs, and egg mimics of Passifloraceae plants deter females from ovipositing (Williams & Gilbert 1981). Pieris sisyphriss lays fewer eggs on Brassicaceae hostplants already having eggs (Kellogg 1985), and egg mimics of Streptanthus (Brassicaceae) apparently deter P. sisyphriss females from ovipositing (Shapiro, 1981a). N. io eggs are laid singly on phyllaries and upper leaves, and are ochre-yellow; the eggs do not change color to orange, unlike all other Pieridae eggs I am familiar with (Pieris, Pontia, Euchloe, Colias, etc.) which change color to orange. The fact that N. io eggs are laid without hesitation on the plant parts which contain these egg mimics obviously proves the ineffectiveness of these egg mimics. The question therefore arises as to the purpose of these egg mimics. Population geneticists have shown that even a genetic trait that has a benefit of only 1% will spread through the population slowly, yet a benefit of 1% is too small to be proven in nature without great expense; so perhaps D. papposa egg mimics deter a small proportion
such as 1% of the eggs. Or perhaps the egg minics originally were more successful in deterring Nathalis oviposition, but the butterflies adapted and are no longer fooled. But there is more an interesting explanation. D. papposa has a strong odor, vaguely similar to parsley or a mixture of mint and onion, that gives the plant the common name "Fetid Marigold" and supposedly emanates from these orangish spots, which are called "glands" by botanists; so perhaps these spots are not true egg mimics and have another (odor) function (perhaps the scent they produce repels ungulates or prairie dogs?). And, far from being deterred by the egglke odor glands, N. iole females oviposit readily on D. papposa and may even prefer it to other plants because the eggs are protected by the chemical defense of the plants against herbivores and perhaps some predators; predators would be repelled by the egglke glands, or would become habituated to regard the orangish-yellow egglke structures as inedible, so when the predator encounters an orangish-yellow N. iole egg the predator would think it is repulsive or inedible. The apparent proof that N. iole eggs are mimicking D. papposa glands, rather than D. papposa glands mimicking N. iole eggs, is that N. iole eggs are orangish-yellow like the glands, not orange as in other Pieridae species, and females lay freely on the gland-bearing plants. The origin of the plant glands needs to be considered. Perhaps the plants evolved them without influence from N. iole, but most plant glands are tiny and not colorful, so the glands possibly originally evolved as true egg-minics, possibly orange in color, then after the egg-minic function was lost the orange color lessened to orangish-yellow and the N. iole eggs, now minics of the glands, followed the color change to orangish-yellow. If D. papposa mimicked N. iole eggs, then the eggs and glands would be orange, the presumed ancestral color of the eggs. Immatures did not diapause in lab; freezes kill the species. EARLY STAGES from Colo.: EGGS orangish-yellow, not changing color. NATURE LARVA green with numerous white hairs (some black primary setae) on pointed bases, a short T1 collar containing two short dorsal red hills, a 0.5 mm wide maroon middorsal band edged by a 1/4 mm yellowish band containing green pointed seta bases (the maroon and especially the yellowish band narrowing on T2 & T1 and narrowest at collar), a 0.3 mm wide yellow band containing spiracles is edged above by a 0.3 mm wide maroon band, A10 has a wide blunt slight tail; head green with many white setae, only 4 black eyes (the lowest smaller). PUPA green with whitish minute sinus markings (except emergence flap and wings have minute whitish-green mottling), underside of abdomen whitish-green, a middorsal maroon line on T1-2, from T3-4 a middorsal translucent-maroon-green band edged by a yellow band (the yellowish band extending forward weakly to rear of T2), A2-3 spiracles white with maroon cap, A4-8 spiracles in a yellow band, A4-8 spiracles with maroon cap above yellow band (a slight maroon spot in front of maroon cap of A4-7 spiracles), orbit translucent-greenish-white, larval eyes marked by 4 whitish-green bumps, sulcus behind vertex dark green and edged posterolaterally on T1 by slight reddish-tinged-cream, wing veins slightly whitish, no horn on head, proboscis extends to wing tips but covered by wings just beyond antenna, abdomen only moves at joints A4-5 and A5-6, pupa attached by cremaster and by silk girdle looped over A1.

Pierinae


Euchloe ausonia ausonides Lucas. Eggs on inflorescence of Brassica nigra, Briones Park, Contra Costa Co. Calif., March 19, 1970. Oviposition B. nigra inflorescence, Berkeley Marina, Contra Costa Co. Calif., June 1970. Several hundred ovipositions (recorded times 9:17, 9:29, 10:05, 10:10, 10:12, 10:24, 10:28, 10:34, 10:41, 11:09, 11:11, 11:38, 12:21, 13:22, 14:13, 14:15, 14:36, 15:09), eggs, and larvae, all found on B. nigra, larvae raised to adults on B. nigra, Point Richmond, Contra Costa Co. Calif., April-June 1970; eggs are laid singly in the middle of the unopened flower buds, and if the plant has more than one such inflorescence, more eggs are laid on the terminal than on lower inflorescences; females almost always lay only a single egg per plant, then fly at least 3 meters or so (usually much farther) before laying another; plants usually had one to several eggs, but one plant had 10; larvae eat the flowers and growing fruits. Three ovipositions and eggs found on Raphanus sativus, Point Richmond, Contra Costa Co. Calif., April-June 1970. Scott (1975a) reports ecology and movements. Eggs bluish-white when laid, turning orange after a day.


A 10-mm-long larva (reared to pupa) found under Cleome serrulata leaflet, Barr Lake, Adams Co. Colo., Sept. 5, 1989. A 12-mm-long larva found on C. serrulata leaf top (larvae wiggles violently from side to side when picked up with tweezers, an anti-predation behavior), Barr Lake, Adams Co. Colo., Sept. 25, 1989. B. orthoceras grows on creek banks, and is the most frequent native hostplant in this area; many Brassicaceae are eaten in weedy areas, and cultivated cabbage etc. are commonly eaten in gardens. Egg yellowish-cream, turning orange-cream. FIRST-STAGE LARVA yellowish cream on body and head. MATURE LARVA green with tiny dark hair bases, a yellow-green narrow heart line, a lateral row of deep-yellow dashes; head green. PUPA usually green but some are brownish-gray, all with some tiny dots including between wing veins, a middorsal cream band (weak on front of abdomen, with orange-brown areas below protruding processes on middorsal crest of head and abdomen), a lateral cream band on abdomen and above wings (partly orange-brown above wings near pointed processes), proboscis tip blackish; browner pupae have more tiny dots and have blackish-tipped processes and have a blackish spot on middorsal band on front of each abdomen segment.

_Pieris napi pallidissima_ (B. & McD.). This is probably a valid sspp., limited to W Colo.-Utah, characterized by very weak black markings and perhaps by multiple generations. Oviposition 11:00 and other eggs found on _Nasturtium officinale_ (W) leaves, Unaweep Can., Mesa Co. Colo., Aug. 30, 1978 (this population is one of the few multi-generation populations in Colorado, all of which are at low altitude along creeks in W Colo.).


FIRST-STAGE LARVA cream, becoming green internally after feeding; head tan-cream.


pupae; a lateral orangish-cream bump on T1 falls in line with a pale black-tipped orangish-cream bump on T2 wing base and in line with cream-gray inner margin of wing; a lateral ridge (lateral on A5-8 but running above wing on A2-4, where it protrudes esp. on A3) is orange-brown on A2-4 (darker red-brown on longest points, black on front on A4 and sometimes on front of A3) but on A5-8 is orange-brown on middle of segment and cream and between segments; cremaster somewhat bifurcate with crochets in center dorsally but most crochets are ventral.

_Pontia c. occidentalis_ (Reak.). Adults associated with Descurainia richardsonii, NE Mineral Point, “12,500’, San Juan Co. Colo., July 18, 1988. Oviposition 11:44 on 1-M-tall Cleome serrulata seedling under a 1-M-tall mature C. serrulata plant (ovipositing female identified by wing pattern and signum bursa 1.0 mm long); adults common around C. serrulata and males patrol for females there. _C. serrulata_ was the only green Crucifer present although a few weeks later the water was stopped in a canal and _Rorippa_ spp. became exposed and abundant; 3 eggs found on nearby _C. serrulata_ seedlings may have been _P. c. occidentalis_ or _P. protodice_; Barr Lake, Adams Co. Colo., Aug. 23, 1989. “20 half-grown to larger larvae found resting on top of _Rorippa_ teres leaves & stems, many reared to adults (determined by wing pattern, venation, signum bursa length); lab larvae prefer _R. teres_ to _Rorippa sinuata_; Barr Lake along canal, Adams Co. Colo., Oct. 11, 1989. _P. c. occidentalis_ flies sympatrically and synchronically with _P. protodice_ at Barr Lake; they occur at the same patches of _C. serrulata_ at the periphery of meadows, and near _R. teres_ in the same canals; in 1989 the _occidentalis_ peaks preceded those of _protodice_ by about 2 weeks (_occidentalis_ was common Aug. 23, scarce Sept. 5, less common Sept. 25, scarce Oct. 11, 21), whereas _protodice_ was common Aug 23, very common Sept. 5, common Sept. 25, extremely common Oct. 11, and scarce Oct. 21 (a freeze occurred Oct. 15-16 which seemed to affect _protodice_ more than _occidentalis_); even though their hostplants, microhabitats, and mate-locating behavior (males of both species patrol about the _Cleome_ to seek females) are the same, differences in timing of their flight peaks, larval color, wing pattern, wing venation, and length of signum bursa all prove that there is little or no hybridization between them. EARLY STAGES from Barr Lake: Pupae hibernate. EGGS yellow-cream, turning orange-red after a day. MATURE LARVA dark bluish-gray with many large black seta bases, a middorsal line on front half of body, a subdorsal band (consisting of, on each segment, yellow between segments, then blue-white, yellow, blue-white, yellow between segments), a lateral band consisting of same colors, a subventral band of yellow spots on A2-7 (on side of proleg base on A3-6), the dorsolateral and dark bluish-gray area is lighter in middle of segments; head bluish-gray except for dorsolateral yellow spot, with many black seta bases, adfrontal sulcus black, anterior eyes in a black crescent, lower part of frons black. Older larvae differ from _P. protodice_ by having darker (dark-bluish-gray) stripes (most larvae can be correctly identified but some cannot be); many pale larvae produced _P. protodice_, 2 somewhat-dark larvae produced _P. c. occidentalis_, 2 larvae described as dark but becoming somewhat dark produced _occidentalis_, many dark larvae produced _occidentalis_. PUPA usually light bluish-gray, sometimes bluish-tan or bluish-cream (pupae average slightly darker than _P. protodice_) with many tiny black dots (on wing the dots are between wing veins and near margin), a larger black dot above lateral ridge on front of each A5-8 segment, larger black lateroventral spots on A4-8, midventral black spots on A5-6 (usually an anterior spot with two legs in front and a posterior spot): the single tanhead horn is tipped with orange-brown; a tiny yellow anteriorly-directed bump just dorsal to antenna base; a middorsal line is orange-brown on thoracic crest (the highest point—on T2 crest—brown) but cream on abdomen (except interrupted by ground color on A2, and black on front of each A4-8 segment); a subdorsal faint cream band is on thorax (very weak) & on abdomen of all except the palest pupae; a slight orangish-tan lateral ridge on T1 falls in line with a black-tipped orangish-tan bump on T2 wing base and in line with cream-gray inner margin of wing; a lateral ridge (lateral on A5-8 but running above wing on A2-4, where it protrudes esp. on A3) is orange-brown on A2-4 (darker red-brown on longest points, black on front on A4) but on A5-8 is orange-brown on middle of segment and cream between segments and sometimes black on front of A7 & A8; anal margin of wing base blackish-gray (wings turning yellowish before emergence); cremaster somewhat bifurcate with crochets in center dorsally but most crochets are ventral.

_Pontia sisybrii_ (Bdv.) (=elivata [B. & B], a very weak sp.). Oviposition
Oviposition


processes and white streaks, extending

a day, FIRST-STAGE

on N-facing slope among Cercocarpus montanus, the female ignored Erysimum asperum and numerous Thlaspi arvense; Green Mt., Jefferson Co. Colo., May 9, 1989. 3 eggs (probably P. sisymbrii) found on plant, 1 egg found on leaf underside, all halfway up stem of Arabis glabra, Lookout Mtn., Jefferson Co. Colo., May 30, 1988. 4 orange eggs (probably P. sisymbrii) found on A. glabra, Tinytown, Jefferson Co. Colo., May 3, 1989. Oviposition 11:21 one egg on leaf underside 5 cm below top of 20-cm-tall plant, one egg found on underside of leaf base 12 cm below top of same plant, both on A. glabra, Tinytown, Jefferson Co. Colo., May 18, 1989. 2 eggs (probably P. sisymbrii) on underside of leaves halfway up A. glabra plants, Tinytown, Jefferson Co. Colo., June 2, 1989. 1 egg (probably P. sisymbrii) found on leaf underside halfway up A. glabra plant, Tinytown, Jefferson Co. Colo., June 6, 1989. 3 eggs (probably P. sisymbrii) on stem of Arabis (Boechera) drummondii 2/3 way up plant, Tinytown, Jefferson Co. Colo., June 8, 1989. Two eggshells (probably P. sisymbrii) found on A. drummondii stem halfway from base to top, Phillipsburg, Jefferson Co. Colo., June 17, 1989. Oviposition 14:30 on underside of leaf 60% up from plant base near stem of Arabis (Boechera) fendleri, eggs yellow-green when laid, Van Bibber Creek, Jefferson Co. Colo., May 26, 1988. Preoviposition, and egg, first-stage larva, and 3rd-stage larvae found on Descurainia richardsonii (W), Irish Can., Moffat Co. Colo., May 28, 1978. Oviposition Erysimum sp., Del Puerto Can., Stanislaus Co. Calif., Mar. 21, 1970 (this plant is probably refused by larvae). The favorite Calif. host (Sirentanthus) does not grow on the Colo. E slope, where Arabis may be preferred. Eggs yellowish-green when laid, becoming yellowish then orange after a day. FIRST-STAGE LARVA pale, with large red-brown plates at base of setae; head red-brown. MATURE LARVA white, with black pattern and yellow spots as follows, on top of body the black pattern consists of a rectangular patch extending from almost the middle of each segment to almost the middle of the next, the jagged sides of the rectangle extending laterally nearly to spiracles; within each rectangle are 1 transverse white, 1 transverse yellow, then 1 transverse yellow lines, then a yellow staple-shaped mark pointed rearward, except T1-2 rectangle has just 1 white line 1 yellow line, T2-3 has just 2 yellow lines, T3-A1 and A7-8 have 1 white line 1 yellow line 1 yellow staple, AB-9 has the ends of 1 white line missing its middle & 1 yellow staple top and underside of A10 black; lateral white area has a yellow fat H-shaped spot centered on each intersegmental area; a fragmented sinuous sublateral black band has tongues of black running down the front of each leg and down the rear of each proleg; underside of body mostly white; head black with tiny short white processes and white streaks, middle of frontoclypeus white, white all around frontoclypeus, white in front of eyes to frontoclypeus, white behind eyes, and white around eye #8.


Neohapasia menapia (F. & F.). Adults assoc. only with Pinus edulis, Bear Creek, Fremont Co. Colo., July 25, 1965, Aug. 6, 1965, Aug. 8, 1969. Oviposition 13:10, the female fluttered and landed 3 times, then landed 4 m up on N side of an 8-m-tall Pinus ponderosa var. scopulorum tree and turned upside down and laid 10 eggs single file along top of needle, the eggs angled toward the leaf tip about 30° and cemented together with very copious glue that filled the spaces between eggs, the process took ~30 sec. and between laying each egg she lifted her abdomen and returned it to between her wings; Shingle Creek, Jefferson Co. Colo., July 27, 1988. Eggs hibernate.

Satyrinae

Unfortunately, finding hosts of Satyrinae is difficult. Females oviposit at least somewhat haphazardly: some species often drop eggs from the abdomen tip, or oviposit on dead grass blades near or among the host, or oviposit on top of shrubs, or oviposit on rocks near the host, etc. The method of finding hosts is limited to observing ovipositions and finding eggs, because larvae cannot be found in nature at least in daytime (they are camouflaged, and may hide at the plant base by day). And many or most Satyrinae may be rather polyphagous on grasses/sedges in nature, because lab larvae can eat many grasses and sedges. Association of adults with potential hosts is useful. Despite all these problems, definite or probable hosts are known for most local Satyrinae.

Leche eryndice fumosa Leussler. Females were watched (at Fort Collins park, Larimer Co. Colo.), and all monocotyledons near the eggs laid were identified and their abundance noted: oviposition 10:45 three eggs in a row on underside of leaf of Asclepias gigantea (W) (this was the commonest plant near egg, but Poa palustris [W] was also fairly common, one Festuca pratensis [W] plant was within 1-2 m, and a few plants of Carex lanuginosa [W] and Scirpus pallidus [W] were within 1/3 m); oviposition 10:55 3 eggs in cluster on underside of Polygonum sp. leaf (Asclepias gigantea [W] was commonest near eggs, Carex praegracilis [W] was uncommon nearby, and Carex lanuginosa [W] was rare nearby); oviposition 11:03 1 egg on underside of Asclepias gigantea (W) leaf (A. gigantea was the commonest plant near eggs, and Carex praegracilis [W] and the grass Anenpyron [Elyttricia] repens [W] were uncommon near eggs); oviposition 11:20 3 eggs in row on underside of Asclepias gigantea (W) leaf (A. gigantea was the commonest plant near eggs, and Bromus [Bromopsis] inermis [W] was uncommon 30 cm from eggs); oviposition 12:02 2 eggs on underside of Asclepias gigantea (W) leaf (A. gigantea was common near eggs, but Poa palustris [W] was about equally common, and Carex lanuginosa [W] was uncommon near eggs); oviposition 12:10 one egg on underside of Asclepias gigantea (W) leaf (A. gigantea was common near egg, Poa pratensis [W] was less common in the understory near egg); oviposition 12:33 3 eggs within 4 mm of each other on underside of Lycopus americanus (Labiatae) leaf (Asclepias gigantea [W]) was the commonest monocotyledon near eggs, but Elaccharis palustris [W] was common in understory near eggs, a Carex nebraskensis [W] plant grew every 15-20 cm, and one clump of Juncus dulcevi [W] was 30 cm away from eggs), all Fort Collins park, Larimer Co. Colo., July 8, 1985. Oviposition 11:40 2 eggs on underside of Asclepias gigantea leaf (A. gigantea common 0-1 m, Poa pratensis even commoner 0-1 m, Dactylis glomerata large clump 70-90, Carex vesicaria 60, 70), 2 eggs found on underside of Dactylis glomerata leaves of very large clump (Asclepias gigantea scattered 10 cm onward), oviposition 12:00 2 eggs on underside of Poa pratensis leaf (P. pratensis thick nearby, Asclepias gigantea common 5 cm onward, Festuca pratensis 80-1 m, Carex vesicaria 30, 50), oviposition 12:25 3 eggs in cluster on underside of Asclepias gigantea leaf (A. gigantea widely scattered & a big clump 25 cm, Carex vesicaria common nearby (a
Collins adults are NOT genetically adapted to woods, even though they now occur seen in a small open marshy area in the woods; this seems to indicate that Fort Collins cylindrical leaves grass, whereas populations farther east eat only sedges (except for a population near Ithaca, N.Y. that Arthur Shapiro found eats grasses). I once thought that proved not to be genetic. Adults at the introduction site flew only in the open Marsh and not in the surrounding woods (although in 1990 several females were seen in a small open marshy area in the woods); this seems to indicate that Fort Collins adults are NOT genetically adapted to woods, even though they now occur mostly in wooded places; further proof of this is the population crash suffered
by the Fort Collins park population in 1990, 1 year after someone dumped "12 dump truck loads of fill dirt on half of the open area of the site (burying a spot where adults were formerly common and ovipositions were seen); the former native Colo. open marsh populations were evidently largely wiped out by water diversion, overgrazing (the Fort Collins meadow population has apparently been decimated by heavy sheep grazing), etc., leaving only the few current populations in marshy riparian woodland. EARLY STAGES from Fort Collins (and egg and 1st-stage also from Minn.): No diapause in lab; half-grown larvae must hibernate in nature. EGG pale cream, shiny, spherical. The eggs are fragile, and if the plant is picked the leaf dries and the eggs become distorted and die. Such mortality is unique among butterflies in my experience (eggs of other butterflies generally are strong enough to survive this); for lab rearing, eggs must be removed from their plant substrate by applying a drop of water until the adhesive is softened enough for removal. FIRST-STAGE LARVA green with 5 white lines (the subdorsal second and sublateral 5th lines wider than the others); head chitin-brown with a bright black points on each bump-like horn rudiment; Minn. larva cream (before feeding) with head orange-brown. 2ND-3RD-STAGE LARVA, body same as 1st stage; head green, mouthpart area brown, a red-brown anterior line extends from near eyes to long horn tip, on rear of horn this line is red-brown on tip then cream as it extends down to just below level of saddle between horns. MATURE LARVA green, a middorsal (paler-centered) dark-green band edged by narrow light-yellow line, then a light-green (paler-centered) broad band, a subdorsal yellow line, a green band, a narrow yellow line, a green band, a narrow yellow line, an olive-green band containing brown spiracles, a sublateral yellow line, (T1 has only the subdorsal and sublateral yellow lines, although the dorsal light-yellow line is weak on the rear half of T1), underside and prolegs dark-green, neck light yellow beside head near head stripe; head green, mouthparts brown surrounded by dirty-cream, the stripe on front of horn yellow at tip, orange-red just below, dark-green-black for most of the stripe down to the two black eyes (another larva has stripe orange-red edged laterally by yellow) on tip, brown-black just below, then darker-green for most of stripe down to eyes); on rear of horn the stripe light-greenish-white, white seta bases common on side of head lateral to head stripe. The older larval head stripe extends down to eyes, and the bumps lateral to this line are small, both traits similar to L. eurydice eurydice (Johan.) rather than to Lethe appalachia R. Cherm. Older larvae make a resting pad on the rearing jar, a silk mat equal to their length and width (these larvae also often rest on other larvae and lay silk over them, which causes difficulties in molting and pupation as the silk prevents the exoskeleton or head capsule from properly shedding, so to prevent deaths and deformities older larvae should be reared in isolation). PUPA bright-yellowish-green (front edge of T1 spiracle whiter-green in one pupa but not in another), wing veins and edge of mouthparts darker-green, greenish-yellow on underside of A5-8, a pearly-white line (widened upward in middle) connects two head horns, a pearly-white line runs along forewing edge from base to tornus, a large middorsal pointed hump (laterally edged with whitish-green at tip) on T2, a middorsal green band on T3-A8, a weak-yellowish-white subdorsal line on A2-10 or A3-10 (extremely weak on A1 or A2), a faint yellow sublateral line on A4-8 or A5-9. Oviposition to pupation 52-70 days in lab. ADULT BEHAVIOR. Males may fly slightly more readily in Colo. than in Minn. and Neb., although in all areas fuMosus is very local, and adults spend at least 80% of their time resting and seldom fly more than 3-6 m before landing (behavior characteristic of very local butterflies such as Boloria improba asperacnea and Erebia theano). Adults often fly through brush and through tree branches, and frequently land 20 cm or so into the plant canopy, often in the shade. Six adults were found resting on the low leaves of an elm tree at midday. To locate females, males seem to occasionally patrol weakly all day, about 20 cm above ground (or just above the plant canopy), and soon rest again, though several patrolling males were followed up to 30 m patrolling males chase other males and Cercaea penala. But perching behavior was seen occasionally: one perching male rested 2 m above ground on an Alnus bush and chased a C. penala and a Pieris rapae that passed near, and 2 other males rested on tall sedges and chased a passing male and a C. penala. In my experience with fuMosus (in Colo., Minn., Neb., S.D.) males patrol much more often than perch to locate females. In courtship of mated rejecting females, the female lands and closes her wings (and often swings down to hang from a leaf if the male persists), the hovering male often flaps his wings with wide amplitude beside and below her perch, then
when he lands he flutters his wings with lesser amplitude (perhaps 10-60 degrees above horizontal, 3-7 times/sec.) while butting her with his head, and he then curves his abdomen to attempt to join. Mating pairs were found at 10:15, 12:10, 14:26. Adults bask dorsally, and in warm temperatures turn parallel to the sun to avoid overheating. Adults were observed feeding on mud and on dung, but not on flowers. ADULT VARIATION. *Ssp. fumosa* adults in SW Minn., Neb., and Colo. show the same continuous individual variation in color, the palest adults forming 5-10% of the population in all three states; males are usually dark brown, the extremes light brown, whereas females are usually brown, the extremes tan (in *L. e. eurydice*, adults are less variable and average paler). Fu length averages longer in Colo.: it is 25.8 mm male & 27.9 mm female in Colo., 24.9 mm male & 28.7 mm female in SW Neb., 24.6 mm male & 26.4 mm female in Minn. (sample sizes are not given because of criticism from persons who decry any sampling of lepidoptera). HOSTPLANTS E OF COLO. Egg found under green leaf of *Sanecocia* among *Carex aquatilis* (*C. aquatilis* 0-400, *Poa pratensis* 50, 80 cm, *Carex stipata* 100, 100 cm), NE Alden, Freeborn Co., Minn., June 23, 1991. Assoc. with *C. aquatilis*, NE Alden, Freeborn Co. Minn., 1985-1991. Minn., Neb., and S.D. *fumosa* are assoc. with sedges in open areas, typically the sedge zone above the cattails and below the grassy edge of nearly-filled-in old lakes, sometimes in roadside ditches with sedges. *L. e. eurydice* larvae in states E of Colo. are known to eat only sedges (Steven Spomer, pers. comm., has reared Neb. and Iowa *L. e. fumosa* larvae in the lab on "nutsedge") and larvae do poorly on grasses (although a dry field population near Ithaca N.Y. eats both grasses and sedges in lab).


agassizensis thick 0-15 m, Bromus [Bromopsis] lanatipes 35-80), female did not hover she merely flew slowly and landed and crawled a bit to oviposit, Tinytown, Jefferson Co. Colo., June 13, 1992. HOSTPLANTS must be a variety of grasses (and probably also sedges, which are known hosts in Europe): Poa pratensis, Poa agassizensis, Festuca arizonica, Festuca idahoensis, Bouteloua gracilis, and Carex pennsylvanica heliophila had one egg apiece, and two other eggs were near Bouteloua gracilis, Festuca saximontana, Stipa comata, and Carex probably pensylvanica heliophila. EGG69 yellowish-cream when laid, soon developing hundreds of orange-brown dots many of which are connected into random streaks and lines. 1ST-STAGE LARVA cream-tan, becoming green due to feeding, a middorsal brown line, then a wide unlined area, a subdorsal brown line, 2 narrower brown lines above spiracles, lateral ridge prominent and becoming paler green, 2 long tails; head brown.

Cercyonis pegala nephele (Kirby) 18 hoopis (Behr)-olympus (Edw.). Oviposition 10:30 on edge of dead blade of Festuca arundinacea (W), Wheatridge, Jefferson Co. Colo., Aug. 7, 1984. Oviposition 13:02, female landed on Rosa leaf beneath shrub, and dropped an egg from abdomen, which fell and stuck to pine needle in litter (grasses within 30 cm of egg were many Andropogon [Schizachyrium] scoparius [W] and a few Poa agassizensis [W]), Genesee Mtn., Jefferson Co. Colo., Aug. 8, 1984. Oviposition 12:38, egg was extruded and dropped from above and stuck to Carex praegracilis (W) leaf, Lakewood, Jefferson Co. Colo., Aug. 7, 1984. Oviposition or preoviposition (egg probably fell into litter where it could not be found) on Solidago leaf above Poa pratensis (W) under a Populus tremula tremuloides tree (P. pratensis common nearby), Critchell, Jefferson Co. Colo., Aug. 2, 1987. Oviposition 11:51, she landed on horizontal green Poa pratensis blade 30 cm above litter and bent abdomen forward under and beyond leaf and an egg popped out and fell forward in a parabola into litter, egg (which must have been covered with adhesive) found stuck to dead grass blade in litter (P. pratensis 0-1 m, Agropyron [Elytrigia] repens 3, 3, etc. common, Carex nebraskensis 80, 90, Carex praegracilis 40-1 m), Lakewood, Jefferson Co. Colo., July 6, 1988. Oviposition 12:59, she landed on horizontal green Poa pratensis blade and bent abdomen down and forward and an egg popped out and fell in a parabolic curve into litter (P. pratensis thick in understory, Bromus [Bromopsis] inermis 0-1 m); oviposition 14:20, she landed on horizontal Bromus inermis blade and an egg popped forward and down into the litter (B. inermis common 0-1 m, Festuca arundinacea all around egg); oviposition 14:34, she landed on Polygonum occidentale leaf and bent abdomen down and a bit forward and shot an egg downward in a parabola, egg stuck to Poa pratensis leaf 5 cm above litter (P. pratensis thick near egg, Carex probably nebraskensis 25, 50); preovipositions 12:48, 12:48, 13:56 on Festuca arundinacea; Wheatridge, Jefferson Co. Colo., July 13, 1988. Oviposition 14:23, she landed on Cirsium arvense leaf and bent abdomen down and forward and an egg popped out and fell in a parabola into litter (Poa pratensis very thick below egg and all around, Agropyron [Elytrigia] repens 1 plant 30 cm, Bromus [Bromopsis] inermis 15, 15, 20-1 m, common), Wheatridge, Jefferson Co. Colo., Aug. 12, 1988. Egg found on dorsal surface of vertical Festuca arundinacea leaf, Wheatridge, Jefferson Co. Colo., July 11, 1988. Oviposition 12:24 below Pinus ponderosa canopy, she landed on Agropyron (Elymus, "Elytrigia") dasystachyum and I disturbed her, she flew 10 cm and landed on A. dasystachyum again and bent abdomen beneath and forward and an egg dropped into litter where it was found stuck to a stem of A. dasystachyum 2 mm above dirt (A. dasystachyum 0-100, Poa pratensis 0-100 in understory of A. dasystachyum, Bromus [Bromopsis] inermis 35, 45, 50, 100, Agropyron cristatum ssp. 80), E of Shingle Creek, Jefferson Co. Colo., Aug. 17, 1989. Preoviposition 13:15 Carex praegracilis (Poa pratensis 20, Eleocharis 30); N Greenwood, Douglas Co. Colo., July 23, 1990. Oviposition 10:40, she landed on Festuca arundinacea and bent abdomen, a cream egg was found stuck to dead litter below (F. arundinacea 0-100, Poa pratensis 0-100, Bromus [Bromopsis] inermis 2-100); Wheatridge, Jefferson Co. Colo., Aug. 11, 1990. Oviposition 11:26, she rested on Bromus [Bromopsis] inermis leaf and abdomen bent down and far forward and egg shot forward & down and stuck to B. inermis leaf 15 cm above ground (B. inermis 0-100, Festuca arundinacea 2-100, Poa pratensis 2-100); oviposition 12:25, she landed on Festuca arundinacea leaf, bent abdomen down & forward, egg popped out and down into litter but could not be found (F. arundinacea 0-100, Poa pratensis 8, Bromus [Bromopsis] inermis 100); Wheatridge, Jefferson Co. Colo., Aug. 13, 1990. Female bent abdomen on Bromus [Bromopsis] inermis above Poa pratensis sward but laid no egg; Wheatridge, Jefferson Co.
Koeleria macrantha (W) (3 or more other grass species were within probably pensylvanica heliophila 2, Agropyron [Elymus = Sitanion] longifolius oviposition was quick so the female doubtfully knew which grasses were near), only grass present was Poa agassizensis (W) common, oviposition 12:57 on underside of pine needle in litter near bush) (Poa agassizensis 3, Solidago, Stipa, Comata) (Poa agassizensis 3, both Corwina Park, Jefferson Co., Colo., Aug. 27, 1984. Oviposition slightly darker small leaftip of Cercocarpus Montanus (in partial shade of this 25 canopy of Ceanothus fendleri prostrate shrub, the only grass there was Poa agassizensis) (1 egg). Larvae are known to eat Poa pratensis in the lab; they occur in Colo., where T3wA4, the petals of Cercocarpus Montanus, are not yet known to eat Carex. Festuca arundinacea has very tough straplike leaves, so perhaps this grass is not favored by larvae. Females no doubt oviposit haphazardly on or near numerous grasses. When I first saw a C. pegala egg pop out and shoot into space, I found it hard to believe, but many further observations prove that this happens more than 50% of the time; the egg is attached directly to a substrate only if the abdomen happens to contact something when the female decides to oviposit (the female seems to make no great attempt to make contact), otherwise the egg is shot into space and falls into the litter. Females generally oviposit when they are 10-40 cm above ground resting on a plant, so in contrast to the weak eggs of Lathe eurydice, the eggs must be tough enough to withstand the fall. All eggs must be coated with wet adhesive when extruded, because they usually stick to the first object they contact on their fall, so that up to 1/3 of falling eggs stick to objects above the basal thatch litter. Because females merely flutter more slowly than the usual flight before ovipositing, and because females DO shoot eggs into space, females must be watched VERY closely to detect oviposition and see the egg fall. Diapause of adult female pegala has been reported, but is doubtful, and does not occur in Colo., where my latest records are Sept. 7 & 30 for males and Sept. 23 for females, though the sex ratio after Sept. 15 is about 25% males. Unfed first-stage larvae hibernate. Egg cream when laid, soon developing about 100 diffuse purplish-red spots. FIRST-STAGE LARVA tan, with a rosy dorsal flush on T3-A4, A10 yellowish, a middorsal dark-red line, two red (or brown) subdorsal lines, a weaker brown lateral line, white scythe-like setae; head yellow-tan with short brown setae. PREPUPA green, darker heart-line, a subdorsal yellowish line; head olive green, eyes 1-5 brown. PUPA light green (green with cream motting, wings streaked with green and cream-green), a middorsal cream line (tuinned on abd.), subdorsal cream line, the sharp upper edge of wing cream (this edged above by green and on wing base a blackish dot), a cream transverse line on sharp lower edge of head, abdomen has a faint cream lateral band and slightly-darker midventral band.

Cercyonis oetus cherson (Edu.). Oviposition 11:39 on dead grass blade below canopy of Ceanothus fendleri prostrate shrub, the only grass there was Poa agassizensis (W), Genesee Mtn., Jefferson Co., Colo., Aug. 8, 1984. Oviposition 11:33 on underside of dead grass blade in litter among Eriogonum umbellatum (the only grass present was Poa agassizensis (W) common), oviposition 12:57 on underside of pine needle in litter near Solidago, Astragalus, and the grass Koeleria macrantha (W) (3 or more other grass species were within 1 m, and the oviposition was quick so the female doubtfully knew which grasses were near), both Corwina Park, Jefferson Co., Colo., Aug. 27, 1984. Oviposition 11:08 on small leaftip of Cercocarpus montanus (in partial shade of this 25 cm tall bush) (Poa agassizensis 3, 4, 8, 10, 15, 15, 20, etc., common in a sward, Stipa comata 10, 12, 15, 20, etc. common, Carex probably pensylvanica heliophila 17, 20, 30, 30, etc., Bouteloua [Chondrosal] praeclasis 60-1 m), Shingle Creek, Jefferson Co., Colo., July 27, 1988. Oviposition 12:11, she landed in little clearing 10 cm wide on ground, crawled 7 cm and laid an egg on underside of dead horizontal grass blade in litter (Poa near agassizensis abundant 5-100, Carex probably pensylvanica heliophila 2, Agropyron [Elymus = 'Sitanion'] longifolius 20, Agropyron trachycaulium 30, Bromus [Bromopsis] lanatipes 85, 100, Stipa probably viridula 50), Tinytown, Jefferson Co. Colo., Aug. 21, 1989. Egg found
on Festuca idahoensis (F. idahoensis abundant 0-100, Agropyron
[Elvynus="Sition"] elymoides 30, 40, Stipa comata 5, 25, common 40 cm onward.
Bromus [Bromopsis] inermis 60, 100), SW Hot Sulfur Springs, Grand Co. Colo. June 28, 1989. Pupa ("13 wasps later emerged from") found attached to Potentilla
gracilis var. pulcherrima leaf underside, the leaf silked somewhat so that it is
conceal downcast to form an umbrella over the pupal abdomen, Festuca idahoensis
common nearby; SW Como, Park Co, Colo., July 17, 1989. HOSTPLANTS: Front Range
females seem to prefer Poa agassizensis (4 eggs), and no doubt occasionally
oviposit on many other grasses including Koeleria macrantha; in W Colo. Festuca
idaensis is a popular host. C. oetus occurs in drier habitats than C. pegeal,
and Poa agassizensis is the native drier-habitat (rich-soil hillsides and
sloping swales) relative (perhaps a ssp.) of C. pegeal's favorite host Poa
pratensis (which occurs in moist swales). Females release the eggs while on the
litter or while up to 10 cm above ground, closer to the ground then C. pegeal.
Female Cerbyonis hop-flutter when they search for a place to oviposit, and the
flight is only slightly more fluttering than the normal hopping flight, in
contrast to non-Satyrinae (and skippers) in which the oviposition flight is much
more fluttering. Unfed first-stage larvae hibernate. EGG cream when laid,
developing 100-200 diffuse red or red-brown spots. PUPA light green, a
middorsal cream band, a subdorsal cream band, the inner angle of wing is cream
edged dorsally by dark green, a subspiracular cream abdomen band, intersegmental
areas between A4-7 tan, cream beneath anterior transverse ridge of head,
spiracles & crochets chitin brown.

Cerbyonis meadi meadi (Edw.). Adults associated with Bouteloua (Chondrosum)
gracilis, Andropogon (Schizachyrium) scoparius, etc., NE Foxton, Jefferson Co. Colo., Aug. 25, 1989. Adults

Cerbyonis meadi alamosa T. & J. Emmal. Adults associated with Bouteloua
(Chondrosum) gracilis in San Luis Valley, Colo., which is probably a hostplant
there. Adults associated with B. gracilis, Jaroso, Costilla Co. Colo., and W
Cerro, Taos Co., New Mex., Aug. 15, 1989. Adults associated with Sporobolus
acicroides (almost the only grass present, except for a small patch of Distichlis
spicata var. stricta), which must be a host, unless adults fly far to find the

Erebia magdalena magdalena Strk. Oviposition 12:28 on side of rock near
Luzula spicata (Juncaceae, which larvae doubtfully eat) (W) on a slope above a
rockslide, Loveland Pass, Summit Co. Colo., July 27, 1978 (Carex albonigra,
Carex rupestris drummondiana, and Carex phaeocephala were also found at this
spot). Vegetation around rockslide where adults were common was C. p. drummondiana common, Luzula spicata common, Carex haydeniana fairly common,
Festuca brachyphylla coloradensis a few, Poa arctica a few; Loveland Pass,
Summit Co. Colo., July 29, 1989. Females fly for short periods and usually land
on rocks, and several possible ovipositions on rocks were seen before I learned
to search the rocks for eggs after females departed. The newly hatched larvae
evidently drop off of or crawl away from the rocks to find food, and are
doubtfully restricted to a single host. Four young larvae ate Poa pratensis
well (grew to half-grown on it), ate some Carex rupestris drummondiana leaf
tips, and ate some Carex nebraskensis (but less of it than Poa pratensis).
Michael Young found that larvae eat Poa pratensis in the lab, and larvae
hibernate. My half-grown larvae died in lab. EGG cream when laid, turning
slightly-reddish cream. FIRST-STAGE LARVA cream at hatching, after feeding
light bluish-green on top half of body from T1-A4, from AS-A9 the blue-green
color diminishes greatly posteriorly, the rear and underside tan, red-brown
lines present (1 middorsal band, 2 dorsolateral lines, 1 band just above
spiracles, a whitish lateral band has a faint narrow red-brown line edging it
beneath), setae black; head black. 2ND-STAGE LARVA bluish-green on T1-A4,
bluish-greenish-tan on AS-A10, 4 bands that are brown anteriorly, red-brown on
rear (1 middorsal, 2 dorsolateral, 1 just above spiracles), numerous tan setae
with brown bases; head black. HALF-GROWN LARVA yellow-green, with dark-brown
bands (middorsal, 2 dorsolateral, 1 on top edge of spiracles), below spiracles a
dark brown line edging an ochre band on lateral ridge, a dark-brown band just
below lateral ridge, thousands of tan setae; head black.

Erebia theano ethala Edw. Oviposition 8:55 on dead "grass" leaf within 10 cm
of Carex foenea (W) and Poa nebraskensis interior (W) and a few Poa fendleriana
var. longiligula and Festuca brachyphylla coloradensis; oviposition 11:29 on dead "grass" leaf within 10 cm of C. foenea (W) and P. b. coloradensis (W) and some P. n. interior and a few P. f. var. longiligula; oviposition 13:15 on dead twig within 10 cm of C. foenea (W), P. nemoralis (W), and Agropyron (Elymus) trachycaulum (W); oviposition 12:27 on dead "grass" leaf within 10 cm of Luzula parviflora (W) and C. foenea (W); C. foenea, P. nemoralis, & A. trachycaulum were the commonest monocotyledons at this site, F. b. coloradensis and P. f. var. longiligula were less common, and there were a few Trisetum spicatum spicatum. Logging about 30 years previously had created its grassy habitat: all N-facing slope on Rollins Pass Road, 11000', Gilpin Co. Colo., Aug. 5, 1978. It is tempting to assume that Carex foenea is the usual hostplant at this site, but its ability to logging has not been tested (larvae do eat Poa pratensis in lab). Adults (ssp. demnia Warren, a weak ssp.) is associated with Calamagrostis canadensis (W) and another coarser grass, Weminuche Pass vicinity, Hinsdale Co. Colo., July 31, 1972. The preferred habitat is fairly long grass/sedge, which logging can provide: certainly the habitats should not be allowed to be destroyed by the overgrowth of trees, so logging (even clear-cutting) or fire should be practiced. P. theano is biennial in Colo., occurring mainly on even years as adults (except for one odd-year colony in the San Juan Mts.) and hibernating as a larva, a young larva during the first winter, perhaps an older larva during the second winter. Larvae eat Poa pratensis in the lab. FIRST-STAGE LARVA cream, lines very faint; head tan. SECOND-STAGE LARVA cream, with red-brown lines (1 middorsal narrow band, 1 narrow dorsolateral line just above a wide dorsolateral band, a weak brown line along spiracles edged below by a tan band on lateral ridge, this edged below by a brown line); head tan. HALF-GROWN LARVA (Corona Pass) ground color brown, a fold between each segment appears as a dark line, a wide middorsal blackish-brown band is edged by tan, next a broad brown band, a dorsolateral paler-blackish-brown band is above a pale-brown band, which is just above a blackish line that edges the top of a brown band mottled with blackish, a narrow tan band below that, then a wide brown band containing black spiracles has dark-brown streaks between spiracles, the lateral ridge is pale-brown and is sharply-edged below by blackish-brown, a sublateral mottled blackish-brown band, underside mottled brown with pale-brown prolegs & legs, two very short tails on rear, body covered with slightly-curved thick setae with dark-brown slightly-enlarged tips; head brown, with shorter slightly-curved brown setae with brown slightly-enlarged tips, no horns.

Erebia epipsodea Butl. 2 ovipositions on Poa pratensis saddle: the female bent abdomen on P. pratensis dead blade, flew then oviposited 14:40 on Oenother coronopifolia (not a host) (P. pratensis 0-10 m, Stipa sp. 45, 55, 70, 100); landed on P. pratensis twice more, then oviposited 15:00 dead P. pratensis leaf (P. pratensis 0-10 m, Stipa sp. 1 m, Carex pennsylvanica heliophila 0-5 m); Tinytown, Jefferson Co. Colo., June 16, 1992. Adults associated with P. pratensis/penstemonis, Crawford Gulch, Jefferson Co. Colo., June 10, 1992. Female bent abdomen 3X on Poa anserine, Tinytown, Jefferson Co. Colo., June 13, 1992. Oviposition 10:20 Carex pennsylvanica heliophila dead (for last 3 cm) leaf tip 3 mm from tip (C. p. heliophila 0-100, P. pratensis 0-10 m, Stipa comata 20, 20, 50, 60, Agropyron (Elymus, "Sitanion") longifolius 12, 20, 30, 40, 50, 50, 100, etc., Koeleria macrantha 70, Danthonia parryi 50-70, 100); oviposition 12:05 Koeleria macrantha vertical green leaf tip (2 cm from tip) (K. macrantha 0-25, 50, 30-90, 100, etc. commonest grass near egg, Agropyron (Elymus, "Sitanion") longifolius 7, 30, 30, 40, 40, 50, 60, etc. common, Poa pratensis 5, 7, 10-100, Bouteloua gracilis 70-100; oviposition 14:55 middle of 20-cm clump of Danthonia parryi on slightly-leaning dead (on last 2 cm) leaf tip 1 cm from tip (D. parryi 0-10, 50, 60, 90-100, P. pratensis 5, 7, 7, 7-100 thick, Bromopsis porteri 15, 30, 35, 70, 70, etc., Agropyron (Elymus, "Sitanion") longifolius 30, 50, Stipa comata 30, 40, 50, 80); oviposition 15:30 Poa pratensis dead (on last 1 cm) leaf tip 2 mm from tip (P. pratensis 0-10 m, Agropyron (Elymus, "Sitanion") longifolius 7, 25, 25, 30, 30, 40, 40, 60, etc., Bromus (Bromopsis) inermis 35, 50, 80); Guy Hill, Jefferson Co. Colo., June 18, 1992. Preoviposition 15:25 dead grass among Poa pratensis (Dyssosis micrantha and Bromus (Bromopsis) inermis 5 cm away etc.), Tinytown, Jefferson Co. Colo., June 17, 1992. Oviposition 10:24 vertical Poa pratensis dead leaf tip (last 5 cm dead, egg 1.5 cm from tip) (P. pratensis 0-10 m, Agropyron (Elymus, "Sitanion") longifolius 7, 15, 20, 30, 30-100 common, Stipa comata 25, Koeleria macrantha 30, 30, 40-50); oviposition 14:54 vertical Carex pennsylvanica heliophila dead leaf tip (last 2.5 cm dead, egg 1.5 cm from tip) (C. p. heliophila 0-100, P. pratensis 2-100, Danthonia parryi 8, 15, 40, 40, 50, 70, 70, etc.)
Erebia callias callias Edw. Oviposition 9:59 on dead grass blade in clump of Poa fendleriana var. longiligula, nearby was Carex rupestris drummondiana (W); oviposition 9:05 on dead grass blade among Poa fendleriana var. longiligula, nearby was Poa glauca (W); oviposition 9:58 on dead grass blade among Poa nemoralis interior, nearby was Anagyrus (Elvus) scribani (W); Festuca brachyphylla coloradensis also common at this site; Loveland Pass, Clear Creek Co., Colo., July 22, 1978. 1 egg (egg and lst-stage larva resembles callias) found on Arenaria fendleri var. tweedyi leaf (Carex rupestris drummondiana 10, 8-15 cm away, Calamagrostis purpurascens? 10, Halictotrichon mortonianum clump 25, Poa fendleriana var. longiligula 20, 25), Hoosier Pass, 12000', Park Co., Colo., Aug. 31, 1988. 1 egg found on dead horizontal culm in Festuca brachyphylla coloradensis clump (F. b. coloradensis 0-3, abundant 5-100, Carex rupestris drummondiana 20-40, 30-100, Poa glauca 50, Halictotrichon mortonianum 20, 22, common 30-50, 50), Loveland Pass, Clear Creek Co., Colo., July 22, 1989. Egg found 13:16 on dead horizontal blade in Festuca brachyphylla coloradensis clump (F. b. coloradensis 0-30 common, Halictotrichon mortonianum 17, 25, 30, 35-50, 40, 60, etc. abundant, Carex foenea 70, 75, Poa glauca 55, 70, Poa fendleriana var. longiligula 30, 60, Carex rupestris drummondiana 40); egg found 13:31 on dead horizontal grass blade in Festuca brachyphylla coloradensis clump (0-15, 10, 10-30, etc. common to 100, Halictotrichon mortonianum 18, 20, 20, 30, 30, 40, etc., Poa fendleriana var. longiligula 20-30, 35, 40, 40, 40, Carex rupestris drummondiana 0-15, 0-15, common 15-100); egg found 13:39 on dead horizontal blade in Festuca brachyphylla coloradensis clump (F. b. coloradensis common 5-100, Carex rupestris drummondiana 2, 2, 5, 8, 10, etc. common to 100, Halictotrichon mortonianum 15, 17-30, 25, etc. common, Poa glauca 15, 17, 25, 30, etc.); egg found 13:50 on dead horizontal grass blade next to Carex foenea (1, 15, 20, 25, 30, etc. to 100) and next to Halictotrichon mortonianum (3, 6, 10, 10, 20, 30) (Carex rupestris drummondiana common 5-100, Festuca brachyphylla coloradensis 2-5, 8-15, etc. common to 100, Poa glauca 40); egg found 14:24 on vertical dead blade in Kobresia mosooides clump (K. mosooides most of vegetation 0-10 m, Carex rupestris drummondiana 2, 5, 5, 7, 7, 10, 10, common to 100, Halictotrichon mortonianum 10, 15, 15, 20, 20, 40, 50, etc., Luzula spicata 40, 40); egg found 14:37 on vertical dead blade in Kobresia mosooides clump (K. mosooides most of vegetation 0-8 m, Carex rupestris drummondiana 2, 4, 8, 10, 14, 15, etc. common to 1 m, Halictotrichon mortonianum 15, 20, 70, 70, 90, 100, Festuca brachyphylla coloradensis 20, 35), Loveland Pass, Clear Creek and Summit Cos. Colo., Aug. 3, 1988. Females oviposit rather haphazardly among grasslike clumps, placing each egg on the underside of a dead blade. Adult association is therefore important for determining probable larval foods: the sedge Kobresia mosooides (W) is the main and often the only plant where adults are common, at Loveland Pass, Summit Co. Colo. (many years data), at NE Gray's Peak, Clear Creek Co. Colo., Aug. 4, 1984, at Houghton Mtn., San Juan Co. Colo., July 22, 1980, at NE Rio Grande Pyramid, Hinsdale Co. Colo., July 31, 1972, and at Uncompahgre Peak, Hinsdale Co. Colo., Aug. 3, 1978. The two eggs found on Kobresia mosooides, together with the fact that adults are most often found on K. mosooides knobs, seem to prove that it is the most frequent hostplant in nature, and E. callias has adapted to it; K. mosooides is the climax dominant of mature tundra soils, forming dense swells on top of thick-soiled gentle knobs and flats where E. callias is common, and where other monocots such as Poa fendleriana var. longiligula, Festuca brachyphylla coloradensis, Carex
Oviposition flight is not as noticeable as in other butterflies such as *Poa pratensis*, but ate no *K. myyosucidae* (in nature larvae may eat *K. myyosucidae* only in June-July when it is more tender, because larvae probably hibernate as young larva then older larva). Other hosts may be *Festuca brachyphylla coloradensis* (4 eggs), *Poa fendleriana* var. *longiluca* (2 eggs), *Poa nemoralis* interior (1), *Carex rupestris drummondiana* (1), *Carex foenea* (1). Larvae perhaps feed on many sedges and grasses. Probably biennial, but flying every year; my 3rd-stage larvae died in lab. EGG light-bluish-green, with ribs on side and bumps around top. FIRST-STAGE LARVA blue-green on thorax, tapering rearward to creamy-tan on rear, with red-brown bands (1 middorsal, 2 dorsolateral, 1 along spiracles), a light-brown band below lateral ridge, many tan spines with black bases; head black. 3RD-STAGE LARVA brown (a blue-green tinge on top of thorax), a blackish heart-band edged by a tan line, 2 dorsolateral blackish lines, a dark-brown line along spiracles, a brown band below light-brown lateral ridge, numerous tan setae with dark-brown bases; head black.

*Neominois ridingii* (Edw.). Six ovipositions on *Bouteloua* (*ChondrosuM*) gracilis, one oviposition on *Koeleria macrantha* (previously reported as *Koeleria cristata*, now a syn. of *K. macrantha*), one oviposition on *Artemisia frigida* (near *B. gracilis*), oviposition on dead twig while sitting on *A. frigida* (near *B. gracilis*); the main host here is undoubtedly *Bouteloua gracilis* which forms the main ground cover; 1 m. up Bear Creek, Chaffee Co. Colo., June 1969, June 1970. Oviposition on *Agropyron (Elymus="Sitanion") longifolius* (="Sitanion hystrix"), Round Mtn., Custer Co. Colo., June 1970. Oviposition on *Stipa comata*; oviposition on top of *Helianthus pumilus* (6) bush; Bull Domingo Mine, Custer Co. Colo., June 1970. Oviposition on top of *Gutierrezia sarothrae* (6) shrub (probably near *Bouteloua gracilis*), Ben West Hill, Custer Co. Colo., June 1970. Females oviposited on either green or dead vegetation, either a shrub or herb or grass, wherever the female happens to be during warm parts of the day (ovipositions 9:16, 9:16, 9:33, 10:05, 10:08, 10:13, 10:21, 12:21, 12:31, 12:32). Females most often oviposited on grasses, but in hot weather females move to the top of shrubs to escape the heat, where they oviposited. The hesitant oviposition flight is not as noticeable as in other butterflies such as skippers. Scott (1973a) reports ecology, behavior, and movements. Adults are biennial in the Hudsonian Zone of Calif., but seem to be annual in Colo.

*Oeneis alberta alberta* Elwes (="oslari" Skin.). Live egg (88) found on *Festuca idahoensis* large clump (*F. idahoensis* 25 cm, 30, 60, 1 m, *Muhlenbergia torreyi* 5-1 m, *Koeleria macrantha* 15-30, *Carex oreocharis* 40-1 m, 90, *Agropyron (Elymus="Sitanion") longifolius* 45), shriveled egg (#78) found on *Festuca idahoensis* large clump (*F. idahoensis* 6-30, 70-1 m, *Muhlenbergia torreyi* 5-1 m, *Carex oreocharis* 25-35, *Agropyron (Elymus="Sitanion") longifolius* 1, 1 m), eggshell (#82) found on *Festuca idahoensis* large clump (*F. idahoensis* 50, *Muhlenbergia torreyi* 0-1 m, *Bouteloua (ChondrosuM) gracilis* 20-1 m, *Agropyron (Elymus="Sitanion") longifolius* 25, 40, *Carex oreocharis* 70, 50-1 m), eggshell (#85) found on *Festuca idahoensis* large clump (3 *F. idahoensis* clumps 1 m, *Muhlenbergia torreyi* 5-1 m, *Koeleria macrantha* 5, 25-40, etc. to 1 m, *Carex oreocharis* 5-1 m); all 4 eggs were "4 cm above ground on downslope side of *Festuca idahoensis* clumps; SW Jefferson, Park Co. Colo., June 23, 1988. Adults associated with *Festuca idahoensis* widespread NE and South Park, Park Co., Colo., June 2, 1988. Obviously *Festuca idahoensis* is the major host in this area because all the monocots were searched somewhat; it is associated with adults everywhere in Park Co. and is the largest bunch grass (*Muhlenbergia torreyi*) grows in a matlike ring with dead center and is somewhat dry, and *Agropyron (Elymus="Sitanion") longifolius* grows in shorter bunches but is shunned by butterflies. Adults associated with *Festuca idahoensis*, NW Tabernash, Grand Co. Colo. (adults found here early June 1969 by Andrew Warren, site revisited June 24, 1989 by Warren and J. Scott). EGG white, the valleys turning reddish-white. FIRST-STAGE LARVA whitish-tan (slightly bluish-green on top of front half of body), middorsal brown heart-band, a narrow brown subdorsal line, a brown supraspiracular band, a brown band just below lateral ridge; head tan, with two faint brown bands corresponding to the medial two bands of older larva (one beside coronal sulcus, the other lateral to that band).

*Oeneis chryxus chryxus* (D. & H.). Oviposition 10:12 the female flew slowly (not hovering) under/near trees a few times then landed on a 2-m-tall unsawed dead stump in partial shade of Ponderosa Pines and laid egg 1.5 m above ground just beneath hanging strip of wood (*Carex rossii* 30-80, 40-60, 80-60, 80, 90, 1 m, *Agropyron (Elymus, "Sitanion") longifolius* 100, *Oryzopsis exigua* 40,
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50, 80, 89, 90, 1 m, 1 m); 31 eggs found under Ponderosa Pine canopies (height of egg above ground, thickness of branch and whether it had bark or bark was gone, and distance of monocots from where egg would fall is noted): egg found 80 cm up on bark of 3 cm branch (C. rossii 30-90, 75, 100, 100, common, Koeleria macrantha 80, Agropyron [Elymus, "Sitanion"] longifolius 40, 40, 45, 50, 50, 50, 50, 80, 80, 80, 80, 80, 90, 90); egg found 8 cm up on 4 mm thick twig (C. rossii 15, 35-100, 50, 50, 50, 50, 80, 70, common, Q. exigua 50, 80, 100, 100, Stipa comata 90); egg found 10 cm up on bark of 5 mm fallen branch (C. rossii 15-25, 40, 45-100, 50-100, O. exigua 10-15, 15, 30, 50, Stipa comata 30, 40, 50); egg found 1 m up on bark of 3 cm twig (C. rossii 10, 10, 10-50, 40, 45, 50-80, 0.100, Stipa comata 60); egg found 8 cm up on bark of 3 cm fallen branch (C. rossii 15, 30-100, 35, 35-100, common, Q. exigua 15, 20, 30, 30, 40, 40 common); egg found 1.5 m up on bark of 3 cm fallen branch lodged against trunk (C. rossii 0-15, 40-100 common); egg found 5 cm up on 4 mm fallen twig (C. rossii 17, 25, 80, 90, Stipa comata 50, 60, 50, 100, 100, O. exigua 50); egg found 5 cm up on 4 mm twig (C. rossii 5, 10, 10, 20, 30, 50, 80, 80, 90); egg found same tree 1 m up on side of barkless branch 3 cm thick (C. rossii 15-100, 30-100, 30, Stipa comata 50, 90); egg found 30 cm up on 8 mm barkless twig of fallen branch (C. rossii 5-20, 30-60, 30-65, 40, etc. common, O. exigua 50, 80, 80, 90); egg (with hole made by trichogrammatid) found 30 cm up on 6 mm twig (C. rossii 30-50, 50-70, 60-120, Q. exigua 30-50, 35, 50); egg found 25 cm up on bark of fallen 3 cm twig (C. rossii 20-45, 50, 50, 100, sparse); egg found 40 cm up on 10 mm twig (C. rossii 25, 50, 60, 80-100, 100); egg found 40 cm up on 2 cm barkless branch (C. rossii 7, 10, 10, 15, 15, etc. common to 100); egg found same tree, 8 cm up on 4 mm twig (C. rossii 30-50, 50-100, 70, 80, 80, etc., O. exigua 100); egg found 10 cm up on 1.5 cm barkless branch (C. rossii 5-100, 50-100, 60-100); egg found 8 cm up on bark of 5 mm fallen twig (C. rossii 10-35, 35-70, 40-100, O. exigua 80-90); egg found 25 cm up on 4 mm fallen barkless branch (C. rossii 15-30, 30, 30-120, 50, 70, O. exigua 30-50, 60, 60, 70); egg found same branch 25 cm up on 5 mm barkless twig (C. rossii 8, 10, 15, 15, 35, 50-100, O. exigua 40, 50, 75); egg found same tree, 8 cm up on bark of 2 mm live twig (C. rossii 0-60, 60, 60, 60, etc., O. exigua 45, 50, 100); egg found 70 cm up on bark of 2 cm branch (C. rossii 5, 10, 25-70, 40, 50, 60, 60, Agropyron [Elymus, "Sitanion"] longifolius 50, 80, Koeleria macrantha 90); egg (with hole made by trichogrammatid) found same tree, 60 cm up on bark of 5 mm twig (C. rossii 8, 30, 30-100, 40-60, 60, etc., O. exigua 30-100, 100, Koeleria macrantha 90, Agropyron [Elymus, "Sitanion"] longifolius 50, 80); egg found 1.2 m up on bark of 1 cm branch (C. rossii 5-100 all around common, O. exigua 50, 60); egg found 20 cm up on 1.5 cm fallen barkless branch (C. rossii 15-40, 50, 50-100); egg found 1.8 m up on bark of 10 cm branch (C. rossii 2-10, 20, 20-50, 30-100, 35-70 etc., Agropyron [Elymus, "Sitanion"] longifolius 70, 100); egg found 50 cm up on bark of 1 cm twig (C. rossii 0-100, 20-35, 30-70); egg found 20 cm up on bark of 5 mm twig (C. rossii 7-40, 40-100, etc., Agropyron [Elymus, "Sitanion"] longifolius 10, 10, 15); egg found 60 cm up on bark of 8 mm twig (C. rossii 0-40, 40, 55, 70-100, 100); egg found 1.3 m up on 5 mm barkless twig (C. rossii 60-100 50, 100); egg found same tree, 1.5 m up on 5 mm barkless twig (C. rossii 0-100, 80); egg found same tree, 1.3 m up on 7 mm barkless twig (C. rossii 0-100, 0-100, 70-100); Crawford Gulch, Jefferson Co. Colo., June 23-24, 1992. Egg found 25 cm up on bark of 8 mm fallen twig 2 m from Douglas fir trunk (Carex geyeri 0-100); eggs found under Ponderosa Pine canopies; egg found 20 cm up on bark of 6 mm fallen twig (Carex pennisylvanica heliolitha 0-100, Festuca saximontana 30, 30, 50, 60, 60, 70, 70); Agropyron [Elymus, "Sitanion"] longifolius 30); egg found 20 cm up on bark of 1.5 mm fallen twig (C. geyeri 0-100); egg found 15 cm up on bare broken end of 4 mm fallen twig (C. geyeri 0-100, Agropyron [Elymus, "Sitanion"] longifolius 25); egg found 10 cm up on bark of 1.5 mm fallen twig (C. geyeri 0-100, 90); egg found 15 cm up on bark of fallen 1.2 cm twig (C. geyeri 0-100, Agropyron [Elymus, "Sitanion"] longifolius 20); egg found 40 cm up on bark of fallen 7 mm twig (C. geyeri 0-100, Agropyron [Elymus] repens 70-100); egg found 30 cm up on bark of 5 mm tree branch (C. pennisylvanica heliolitha 0-100, Poa pratensis sparse 15-100, Agropyron [Elymus, "Sitanion"] longifolius 20, 30, 40, 50, 80, 100); 2 eggs found on same tree 55 cm up on bark of 7 mm twig (C. pennisylvanica heliolitha 0-100, Agropyron [Elymus, "Sitanion"] longifolius 10-70, 40, 60, etc.); Falcon County Park, Jefferson Co. Colo., June 27, 1992. 2 eggs found under ponderosa pines; egg found 3 cm up on bark of side of 3 cm fallen branch (Carex rossii 3-35, 40, 50, 100, 100); egg found 30 cm up on bark of 3 mm branch (C. rossii 3-30, 8, 15, 15, 30, 40 etc., Agropyron [Elymus, "Sitanion"] longifolius 80, Elymus exigua 80, Koeleria macrantha 100);
Lookout Mtn., Jefferson Co., Colo., June 29, 1992. Eggs found (all but one under ponderosa pines); egg found 70 cm up on 5 mm branch (Carex rossii 30, 35, 40, 40-100, 80, 80, 100, 100, Oryzopsis exigua 70-100); egg found 1.5 m up on bark of 3 mm Douglas fir branch (Carex pennsylvanica heliophila all around 0-100, Stipa comata 10, 15, 25, etc. common to 100); egg found 1 m up on bark of 3 cm branch (C. p. heliophila 100, Carex gaepheila 2-70, Poa pratensis 2-100, Koeleria macrantha 15, 20, 100, Stipa viridula 70, 100, Carex foenea 70); 2 eggs found 2 m up on bare 4 mm branch (C. rossii 0-100); egg found 1.7 m up on bark of 2 cm branch (C. rossii 20, 20, 30, 25-70, 40, 50, Agropyron (Elymus, "Sitanion") longifolius 4, 20, 20, 25, 30, 50, 70, 80, C. pennsylvanica heliophila 45-100, 90, Festuca saximontana 70, Oryzopsis exigua 80, Koeleria macrantha common at 100, Carex pygmaea 100); egg found 50 cm up on bark of 15 mm branch (C. rossii 0-5, 10, 15, 20, 20-100, Stipa viridula 50, 55, 80, 100); egg found 30 cm up on bark of 12 mm branch (C. rossii 0-100, Stipa viridula 50, 60, 70, Bromus japoicus 25); Sawmill Gulch Rd. pass, Jefferson Co. Colo., June 29, 1992. Adults found at site where Carex brevipes is apparently the only sedge, hill SE Empire, Clear Creek Co., Colo., June 30, 1992. Egg found 50 cm up on bare 3 mm Douglas fir branch (Carex geophila all around 2-100, Koeleria macrantha 7, 10, 10, Carex rossii few 5-20, 40, 60, Poa nemoralis interior 70, 100), Chief Hosa Lodge, Jefferson Co. Colo., July 1, 1992. HOSTPLANTS: Carex surely is the principal host genus, although I have not yet tested it on larvae. Carex rossii is the main host in the lower foothills; Carex gerberi is only an occasional host there because it is less common, but is likely to be the most common host in Montane and Subalpine Zones; Carex pennsylvanica heliophila is only an occasional host in the foothills because it usually grows in full sun rather than the shade under trees; Carex geophila is no doubt a rare host in the foothills (it is rare). Carex rossii is adapted to growing in the shade/partial shade beneath or near the Ponderosa Pine canopy on ridges and W- or E-facing slopes (Carex geophila occurs mostly in shade, whereas Carex pennsylvanica heliophila occurs in sunny spots), and O. chryxus only occurs in these forests and does not breed on open ground. (Though males may hilltop to treeless hilltops). O. chryxus is the only butterfly in the foothills with a 2-year life cycle, perhaps because it is the only satyr which lives in the shade under trees where snow lingers in spring and summer temperatures are cooler. Females oviposit—flying only a little slower than normal—by finding abundant Carex rossii under or near the canopy of Ponderosa Pine trees, then they land on branches there, and evidently oviposit nearly always on the underside of branches (narrow or thick, barked or barkless, either dead branches fallen on the ground or dead or live lower branches still attached to the tree) preferably above the C. rossii. In 1989 I searched Carex rossii but found no eggs, obviously because females oviposit on twigs/branches/bark over the host, not on the host itself. In 1992, I found that eggs could be found quickly by searching for branches—fallen or not—just above a thick stand of the host, and turning over the fallen branches or peering up at the bottom of the attached ones. The first-stage larvae may crawl to the ground, but probably just drop off the branch then crawl to the host. Egg white, the valleys darker, small bumps around the top and strong vertical ribs.

Oeneis uhleri uhleri (Reak). Eggshell (compared to uhleri eggs) found on underside of Koeleria macrantha leaf (<K. macrantha very common 0-1 m, Andropogon gerardii 6-20 cm, 30-60, Stipa comata 15, 20, 30, 50, 1m, etc. common, Andropogon (Schizachyrium) scoparius common 45-1 m), Mt. Zion, Jefferson Co. Colo., July 11, 1988. Oviposition 14:38 under dead grass blade 10 cm above Poa agassizensis clump (P. agassizensis abundant 0-100 cm, Carex probably pensylvanica heliophila less common 20-100 cm, Agropyron (Pascopyrum) smithii common 10-100 cm); oviposition 15:02 under dead grass blade 10 cm above clump over Poa agassizensis clump (P. agassizensis abundant 0-1 m, Carex probably pensylvanica heliophila abundant 10 cm-1 m, Bromus (Bromopsis) lanatipes common 5-100 cm); Tinytown, Jefferson Co. Colo., May 18, 1989. Adults associated with Poa agassizensis, some Poa pratensis, Poa nemoralis interior, and Carex pensylvanica heliophila, Tinytown, Jefferson Co. Colo., June 1, 1988, May 12, 18, 1989, May 30, 1990, June 11, 13, 1992. Egg found on Festuca idahoensis (F. idahoensis 50, 55, 60, 90, Carex? 40, Koeleria macrantha 80 cm away), SW Hot Sulfer Springs, Grand Co. Colo., June 24, 1989. Egg found 14:05 on Festuca idahoensis (F. idahoensis 0-10, 25-40 etc. common, Stipa comata 7, 10, 20, common 30-100, Carex vallicola 18-30, Agropyron (Elymus="Sitanion") elymoides 20-50, 60); egg found 14:24 on Festuca idahoensis (F. idahoensis 25, common 40-100, Agropyron prob. (Elymus, "Elytrigia")
Festuca brachyphylla coloradensis on dead straw-colored horizontal Cerastium vulgatum Mortonianum ORANGISH-TAN with TINY BROWN DruMMondiana #I Myosuroides wide patch growing at edge of a brown line along spiracles, rear forked; head yellowish-tan, seta bases & eyes black. 2ND-STAGE LARVA cream, a middorsal dark-green band (brown with whitish center on abdomen), then a broad cream band with weak reddish-brown line through it, a dark-brown line, broad cream band with weak gray line through it, a brown broad band with tan line through it, a cream band, a brownish-red band with cream inside it, two reddish-brown tails; head light ochre-tan, seta bases black. HALF-GROWN LARVA tan, a blackish-brown middorsal line (stripe #1 of Scott 1986a), a broad cream band with red-brown line through it (#2), a red-brown band with tan center, another broad cream band with weak red-brown line through it (#3), a dark-brown band of striations edged with black lines (#4), a narrow cream band edged below by an orange-brown line, a light-brown band along spiracles (#5) a brown irregular weak band just below spiracles, a cream-line lateral ridge, a brown line (#6), underside brownish-tan; head tan with light-brown frontoclypeus and 3 vertical brown stripes on each side, eyes dark brown, eyes 2 & 3 in a cream patch.


Genus melissa melissa (Fab.)=Lucilla B. & McD.). Oviposition 12:10, she fluttered & landed at several spots near Carex rupestris drummondiana, then landed on sedges beside a 20-cm-wide low rock raised little above soil, and crawled over rock and laid egg on SE-facing slope of top of rock among lichens. egg was 4 cm from vegetation (C. r. drummondiana dead 5 cm, live 6, 8, 10, common 10-100, Trisetum spicatum spicatum 4-10, 25-30, 40-50, etc., Kobresia myosuroides 12, 20, 25, 40-100 common, Poa glauca 15, 30, 35, uncommon, Helictotrichon mortonianum 20, 20, 20, 40, etc., Agropyron scribneri 10 [four small plants], 40, Luzula spicata 5, 10, 12-20, 20, 40-100); Mt. Bross, "13,800', Park Co. Colo., July 17, 1980. Luzula (Juncaceae) is presumably unpalatable to larvae, but larvae can probably eat all the other plants; Carex rupestris drummondiana is probably a common host. Larvae eat Poa pratensis well in lab. My 4th? stage larvae died in lab, so this must be the hibernation stage during the second winter. EGG white. FIRST-STAGE LARVA band #1 dark-gray-green, #2 & 3 greenish-white (whitish-green on front 2/3 of body) with dark-gray-green dash in middle of each segment, a dark-gray-green line between #2 & 3, #4 greenish-tan, #5 & 6 greenish-white (lateral ridge pale, slightly darker just below lateral ridge), rear of A10 orange-tan; head orangish-tan with tiny brown dots, labrum brown, eyes black. HALF-GROWN LARVA-LARVA #1 continuous blackish, #2 brown (ventral part [#2b] later develops black dashes), #3 cream (a weak brown band through it), #4 brown (later becoming light-brown between segments) with blackish-brown edges, #5 brown mottled with cream, lateral ridge cream-tan, #6 brown, underside light brown; head pale-brown with 6 weak brown stripes. LARVA 20 MM LONG (4th-stage?) light brown, #1 has black dashes alternating with tan bullet-shaped dashes, #2 cream but ventral 60% (82b) tan with a blackish dolphin-shaped dash on each segment just above a longer blackish dash on lower edge of #2, #3 cream, #4 tan-brown (edged above with 2 blackish dashes on each segment [the rear longer], edged below by blackish line that is thinner posterodorsal to spiracle), #5 a narrow tan band (edged below by tiny brown specks) above a pale-tan-brown band containing spiracles, lateral ridge cream-tan, a brown line below it, #6-underside tan; head pale-brown with 5 dark-brown stripes.

Genus polixenes brucei (Edw.). A female was watched 9:30-10:30 in a N-facing hollow of tundra ridge, where she laid 4 eggs and voluntarily returned to the hollow several times after flying over drier surrounding areas; oviposition 9:40 on dead straw-colored horizontal Cerastium vulgatum stem (C. vulgatum a 7-cm-wide patch growing at edge of a 30-cm wide lichen-covered rock, Carex rupestris drummondiana 10-20, 30, 30, 40, 40, 50, etc. to 100, Helictotrichon mortonianum 10, 30, 30, 50, 60, 80, Carex elynoides 20-30 common, 50, 70, 80, Festuca brechvyphylla coloradensis 10, 35, 40, 40, 50, 60, etc.)
**First Stage Larva**

Pale-yellow-tan, with a purple (green after feeding) dorsal flush on front half of body, #1 light-orange-brown (paler in center), #2 & 3 creamy-tan-yellow with a light-orange-tan line between them, #4 orange-brown (paler in center) with brown edges, #5 creamy-tan-yellow with an weak orange-brown band along spiracles and a cream lateral ridge, #6 light-orange-brown, underside creamy-tan-yellow, two short blunt tails; head light ochre-yellow with three weak light-brown vertical bands, eyes black. 2ND-STAGE LARVA cream-tan (greenish-tan on front 2/3 of body after feeding), same as 1st-stage except an orange-brown line in middle of bands #2 & 3, #4 slightly darker, the cream-tan head now has the 3 usual bands light brown, eyes black. HALF-GROWN LARVA #1 alternating black, blackish, and brown rectangles, a cream line below them, #2 cream with numerous brown striations, edged by brown lines, #3 cream with a weak brown line through it, #4 blackish, edged below by a cream line, #5 mottled light-brown, a cream lateral ridge, #6 a brown band, underside light-brown; head light-orange-brown with weak mottled brown stripes like those of 18-MM long larva but weak. LARVA 18-MM LONG (4th-stage?) #1 alternating black and tan dashes, edged below by cream or tan line, #2a striped brown, #2b (present on T5-T6 only) has tan ovals in black band, edged below by cream or tan line, #3 striped light-brown, #4 solid black edged by cream or tan lines, #5 mottled brown, lateral ridge cream or cream-tan, #6 blackish-brown, underside light-brown (an irregular brown line just below #6), 2 short tails; head light-brown with 3 blackish-brown stripes, a few brown marks on side of frontoclypeus, a small brown crescent (concave upward) behind eye #1.

**Apaturinae**


*Asterocampa celtis antonia* (Edw.). Ovipositions 12:45 on leaf, 13:20 on twig, 13:20 on berry, of *Celtis reticulata*, Rockvale, Fremont Co. Colo., July 23, 1972; the resulting larvae would not eat *Ulmus pumila* in lab. 3 larvae (stages 3-5) and pupal shell (shell attached by the cremaster to one end of a long silk mat that the shell is appressed to for its entire length beneath leaf) found beneath leaves of *C. reticulata*, Falcon County Park, Jefferson Co. Colo., July 14, 1984. 2nd stage larva found beneath leaf of *C. reticulata*, Falcon County Park, July 28, 1984. Pupal shell found on underside of *C. reticulata* leaf, the leaf was curiled downward somewhat with silk and the pupa rested lengthwise pressed horizontally against leaf (not hanging from cremaster), Falcon County Park, Jefferson Co. Colo., July 27, 1987. One 5th stage larva on silk mat on bottom of *C. reticulata* leaf, the leaf bowed downward some, Tucker Gulch, Jefferson Co. Colo., June 13, 1988. Preoviposition 11:20 *C. reticulata*, Apex Gulch, Jefferson Co. Colo., Sept. 3, 1998. 11 pupal shells found under *C. reticulata* leaves (on W side of tree only), Wheatridge, Jefferson Co. Colo., Aug. 27, 1991. Ovipositions 12:00 on twigs of planted *Celtis occidentalis*, commercial tree nursery, N. Washington St. X 64th Ave., Denver, Denver Co. Colo., June 28, 1973. EARLY STAGES (Jefferson Co. Colo.): EGG cream. MATURE LARVA light-green (bluish-green below lateral line) with numerous white seta basas, a subdorsals yellowish-white line runs from head (on rear of horn) to top of tail, on each abdomen segment a faint yellow-green middorsal area (a vestige of a pale-yellow middorsal spot present on front of each abdomen segment of 4th stage larvae) (the yellow-green area small on A1 and A8), a zigzag white line above spiracles on abdomen is formed of a squat V on each segment (the posterior arm of each V thicker and slightly-yellowish-white), a lateral line (consisting of yellow above white) runs from T2-A9, two tails; head green, with an anterior greenish-white vertical stripe extending from corner of labrum and curving and narrowing to medial side of horn base, another shorter greenish-white vertical stripe from dark eyes to anterior base of horn, the subdorsal yellowish-white line of body runs onto rear of horn, two brown-tipped antlers. PUPA light- (slightly-bluish)-green with numerous short white striations, wing veins white, a white ventral line beneath each horn, a white dorsal line runs from each of the two horns to near middorsal crest on T2, a yellow-white middorsal line extends along crest from T2 to cremaster, a tiny black spot is beside the yellow-white line on top of crest on front of each A3-8 segment, a white line along inner margin of wing and another along posterior margin of wing, a lateral white line below spiracles on A4-8, a subdorsal oblique white dash extending up and to the rear on each segment from A2-A8 (dash longer on A2, weak on A7-8, on A3-8 each dash is two-parted, the longer posterodorsal part enlarged into a white spot at its anteroventral end), a subdorsal spot on T2 has a white dash extending anteroventrally from it; attached by an elongated cremaster to a silk mat all along underside of leaf so that entire ventral part of pupa is appressed to leaf.

*Asterocampa clyton.* 6 egg clusters (145, 110, 149, 220, 105, 230 eggs), 1 cluster of 50 1st-stage larvae (with heads aimed outward from cluster like besieged Musk-Oxen), 1 nearly-mature larva, 1 prepupa, 7 pupal shells, 6 pupae (3 emerged June 16 as 1m2f), all found on *Celtis occidentalis*; larvae silk leaves together some and rest under a leaf not bowed downward, pupae rest flat under leaf; many reared to adults; Lincoln, Neb., June 15, 1991. EGG cream. 1ST-STAGE LARVA greenish-cream, heart-line bluish-green, green lines next to heart and subdorsally, suranal plate brown; head dark brown, with light-brown extending down face. 2ND-STAGE LARVA cream, heart-band green, a green line next
to it, a green subdorsal band, greenish-cream sublaterally; head white, with black dorsal spot between horns, horns black with black extending laterally down from horns to side of head and neck (with three white bumps forming seta bases in this black patch), a large black pyramid on lower front of face, an inverted black anterolateral Y below horn, black around eyes, cream above labrum, brown below.

Nymphalinae
Limenitidini

Limenitis (Adelpha) bredowii (Gey.). Very fresh male caught Sept. 8, 1980, 2.5 months after a worn female was found June 24, 1980, which, together with the fact that these are the only L. bredowii I have ever seen in northern Colo., suggests that the female laid the egg that produced the male on Quercus gambelii, the only suitable host there; Tinytown, Jefferson Co. Colo.

Limenitis archippus archippus (Cramer). Oviposition 11:27 on top of leaf tip of Salix exigua interior (W); Box Elder Creek, Arapahoe Co. Colo., Aug. 11, 1984. Adults associated with S. exigua interior, Wood Duck Wildlife Area, Stanton Co. Neb., July 16, 1985. Adults associated with S. exigua interior, Helmer Myra State Park, Freeborn Co., Minn., June 16 and 19, 1986. S. exigua must be the hostplant in Weld, Pueblo, Fremont, and Saguache Co. Colo. as it is the only willow/poplar growing at most sites. Unaccountably never found in the western Denver suburbs, though common along streams SE, E, and NE, and SW of Denver (along the South Platte River S to Chatfield Res. in S Jefferson Co.); evidently females will not oviposit on the variety of deciduous trees planted in the suburbs.


Nymphalini

Precis coenia (Hubn.). 47 ovipositions at 9:54, 10:18, 10:21, 10:50, 10:55, 10:58, 11:03, 11:09, 11:17, 11:33, 11:48, 12:30, 12:31, 12:48, 12:52, 13:08, 13:34, 13:52, 14:31, and 14:52, usually laid on underside of leaf petioles of small plants without inflorescences (but eggs were laid on plants with 4 and 7 inflorescences), often laid on the fuzzy new leaf buds at the plant center or on twigs or other debris near the plant center, and about 50 larvae found near or eating the plants, all on Plantago lanceolata, Point Richmond, Contra Costa Co. Calif., 1969, 1970, 1971, many larvae raised to adults in lab on P. lanceolata and on Plantago major. Oviposition is rapid; one Point Richmond female in nature laid 25 eggs in less than an hour, and the maximum in the lab was 166 in
a day; oviposition starts at about age 3 days and continues till day 22 at least in the lab, peaking at age 5-18. Individual females laid from 497-962 eggs in the lab (average 547, N=7). The hibernating stage is controversial (evidently no stage survives hard freezes), but at this mild-winter Calif. coastal site larvae were found in winter near the hostplants. Scott (1975d) reports ecology and movements at this site. Ovipositions 14:30 and 14:40, and two tiny larvae and two half-grown larvae found, all on young Castilleja sessiliflora seedlings, E of Renville County Park, Renville Co. Minn., July 13, 1986. Ovipositions 13:09, 13:10, 13:11 leaves and stem on top of Limaria vulgaris seedlings, Tinytown, Jefferson Co. Colo., July 1, 1981. EGG light green. 1ST-STAGE LARVA yellow-cream, gray on top, and blue-green on top of thorax, seta bases brown, suranal plate and collar blackish; head black.

*Vanessa atalanta* (L.). Larvae on *Urtica dioica gracilis*, SE Wettet horn Peak, Hinsdale Co. Colo., Aug. 19, 1979. Four larvae in rolled leaves of *U. d. gracilis*, Tinytown, Jefferson Co. Colo., July 31, 1978. Larvae on *U. d. gracilis* (W), Sapello Can., San Miguel Co. New Mex., Aug. 23, 1979. Larva on *U. d. gracilis*, Mother Cabrini Shrine, Jefferson Co. Colo., Aug. 8, 1978. Oviposition 10:00 on leaf petiole of Rubus idaeus melanocerasius next to *U. d. gracilis*, and two larvae on *gracilis*, Tinytown, Jefferson Co. Colo., July 30, 1978. Oviposition *U. d. gracilis*, Horse Creek, Elbert Co. Colo., July 3, 1978. Larva *U. d. gracilis*, Mother Cabrini Shrine, Jefferson Co. Colo., July 9, 1977. Mature larva in leaf nest of *U. d. gracilis*, Cherry Gulch, Jefferson Co. Colo., July 7, 1984. (Note: larvae from NW Big Turkey Cgd., Douglas Co. Colo., Aug. 26, 1985, reported by Scott [1986a], were actually *Nymphalis milberti*). 3 larvae found on *U. d. gracilis*, each in nest of leaves tied together (none with stem cut to let leaves droop), Barr Lake, Adams Co. Colo., Sept. 8, 1987. 3rd-stage larva found in *U. d. gracilis* leaf nest (leaf base eaten between veins to make leaf droop, leaf eaten to midrib 2/3 of way from base to tip to allow sides of leaf except tip to bend upward to enclose larva), Mother Cabrini Shrine, Jefferson Co. Colo., June 26, 1989. Egg found on *U. d. gracilis* leaf edge underside, Apex Gulch, Jefferson Co. Colo., July 18, 1989. Oviposition 10:46 on side of green fruit, egg found on upperside of small leaf edge, both on *U. d. gracilis*, Tinytown, Jefferson Co. Colo., July 25, 1989. Half-grown larva found on *U. d. gracilis*, Tinytown, Jefferson Co. Colo., July 1, 1981. 4 ovipositions: 10:02 side of tiny new whorl-leaf (1 of 4 subtending leaf base) at top of plant, 10:05, 10:05 on top of leaf edge, 10:08 side of young whorl-leaf, all on *U. d. gracilis*, Tinytown, Jefferson Co. Colo., June 16, 1982. 2nd stage larva in leaf nest (leaf folded up around larva) on *U. d. gracilis*, Walnut L. Wildlife Area, Faribault Co. Minn., June 23, 1985. 2nd stage larva in leaf nest (leaf folded up around larva) on *U. d. gracilis*, NE Alden, Freeborn Co. Minn., June 23, 1985. Mature larva found in drooping nest (the larva chews the petiole so the leaf droops, and then silks the leaf edges upward above the larva), three 7-mm larvae in folded-leaf nests, and two white wasp cocoons next to small Vanessa larval skins the wasp emerged from, all on *U. d. gracilis*, Helmer Myre State Park, Freeborn Co., Minn., June 16, 1986. 3 larvae found on *U. d. gracilis* leaf top nests; NE Alden, Freeborn Co. Minn., June 10, 14, 1980. 1 empty larval nest on *U. d. gracilis*; Halls of Humes Lake, Freeborn Co. Minn., June 15, 1990. NEST: Larvae live in a silk nest on top of leaf, the leaf drawn together above the larva, and older larvae chew partway through the petiole so the leaf droops. Early stages from Colo.: EGG6 green. FIRST-STAGE LARVA yellow, after feeding turning greenish-yellow. MATURE LARVA varies in different larvae from cream with tiny brown motting, to mostly red-brown with fine cream motting, or chocolate brown with tiny white dots, scoli the same in number as *V. cardui* (BD0 on A1-6 & a rudiment on rear of A8, BD2 on T2-A8, BSD on T2-A10, BL on A1-8 & tiny bumps on T1-3), scoli cream, but scoli bases are orange or yellow on front of body grading uniformly to cream on rear of body, underside brown, proleg tips reddish-brown; head black with many brown-tipped ochre or cream processes, each tipped by a brown seta. The cream bases of head processes, the gradual change in color of *colci* from T2 to A10, and the weaker body pattern, distinguish *V. atalanta* from other *Vanessa*; the gradual change in color of scoli from T2 to A10 is perhaps phylogenetically related to the more drastic color change in some *Polycyonia* (Scott 1988b). But there is great variation between larvae: One larva was cream all over with tiny brownish-red motting, a wide subspiracular cream band (angled upward into a shallow inverted V between scoli), scoli cream, but scoli bases orange-ochre on front of body grading uniformly to cream on rear of body. One larva cream with sparse tiny blackish motting, a dark-brown patch on each segment between BD2 & BSD, scoli cream-yellow but scoli bases yellow on front of body grading uniformly to cream on rear of body. One larva cream with fine blackish-brown motting, a dark band (interrupted between segments) between BD2 and BSD scoli, scoli cream (except T2 scoli tipped by blackish-brown & T3...
ho

CirsiuM ochrocentruM, 4th-stage larva found in Lupinus argenteus (blue flowered CirsiuM aryense leaf; N fork Clear Creek, Gilpin Co. Colo., July 29, 1991. 2


also have hairs, underside of larva gray; head black with small blackish and adults are generally present in spring without observed migration (though brown line on creaster.

creaster has two brown clubbed ridges extending forward nearly to abdomen band, large subdorsal brown abdomen patches are blended into the ground color, many small brown dots on abdomen and top of thorax, a row of tiny brown dots on each side of antenna, a few brown postmedian dots on wing, a brown lateral dot on the middle of each leg, middle of leg may be golden, proboscis tip brown, many coppery-gold cones (large subdorsal cones on thorax and abdomen and smaller middorsal cones on abdomen, a large cone on anterior wing base, a small cone on wing base below T3, a small submarginal wing cone below A3), a black lateral band and a black dorsal band on cremaster, ventral part of cremaster has two brown clubbed ridges extending forward nearly to A8, middorsal brown line on cremaster. ADULT HIBERNATION: Fall adults on the Colo. plains and foothills do NOT migrate (they merely feed on Chrysothaumus nauseosus flowers), and adults are generally present in spring without observed migration (though
every 7 years or so a mass migration does fly up from SW U.S.-Mex.; therefore, adults must survive most winters in Colo. As proof, T. Cockerell once found an adult in Boulder, Boulder Co., Colo., in Jan. and my experiments placing Sept.-Oct. adults of Vanessa, Polygonia, and Nymphalis in the freezer indicate that V. cardui take just as long as the others to die (all of these die rather quickly in the freezer, apparently indicating that adults must require many weeks of gradually colder temperatures to develop frost-resistance).


**Vanessa cardui annabella** (Field). Larva inside silk web on top of *Malva* sp. leaf, Berkeley, Contra Costa Co. Calif., Feb. 23, 1970. Rare in Colo., but evidently a native. Having now reared *V. cardui* from *Malva neglecta* (see above), I now think that the *V. cardui* larva from *M. neglecta* at Cherry Creek Reservoir (Scott 1988a), Aug. 13, 1985, was probably *V. cardui*.


Nymphalis milberti also migrates to the alpine zone; P. g. zephyrus makes less of an altitudinal migration than N. milberti, and the other Polygonia, Nymphalis, and Vanessa evidently make no altitudinal migrations. Scott (1988b) reports the complete life history. Adults hibernate.

**Polygonia procone procone** (Cramer). Adult associated with Ribes inermes (W.), 10 mi. NE Edgemont, Fall River Co., S.D., July 16, 1886. Adult associated with Ribes cymosatii L. (W.), Monroe Can., Sioux Co., Neb., July 16, 1886. Early stages (from photos sent by Steven Sponer, Lancaster Co. Neb. Ribes misouriense): MATURE LARVA colors identical to those of P. procone nigrozephyrus Scott (1988b), including the change of dorsal ground color from ochre on thorax to cream on rear; the only difference seems to be the darker spines, esp. the sublateral spines which are brown (versus cream in nigrozephyrus & oreae) with orange bases, and the other spines are darker also (orangish-cream, versus cream), and the sublateral pale band seems slightly darker (ochre-cream versus cream). PUPA evidently identical to nigrozephyrus, light brown, most either pinkish-brown or pinkish-olive-greenish-brown.


**Polygonia procone oreae** (Edw.). Larvae found on underside of leaves of Ribes sp. not divaricatum Douglas (plants with spiny fruits and stems) reared to adult, Duncan's Mills, Sonoma Co. Calif., June 1, 1974.

**Polygonia faunus hylas** (Edw.). Ovipositions 12:40 & 13:04, and 15 other eggs found, all on healthy twigs of Salix bebbiana (plants recollected and reidentified at the same site in 1988) shrubs (2 m tall) with leaves just emerging, the plants growing along a small creek, Russell Ridge, Douglas Co. Colo., June 3, 1973. 22 eggs found near or at the ends of S. bebbiana twigs having young leaves (length 3-15 mm, usually 9 mm, versus 30-100 mm when mature); (12 eggs on side of twig, 1 egg on leaf bud cap, 4 on leaf underside, 3 on leaf tip, 2 on leaf base), some eggs were clustered (6 eggs were found alone, 3 clusters of 2 eggs, 2 clusters of 3 eggs, 1 cluster of 4 eggs), no eggs found on Alnus incana tenuifolia, no eggs found Salix monticola, Russell Ridge, Douglas Co. Colo. May 27, 1988. 2 eggs found (1 mm apart) on bud scale on end of twig with 12 mm leaves of S. bebbiana, other deciduous shrubs (S. monticola, Salix exigua, A. tenuifolia, Populus tremula tremuloides) had no eggs, Tinytown, Jefferson Co. Colo., June 1, 1988. 2 eggs found together on underside of S. bebbiana tuft 1 cm from twig tip, the leaves just emerging (longest only 1 cm long, on 70-cm-tall plant), Tinytown, Jefferson Co. Colo., May 18, 1988. Egg found on underside of red twig of S. bebbiana (small plant 1/2 m tall) 2 cm from tip of twig which had 13-mm-long expanding leaves; Tinytown, Jefferson Co. Colo., May 22, 1988. About 5 eggs found on Ribes inermes leaves (one reared to adult), Tinytown, Jefferson Co. Colo., May 26, 1988. An average of 1.86 eggs is laid at each oviposition. Scott (1988b) reports the complete life history. Note: The OLDER LARVA head may not have an orange inverted-V in hylas as it does in Calif. rusticus (my one pickled Colo. larva and Clyde Gillette's [pers. comm.] Utah larva lacked it). One flight L July overwintering to May. Adults hibernate.

on *U. d. gracilis*, Tinytown, Jefferson Co. Colo., July 15, 1984. Many larvae on *U. d. gracilis*, Tinytown, Jefferson Co. Colo., July 20, 1984. Three clusters of 4th-5th stage larvae on tops of *U. d. gracilis* (4 larvae were inside a drooping, base-clipped leaf nest, which probably had been made and abandoned by a *Vanessa atalanta* larva), Green Mtn., Jefferson Co. Colo., June 7-8, 1985. Larva on *U. d. gracilis*, Mother Cabrini Shrine, Jefferson Co. Colo., June 18, 1985. 20 2nd stage larvae on *U. d. gracilis*, NE Mt. Judge 9100’, Clear Creek Co. Colo., Aug. 8, 1985. 1 mature larva eating top of plant, 1 larva in leaf nest (folded together above larva) with parasitoid pupa beside it, both on *U. d. gracilis*, NW Big Turkey Cpd., Douglas Co. Colo., Aug. 26, 1985 (misidentified as *U. atalanta* in Scott 1986). Oviposition 11:40 cluster of 88 eggs (cluster 5 mm wide, in several layers) on underside of leaf of small *U. d. gracilis*, Tinytown, Jefferson Co. Colo., May 15, 1986. 60 larvae on *U. d. gracilis*, Van Bibber Creek, Jefferson Co. Colo., May 26, 1988. 5th-stage larva on top of slightly curled *U. d. gracilis* leaf, Tinytown, Jefferson Co. Colo., June 2, 1988. Larva (prepupa) found on Ribes inermis (the larva wandered to this) near defoliated *U. d. gracilis*, E Empire, Clear Creek Co. Colo., July 2, 1988. Oviposition 14:17 "145 eggs on *U. d. gracilis* leaf underside, Apex Gulch, Jefferson Co. Colo., April 21, 1989. "40 3rd stage larvae on silk web on basal part of *U. d. gracilis* leaf; larvae evidently have an ant-repellent chemical, probably produced by the ventral neck gland: 5 ants (red, with black abdomen) refused to walk onto the larval leaf (they walked onto leaf petiole SX then backed away), then I placed one ant on the leaf tip and it refused SX to walk near the larvae over a 2-minute period, then when I placed this ant on top of larvae it instantly dropped off of leaf; Tinytown, Jefferson Co. Colo., June 6, 1989. 2 larvae 12 mm and 17 mm long found on top of curled up and tied *U. d. gracilis* leaves, "6 similar shelters found, Tinytown, Jefferson Co. Colo., July 25, 1989. Oviposition, she landed and tested Many young low *U. d. gracilis* plants 10:50-11:20 before laying, then laid "100 eggs 11:30-11:52 in an unstructured pile on *U. d. gracilis* leaf underside of plant 10 cm tall; another cluster of "90 eggs in unstructured pile found *U. d. gracilis* leaf underside; Tinytown, Jefferson Co. Colo., May 22, 1990. 5 clusters of half-grown larvae found on top of *U. d. gracilis* leaves; Tinytown, Jefferson Co. Colo., June 21, 1990. Several older larvae found on *U. d. gracilis*; Tinytown, Jefferson Co. Colo., July 2, 1990. "40 4th- & 5th-stage larvae found on *U. d. gracilis*, evidently proving the existence of a second generation; Tinytown, Jefferson Co. Colo., Aug. 29, 1990. Mature larvae found on *U. d. gracilis*, Tinytown, Jefferson Co. Colo., Sept. 6, 1990. "50 1st-stage larvae in cluster on *U. d. gracilis*, Tinytown, Jefferson Co. Colo., July 1, 1991. 1 "4th-stage & 2 mature larvae found on *U. d. gracilis*, Tinytown, Jefferson Co. Colo., July 31, 1991 (1 adult female found also). "50 2nd-stage larvae found on top of leaf base (breaking leaf down so it drooped), mature larva found on other leaf, both on *U. d. gracilis*, Tinytown, Jefferson Co. Colo., June 13, 1992. PHENOLOGY AND MIGRATION: Evidently there is usually only one yearly flight in Colo.; first generation overwintering adults mate and lay eggs in spring, then the larvae are common on the hosts in June-M July, and adults emerge in L June-July, when they seem to migrate high in the mountains to feed on flowers in L July-Aug. (adults are common on flowers in the alpine zone throughout the state, where the host does not grow), then in Sep. they evidently return to the lower mountains to hibernate. The usual absence of Aug. larvae, and the abundance of adults in the alpine zone where the host is absent, seem to prove this altitudinal migration. Further proof: the closely related *Nymphalis urticae* L. (Yamamoto 1976) and *Inachis io* L. (Hasegawa 1975) also make altitudinal migrations in Japan. However, in 1980 there was at least a partial 2nd generation in the foothills & upper plains of Jefferson Co. Colo., based on adults found (Crawford Gulch, June 20 fresh male, July 5 fresh adult seen; Tinytown June 21 fresh female; Wheatridge July 14 slightly worn male), and larvae found at Tinytown in late Aug.-early Sept. 1980 which would produce adults in Sept. Adults hibernate. EARLY STAGES from Colo.: EGG green. 1ST-STAGE LARVA yellowish-cream, turning bluish-green anteriorly after feeding, suranal plate & collar black; head black. 2ND-STAGE LARVA yellowish-cream, a subdorsal band of irregular brown crescents, seta bases brown, suranal plate & collar black; head black. MATURE LARVA black with numerous tiny white dots (dots more common on rear of each segment, where they are arranged in transverse bands, and a short streak of white dots extends anteriorly from BD2 scoli), a middorsal black band (lacking white dots); white dots are common beside this black band forming a whitish band, a cream band runs between BD2 scoli just above spiracles, behind BSD on AI-7 an orange-red streak extends anterodorsally from this white band almost to BSD, and a white streak extends anteroventrally from this white band to nearly below spiracle, a gray-centered black band includes spiracles, a cream subspiracular band, underside creamy-gray except a
large reddish-brown spot is just anteroventral to each BL scolus on T2-A7, a midventral brown band, many scoli (black BD1 on A2-A8 & a rudiment on "A9", black BD2 on T2-A8, black BSD on T2-A10, cream BL on A1-A8 (extremely tiny on T1-3, tiny processes with setae below BL scolus); head black with long pale hairs, many short white processes tipped by pale hairs, one short black dorsolateral process is also tipped by a pale hair. PUPA golden-tan or golden-gray-tan, a light-brown lateral abdomen band, a wide light-brown midventral abdomen band, the abdominal cones tipped by coppery-gold.

*Nymphalis Californica* (Bdv.). 70 half grown to mature larvae on *Ceanothus fendleri*, June 17 & 23, 1980, and egg cluster of 80 eggs found on underside of leaf, July 11, 1980, all Apex County Park, Jefferson Co. Colo. Two larvae on *C. fendleri*, Ralston Butte, Jefferson Co. Colo., June 20, 1980. About 70 2nd-4th-stage larvae gregariously feeding on *C. fendleri*, Red Rocks, Jefferson Co. Colo., May 25, 1988. 70 3rd-stage larvae found on one *C. fendleri* branch, they eat leaves on the branch tip then eat toward the base then move to another branch, Tinytown, Jefferson Co. Colo., June 2, 1988. Preoviposition 11:32-11:56 on *C. fendleri*, Indian Peak, Jefferson Co. Colo., April 21, 1989. Larvae of *N. antiona* & *N. californica* do not make silk nests. There is evidently only one yearly flight in Colo., July overwintering to May, because summer adults feed on mud etc. but do not show mate-locating behavior (hilltopping in this species) which the spring adults do display. Adults hibernate. Early stages from Colo. MATURE LARVA black with many long cream hairs & many tiny cream dots, these dots grouped into 3 transverse rows on rear of each segment, a middorsal black band (interrupted by the cream BD1 scolus) is sharply-edged by a light-yellow band (this band is wide in some larvae, narrow in others), a dark band (caused by absence of white dots on front of each segment, producing a black area) runs between BD2 & BSD scolus, a cream band (narrowed to a line just above BL scoli) runs between BL scoli, a red-brown band runs below that band, underside cream, true legs black, side of anterior 8 prolegs light-red-brown, side of A10 proleg blue-black, a brown midventral band, all scoli have black-tipped spines, most scoli are light brown (light-orange-brown in some larvae), BD1 scoli (present on A1-8, & a rudiment on rear of "A9") are yellow-cream with a light-brown tip and sometimes a very narrow red-brown ring around base, except BD1 tan on A8, BD2 scoli (present on T2-A6) are black on T2 with reddish-black base medially and blue-black base laterally, brown with red-brown base on T3, light-brown with red-brown base on A1-6, brown on A7, blackish-brown on A8, BSD scoli (present on T2-A10) brown on T2 & A7, light-brown on T3-A6 with narrow red-brown base, black on A8-10, BL scoli (present on A1-8) are light-brown with cream base on A1-6, brown on A7, black with brown base on A8; head blue-black with many pale hairs, many black processes (some fairly long on top of head including two close together which almost form a rudimentary horn) are tipped by pale hairs, about 5 tiny white bumps on top of head are tipped by a pale hair. PUPA light-gray (with dorsal areas of A1-4 gray-tan) or tan or dark-brownish-gray or grayish-brown or reddish-brown or gray-black in different pupae (the lighter pupae tend to have dorsal areas of A1-4 brownish), all pupae have two short horns on head (each horn has black on the sides), a keel on T2 (with black on the side of the tip), two small black-tipped cones on wing base, a small subdorsal black-tipped cone on T2, small black-tipped middorsal and large subdorsal abdomen cones, the subdorsal abdomen cones on A2-T are black distally with an orange tip, the subdorsal cones on T3 & A2 have a wide white base with black tip (the very tip orange on A2 cone), a white spot is where the subdorsal T1 cone would be (it is absent), a pale-brown-edged middorsal abdomen band, a lateral brown abdomen band, a brown midventral abdomen band, a black dot just dorsal to and a black dot just posteroventral to each black abdomen spiracle, wing has a blackish spot on tornus and a row of tiny postmedian dots, cremaster has a wide black middorsal stripe & a wide black midventral stripe & a black lateral stripe & a long subdorsal orange ridge and a long subventral orange ridge, all on cremaster.

*Nymphalis antiona* (L.). Larvae on *Salix exigua*, Mirage, Saguache Co. Colo., Aug. 9, 1970. Larvae on *S. exigua*, Lake Creek Cgd., Custer Co. Colo., Aug. 24, 1970. Larvae on *S. exigua*, WNW Crestone, Saguache Co. Colo., July 22, 1971. Larvae on *S. exigua*, Pruess Lake, Millard Co. Utah June 17, 1972. Oviposition from before 10:35 (when female was spotted) to 12:00 (when she finished and flew away) "146 eggs in several layers in a 12x3 mm cylindrical mass around 1.3 mm wide stem near top of 1/2 m tall *S. exigua* shoot, she rested upside down on stem during oviposition, N Fork Clear Creek, Gilpin Co. Colo., July 15, 1988. Cluster of 727 eggs found on *S. exigua* forked stem (the cluster was in two parts, the upper part was 86 eggs 70% of way around twig just above fork, the other part was 76 eggs 70% of way around twig just below and at fork, fully joined to "93 eggs all the way around twig base angling up and away from
(19 eggs had hatched, half the eggs were dark red, half were black with larva visible within); N Greenwood, Douglas Co. Colo., July 23, 1990. Mature larva found wandering 10 m from S. exigua plant which had 4 mature larvae and traces of feeding and cast skins of 50 departed larvae; Tinytown, Jefferson Co. Colo., Aug. 5, 1991. Larvae reared Salix amygdaloides, Central Plains Experimental Range, Weld Co. Colo., June 28, 1976. 50 5th stage larvae defoliating S. amygdaloides. 5 larvae wandered to adjacent S. exigua and ate it, 6 larvae wandered to adjacent small Populus deltoides monilifera (=sargentii) and ate it, Lakewood, Jefferson Co. Colo., June 4, 1988. 50 larvae on Salix bebbiana (W), N fork of Clear Creek, Gilpin Co. Colo., 2 July 1978.

Larvae on Ulmus pumila, Lakewood, Jefferson Co. Colo. 1951. Larvae on U. pumila, Fort Collins, Larimer Co. Colo., 27 June 1976. Cluster of 30 4th-stage larvae found on Celitis reticulata (the larvae had eaten "20 whole leaves"), Lookout Mtn., Jefferson Co. Colo., June 5, 1991. Larvae on C. reticulata leaves found by Steven Cary, Ute Lake State Park, Quay Co. New Mex., 14 May 1985. Diseased dead (almost certainly sprayed with insecticide) half-grown (thus having fed for some time) larvae found on planted Celitis occidentalis, Northern Nursery, N Washington St. X 54th Ave., Denver, Denver Co. Colo., June 29, 1973. 10 larvae crawled down C. occidentalis trunk onto sidewalk after defoliating one branch, Lakewood, Jefferson Co. Colo., June 10, 1988. Ovipositions and even larvae of N. antiopa are seldom seen, obviously because a female probably lays only 1 or 2 egg clusters during her life. There is undoubtedly only one generation in the higher mountains, as in Europe (Roer 1970), but in the foothills and plains two flights occur, because every year fresh adults appear L June-M July, and I have often seen these fresh adults chasing each other in mate-locating behavior (perching along creeks and chasing other butterflies) (hibernating adults generally show mate-locating behavior only in spring). And the egg cluster found July 23, 1990, and an oviposition seen by other people in Denver July 1990, are conclusive proof that two generations occur on the plains and lower foothills. And while discarding alcohol vials of preserved insects that I had collected during an entomology course field trip, I found a preserved N. antiopa larva from the second generation (White Rocks, Niwot, 5100', Boulder Co., Colo., Oct. 4, 1967). The larvae found Aug. 24 and July 22 represent offspring perhaps of the midsummer flight, or perhaps of very late hibernators, because the localities are higher than the foothills. If only one flight occurred in the foothills, then the adults would have to diapause and go into hiding in E Aug., then reappear in M Sept.-Oct. and feed on flowers before hibernating; there is no evidence for this hiding, and N. antiopa rarely occurs in the alpine zone so does not have altitudinal migrations like N. antiopa. Adults hibernate. MATURE LARVA (Colo.) black with numerous tiny white dots (these dots arranged in reverse rows on rear part of each segment), many long cream hairs, a middorsal black band (constricted or interrupted by the red spots), a middorsal red spot on T3-A7 (small on T3, successively larger on A1-2, largest on A3-7) (each red spot is behind scolus BD1 and extends laterally to BD2 scoli and is connected anteriorly to the red left and right bases of the BD1 scolus [the front base of the BD1 scolus is black], each red spot has a black transverse streak in it behind the BD1 scolus, and each red spot is partly or completely divided by the middorsal black band), a black circular subdorsal area occurs below each red spot, a longitudinal row of black spots (black because lacking white dots) near the segment joints runs along the body between BD2 & BSD scoli, the anterior 8 prolegs red, anal prolegs black, true legs black, a brown midventral band, long scoli present (BD1 on A3-8, BD2 on T2-A8, BSD on T2-A10, BL on A1-A8), scoli black except BD1 scoli on T2-A8 have base of scoli shaft orange; head black with long tan hairs, short black processes, no horns.

Melitaenini


Euphydryas chalcedona/anicia wheeleri (H. Edw.). Larva on bracts of Castilleja chromosa, SW Pulpit Rock, Montezuma Co. Colo., May 9, 1983. MATURE LARVA (Pulpit Rock) black, all scoli have black needles, middorsal spines ochre in an orange ochre-rimmed patch, two small ochre middorsal spots (the posterior spot smaller) on each segment beside a middorsal black line, subdorsal spines black, supraspiracular spines ochre on abdomen, black on thorax, all supraspiracular spines in an orange ochre-rimmed patch, two ochre spots (the posterior tiny) between adjacent supraspiracular patches, lateral (subspiracular) spines black on abdomen, ochre on thorax, a few tiny ochre lateral dots, sublateral spines ochre, a few small sublateral ochre spots, underside blackish-brown, a midventral blackish-brown line on either side of which is an ochre ocellus on the ochre patch (on proleg segments the ochre patch is on anterior base of proleg); head black.


Euphydryas chalcedona/anicia anicia (Dldy. & Htw.) ("brucei" Edw.). Pupal shell found on Castilleja occidentalis leaf, and adults associated with this plant (no other Scrophulariaceae nearby), Loveland Pass, Clear Creek Co., Colo., July 22, 1989. One older larva on Potentilla sp. (no feeding damage on plant, evidently just a wandering larva), Mt. Sherman, Park Co. Colo., July 17, 1980. About 20 half-grown apparently-diapausing larvae on underside of rocks apparently in diapause, Uncompahgre Peak, Hinsdale Co. Colo., July 18, 1980; the presence of adults and half-grown apparently-diapausing larvae in abundance at the same midsummer time proves that in the alpine zone many individual life cycles are biennial or longer. Half-grown larvae hibernate. OLDER LARVA (Mt. Sherman) black with many ochre dots, spines black, middorsal scoli have orange bases, a middorsal black line is edged by an ochre band of irregular spots, supraspiracular spines with orange bases, in an ochre band of irregular spots, sublateral spines ochre-brown on T2-abdomen, in an ochre band of irregular spots, underside blackish-brown with ochre spots, a midventral blackish-brown band edged on A1-2 and A7-9 by an ochre band and spots, proleg bases ochre; head black. MATURE LARVA (Uncompahgre Peak) same as Mt. Sherman larva, but the bands on body are gray (not ochre); the Mt. Sherman larva was pickled, so perhaps it was grey in nature as well. PUPA (Uncompahgre Peak, Loveland Pass) white with many black streaks and marks, and middorsal, subdorsal, supraspiracular, subspiracular, and subventral rows of orange-behind-black spots (the latter three rows only on abdomen), the first three rows of spots are on cones (each cone except the anterior middorsal cones has a black crescent clasping its anterior base and an orange semicircle on the anterior top).

Euphydryas chalcedona/anicia anicia-capella ("suvrion" [Mea.d]). Larva on Castilleja integrata (G) bracts raised to adult, NE Rosita, Custer Co. Colo., June 1970. PUPA (Rosita) white with brownish-ochre marks and tiny black markings (pupal markings shaped like those of ssp. brucei including the black-and-orange dorsal bumps, but black markings much smaller esp. on wing), base of eclosion flap mostly blackish-brown.

48 larvae found on "150 C. miniata or "150 P. virens or "15 Verbascum plants; Tucker Gulch, Jefferson Co. Colo., July 27, 1989. 9 clusters of 1st-3rd-stage larvae found on L. g. dalmatica (a million or more plants occurred), 2 clusters of 1st-2nd stage larvae found on two P. glaber plants (only 3 plants found, proving that this is a favorite host), "45 C. miniata plants had no larvae, "62 Castilleja integra plants had no larvae, "15 Verbascum plants had no larvae, "50 P. virens plants had no larvae, Tucker Gulch, Jefferson Co. Colo., July 31, 1989. 13 clusters of 1st-3rd-stage larvae found on L. g. dalmatica, "15 C. integra plants had no larvae, "40 C. miniata plants had no larvae, "25 P. virens plants had no larvae, 3 P. glaber plants had no larvae, "30 Verbascum had no larvae, Crawford Hill, Jefferson Co. Colo., Aug. 1, 1989. 1 cluster of "2nd-3rd-stage larvae found on L. g. dalmatica (plants very present but only 1 cluster seen), 10 C. integra plants had no larvae, 2 Verbascum had no larvae, Mt. Zion, Jefferson Co. Colo., July 29, 1989. 1 cluster of "20 "2nd-stage larvae found in curled dried L. g. dalmatica leaf, the lower 2/3 of plant eaten & dried, the only cluster seen among "300 plants checked, Van Bibber Creek, Jefferson Co. Colo., Aug. 8, 1989. No larvae found on many L. g. dalmatica, some Verbascum, some P. virens, E of Shingle Creek, Jefferson Co. Colo., Aug. 17, 1989. No larvae seen on many L. g. dalmatica, some L. vulgaris, a few P. virens, "15 P. v. asagrayi, some Verbascum, 1 C. miniata, Apex Gulch, Jefferson Co. Colo., Aug. 24, 1989. Of 11 P. glaber plants examined, 1 had empty mature larval web nest covering a 5-cm-long area of leaf & stem, 3 had 1 egg cluster, 2 had 2 egg clusters, 1 had 5 egg clusters, 4 had none, (4 of the 12 egg clusters were light reddish, perhaps due to disease). 1 L. g. dalmatica plant (of many examined) had 1 cluster of yellow eggs on leaf underside and 2 clusters of red-brown eggs on leaf upperside (the only clusters noted on leaf upperside, all others were on underside); the 4 preserved clusters had 44, 84, 112, and 130 eggs; Crawford Hill, Jefferson Co. Colo., July 1, 1990. Cluster of "10 half-grown larvae in curled L. g. dalmatica leaves silked shut; Mt. Zion, Jefferson Co. Colo., Aug. 14, 1990. Cluster of "30 1st-stage larvae in 2 silked L. g. dalmatica leaf tops; Beaver Brook Trail, Jefferson Co. Colo., Aug. 14, 1980. "15 larvae found in curled leaf nest of L. g. dalmatica; Apex Gulch, Jefferson Co. Colo., Aug. 20, 1990. Cluster of 20 larvae found on L. g. dalmatica; Apex Gulch, Jefferson Co. Colo., Aug. 23, 1990. L. g. dalmatica is an introduced Mediterranean plant, now enormously abundant in the Front Range foothills on open E- and S-facing slopes (and some dry N-facing slopes), and 63 larval clusters were found on it; normally E. c./a. capella is rare, but in 1989 it was extremely common in an area centered on Tucker Gulch (it was fairly common but less so nearby at Mt. Zion, Guy Hill, and Van Bibber Creek, three sites at the periphery of the population explosion), and rather common at the Tucker Gulch epicenter also in 1980, evidently because the Tucker Gulch population developed (evolved?) the ability to eat the plant, then the abundance of the plant led to an infestation; the native hostplants (Penstemon virgatus asagrayi and P. glaber=alpinus) are uncommon in the foothills, which explains the usual rarity of capella. Castilleja miniata and C. integra are not hostplants, evidently because females do not like their biochemicals. Other Scrophulariaceae are not hostplants probably because of physical deficiencies as well as for probable biochemical reasons: Linaria vulgaris leaves are too narrow and the plants too small to support a larval cluster, Verbascum is very hairy, Penstemon virens is very abundant but has tough dry leaves, Penstemon secundiflorus has very glaucous leaves; no butterfly eats the latter three as far as known, although there is a record of E. c./a. capella on P. secundiflorus in Larimer Co. Colo. (which must be a rare occurrence if the plant was correctly identified) and Precis coenia sometimes eats L. vulgaris). Half-grown larvae hibernate. Egg pale-green when laid, becoming pale yellow; some eggs are pale-red, evidently due to virus or heat death. FIRST-STAGE LARVA orangish-yellow, after feeding greenish on top of T1 or T2 to A3, later becoming light brown; head & collar black. MATURE LARVA (Tinytown) white with black spines, some scoli (middorsal, supraspiracular) have orange bases as in ssp. "brucei", larva resembles "brucei" but body ground color white due to expansion of the white bands of "brucei" nearly all over the body; head black. Euphydryas editha beani (Skr, X=hutcheni McD.=gunnisonensis Brown=alsharki F.). Adults associated with Castilleja flava (a few Penstemon strictus also present at locality), SW Hot Sulfur Springs, Grand Co. Colo., June 30, 1989 Poladryas minuta minuta Edu. 10 eggs in cluster on leaf underside of Penstemon jamesii (det. J. Scott, and flowering plants found here on May 26, 1985 det. by W), E of Abbot, 8200', Colfax Co. New Mex., Sept. 11, 1978. 25 eggs on underside of P. jamesii leaf, Taylor Springs, 6000', Colfax Co. New Mex., Sept. 11, 1978. Many eggs and larvae on underside of P. jamesii leaf, Eagletail Mtn., Colfax Co. New Mex., Sept. 13-14, 1980. Cluster of 32 yellow
eggs on underside of Postman (W) leaf, Eagletail Mt., Colfax Co. New Mex.,
May 27, 1985. Egg cluster on underside of leaf, and two plants with first-stage larval feeding damage, all on Postman (W), 18 mi. NW Tucumcari, San Miguel Co. New Mex., May 13, 1985. Adults assoc. Postman (W), Canadian R. W. of Roy, Mora Co. New Mex., May 12, 1985. Five egg clusters on underside of Postman albidosus (blue-flowered variety)(W) leaves, Caprock S of San Jon, Quay Co. New Mex., May 13-14, 1985 (plants of Penstemon secundiflorus—not a host—at this site showed no evidence of minuta feeding or eggs). Three egg clusters (24, 29, and 33 eggs) and other 1st-2nd-stage larvae found on underside of Penstemon cobaea (det. J. Scott and Roy G. Kendall) leaves, some larvae dispersed even this early in year, Seymour, Baylor Co. Texas, May 1, 1972. Scott (1974b) reared adults from this site, released reared females in front of Colo. arachne males to obtain matings, reared the F1 offspring, released F1 females in front of wild Colo. arachne males to obtain matings, and reared the backcross offspring: in the lab, minuta larvae ate leaves of Penstemon confertus (W), Postman perflexus (W), young Penstemon secundiflorus (W), Penstemon whippleanus (W), Penstemon strictus (W); F1 hybrid (ssp. minuta female X ssp. arachne male) and backcross (F1 female X arachne male) larvae also ate young Penstemon secundiflorus and other Penstemon. Half-grown larvae hibernate. Early stages (see also Table 2): MATURE LARVA entirely orange (in Baylor Co. Tex. and Colfax Co. N.M. versus white in arachne) including the subdorsal scoli (which are orange with black tips in ssp. minuta and arachne), except all other scoli black, a narrow middorsal black line on T2-3, middorsal black scoli have some black around base, subdorsal scoli bases have black tapering forward and rearward to form an interrupted black band; head orange, with a brown patch around eyes, and a thick brown curled mark resting on top of frontoclypeus (no brown spot beside this mark or a very weak one, whereas arachne usually has a brown spot), lower part of frontoclypeus brown. PUPA white with many black bars & spots & orange dorsal cones: front of head has a black ventral spot on each side, and often a brown anteroventral transverse rim, eye cream, orbit and just below it black, a black oblique rectangle angles from bottom-middle of orbit to base of proboscis, posterior end of frontoclypeus narrowly black, proboscis mostly blackish except for a cream patch near base of middle leg, which patch is just ventral to the rear half of the white base of middle leg (middle leg then has a blackish bar across it and distal part is cream), hindleg blackish except dark-cream at extreme base and a cream bar across leg just beyond point where middle leg ends, antenna has alternating black and orangish bars (except shaft has an orangish streak down it medially, and the bulbous antenna base has a creamy sliver medially and a creamy bar distally), anterior edge of T1 has a small subdorsal oval, T1 spiracle orangish-black, anterior edge of T2 has a triangular spot (this spot in arachne is usually widened medially to often join its fellow on the other side, but occasionally is triangular also) pointing rearward near midventral line, this triangular spot often narrowly-connected (seldom connected in arachne) to a curled black mark (which starts above anterior wing base, extends upward just in front of a subdorsal orange cone, then rearward and angles slightly medially; where it comes close to its fellow on the other side there is a slightly-orangish spot, then posterolaterally to widen where it touches T3), touching the T2 curled mark is a black mark on T3 just below a subdorsal orange cone and a small black spot just above cone, the anterior rim of A1 is blackish between a slight middorsal cone and a slight subdorsal cone (both cones very rudimentary and black with a slight amount of orangish behind), A2-9 have a middorsal anterior black semicircular crescent (only the front half of the circular spot present) that encloses an orange middorsal cone, A2-8 also have a subdorsal black crescent (similar in shape & orientation but wider from side-to-side than the middorsal crescent) enclosing an orange subdorsal cone (this cone more posterior than middorsal cone [in middle of segment]), (the subdorsal black crescents are longest from side to side on A2-5, shorter A7, shortest A9) (the middorsal and subdorsal crescents are often fused anteriorly on A2-3 in minuta, seldom in arachne), on A2 the subdorsal crescent extends anterolaterally to level of spiracle, on A3-4 the subdorsal crescent also extends anterolaterally to level of spiracle and ends just anterovelical to a supralateral orange cone, the posterolateral corner of A2 & A3 have a black triangle that anteriorly includes spiracle, A1-9 each have a narrow black posterior rim (continuous from middorsal to supraspiral)(front-to-back thickness greatest on A8) just in front of the black middorsal/subdorsal crescents of the segment behind (this posterior black rim is present on all minuta [though weak on a few] but absent on A4-6 of most arachne [except one has it on A5, and one has a streak representing lateral part of black rim on A4-6]), A9 has no cones but has an anterior subdorsal black patch, A10 has a subdorsal bend extending onto the dark-brown cremaster, A4 has
a black oval whose side touches posteroventral half of spiracle, A5-7 have a black oblique streak containing spiracle (extending from just above & behind spiracle anteroventrally then curving posteriorly a bit) that has some orangish flush behind it, A8 has a little blackish in front of and below spiracle and some orangish behind, A9 has a black lateral spot that extends back along cremaster, A5-9 have anterior (but in middle of A9) black rectangles just lateral to the midventral line and A10 has a similarly-positioned black band extending onto cremaster, A4-7 have midventral black patches (on rear of A4, mostly on front and rear of A5-6, on front of A7), orange-brown is between these two rows of ventral spots of A5-10, A5-6 are narrow ventrally, A7 very narrow, A8 constricted to nothing ventrally, A9 has midventral sex-mark and two small orange-tipped black projections (the anterior ends of the two sustensor ridges of cremaster base), the brown cremaster has wide lateral shoulders prior to cremaster tip, wing base has a transverse black dash next to antenna, a transverse orangish-brown dash behind it, a black rectangle extending posteriorly from that, then a short transverse narrow black streak, then several small black streaks beside a transverse black crescent (slightly-concave anteriorly) that touches anterolateral corner of T3 (all these wing base marks have orangish-brown between them), a tiny black spot is below this crescent near antenna, hindwing base has a black spot, hindwing sliver is orangish-brown, a black irregular patch is on anal margin of wing just below A2, wing margin is orangish-brown on tornus, a black rectangular mark on tornus is partly divided by a submarginal orange-brown line that extends to apex where it runs through a transverse apical black patch, 3-4 black postmedian longitudinal streaks (the upper oval) are just above antenna, in middle of wing a black patch extends posteriorly then turns anteroventrally for a short distance, between its turn and the tornal black mark are 1-2 small black spots (often a black dot above the front of a longitudinal black streak), in minuta the tornal mark and mid-wing patch are usually separated by these small spots but occasionally are connected by black, whereas in arachne most individuals have tornal mark and mid-wing patch connected. The taxonomy of *P. minuta* has been subject to much incompetence in print. In several characters arachne falls between monache and minuta (antenna club color, width of unh red and white bands; minuta is not extinct in the U.S. as the Kerrville types are similar to extant N Tex.-E N.M. populations; both arachne and minuta fly in Colfax Co. New Mex. (the latter 2300 feet lower on the plains) where intermediates may occur (adults are rather similar and the larvae show the greatest difference between these two ssp.; the most extreme examples of minuta (thick black unh marginal line etc.) are in E Mex., which may represent a new ssp.

Poladryas minuta hybrids (of Scott 1974b). MATURE LARVA (F1 ssp. minuta female X ssp. arachne male) intermediate in black bands & orange ground color to arachne & minuta: slightly-whitish orange (closer to minuta in color) a narrow middorsal black band, a partial blackish band is formed of a brown patch in front of supraspiracular scoli and a small amount of brown behind, a narrow line is below subspiracular scoli. PUPA (F1) intermediate, posterior black rim on top of A4-5 very narrow on A5-6, absent on A4, tornal spot connected or not to midwing spot, A2-3 middorsal & subdorsal crescents touching. MATURE LARVA and PUPA (of backcross, F1 female X arachne male) very similar to arachne in appearance.

Poladryas minuta arachne Edw. Oviposition Penstemon virgatus (W), Cripple Creek, Teller Co. Colo., Aug. 1969. 4 larvae on *P. virgatus asagrayi* (W), Green Mt., Jefferson Co. Colo., Aug. 14, 1970. Adults associated with *P. v. asagrayi*. 1 mi. up N Fork Clear Creek Can., Clear Creek Co. Colo., July 25, 1987. Oviposition 12:25-12:31 35 eggs on underside of leaf of *P. v. asagrayi* 5 cm seedling, Guy Hill, Jefferson Co. Colo. June 8, 1988. Oviposition 11:01 3 eggs (I disturbed her trying to get photo and she flew away, and would have laid many more eggs) in cluster on *P. v. asagrayi*, Guy Hill, Jefferson Co. Colo., June 17, 1988; on June 19 I looked at this same leaf and found shiny spots where ~25 eggs had been laid in a cluster, so the female must have returned to this same leaf and laid ~22 more eggs, then all eggs were eaten by a predator. Preadvposition 10:33, cluster of 64 eggs found under leaf, all on *P. v. asagrayi*, N fork Clear Creek, Gilpin Co. Colo., July 11, 1991. Egg clusters (28, 27, 52 eggs) found under leaves, a 2nd and a ~3rd-stage larvae found on leaf bases halfway up plants, all on *P. v. asagrayi*; N fork Clear Creek, Gilpin Co. Colo., July 29, 1991. Adults associated with common *Penstemon albicus* which is surely the hostplant on the plains here (a few *Penstemon angustifolius* occurred but this plant has thick glaucous leaves like *P. secundiflorus* which *P. m. arachne* shuns), E Box Elder Creek at Quincy Ave., Arapahoe Co. Colo., June 4-5, 1988. Adults associated with common *P. albicus* (a few *P. secundiflorus* present which arachne shuns, no *P. angustifolius* seen), E Delbert Rd., Smoky Hill
anterior edge of T2 is usually widened medially to often join other side (spot usually triangular in Minuta) and the spot Table 2. Differences between wing Marks are thicker (at least in offspring of with Many black bars & beside brown pupal black wing spots

Table 2. Differences between *Poladryas minuta* minuta & *P. m. arachne*.

<table>
<thead>
<tr>
<th>Trait</th>
<th>minuta</th>
<th>arachne</th>
</tr>
</thead>
<tbody>
<tr>
<td>larval (older)</td>
<td>orange</td>
<td>white</td>
</tr>
<tr>
<td>ground color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>larval gena</td>
<td>brown spot absent</td>
<td>brown spot fairly</td>
</tr>
<tr>
<td>beside brown curved mark</td>
<td>or very weak</td>
<td>distinct or very weak</td>
</tr>
<tr>
<td>pupal black posterior rim</td>
<td>present (though weak on several)</td>
<td>absent (except present laterally on one, present on A6 on one)</td>
</tr>
<tr>
<td>of top of A4-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pupal black wing spots</td>
<td>tornal mark usually separated from mid-wing patch by several small spots</td>
<td>tornal mark usually connected to mid-wing patch</td>
</tr>
</tbody>
</table>

P. albidus is no doubt a host on the plains. *Penstemon viridans* is very abundant (by far the commonest *Penstemon*) but its leaves are very tough (it is restricted to N-facing slopes which may also be undesirable) so it is shunned; *Penstemon secundiflorus* has thick glaucous leaves and is shunned; "*P. barbatus torreyi*" was reported as a hostplant in Boulder Co. in the Front Range (J. Emmel, O. Shields, D. Breadlove, J. Res. Lepid. 9:238), but this plant was misidentified because *P. barbatus* does not occur within 100 miles of Boulder Co. (the closest site is Manitou in El Paso Co., W. Weber pers. comm.), and probably was *P. v. asagrayi* which has similar leaves. Lab larvae ate *Penstemon whippleanus* (W), *young P. v. asagrayi* (previously identified as *P. secundiflorus*, which is doubtfully eaten), *Penstemon griffinii* (W), *P. barbatus*, and *Penstemon pinifolius*. Scott (1974b) details ecology, behavior, and movements and studies hybrids between minuta and arachne. Neither *P. minuta* asp. has larval nests. Half grown larvae hibernate. Early stages from Colo. (see also Table 2): EGG pale yellow. 1ST-STAGE LARVA yellowish-cream, turning greenish-cream anteriorly after feeding, with dark-brown seta bases, suranal plate, and collar; head black. MATURE LARVA white, with a middorsal wide black line containing black scoli, next a wide white subdorsal band containing (and interrupted by) orange (black-tipped) subdorsal scoli (orange just in front of this scolus, and the narrow piece of white band is replaced by orange just above scolus), a wide black supraspiracular band containing black scoli (except the T2-3 scoli are just below this band in the next white band), a wide white band containing black spiracles and subspiracular black scoli, underside dark-brown (the upper edge of this brown area is sometimes a blackish-brown line), in this brown area are paired small scoli just above level of prolegs (body sometimes orange around these scoli), a ventral band of white mottling contains legs & prolegs, a midventral dark-brown line is on abdomen of at least some larvae, all scoli black except subdorsal ones, legs black, prolegs orange; head orange, with a brown patch around eyes, and a thick brown curled mark resting on top of frontoclypeus, a very weak or fairly distinct brown spot (absent or very weak in asp. minuta) occurs lateral to the lower part of this mark, lower part of frontoclypeus somewhat brown. PUPA white with many black bars & spots, & dorsal orange bumps (middorsal, subdorsal, supralateral bumps), pupa very similar to minuta (see it for description), except a posterior black rim is absent on top of A4-6 (except one has it on A6, and one has a streak representing lateral part of black rim on A4-6) (versus rim present on all minuta, though weak on a few), the black mark on wing tornus is usually connected to mid-wing patch (versus usually separated in minuta), black wing marks are thicker (at least in offspring of some females), the spot on anterior edge of T2 is usually widened medially to often join its fellow on the other side (spot usually triangular in minuta) and the spot is rarely connected to curled mark (often narrowly connected to curled mark in minuta), the black middorsal and subdorsal crescents on A2-3 are usually separate (versus often fused anteriorly in minuta).


Chlosyne leanira fulvia Edw. Many larvae on Castilleja integra (W) reared to adults W & SW Pueblo, near Beulah, and E Wetmore, all Pueblo Co. Colo., 1965-1976. Oviposition 13:30, a female resting on ground laid one egg cluster on underside of lowermost leaf of plant base of C. integra, E of Wetmore, Pueblo Co. Colo., July 5, 1970. Larva on C. integra, Smith Creek Cgdt., Custer Co. Colo., July 27, 1970. Larva on C. integra reared to adult, Green Mtn., Jefferson Co. Colo., Aug. 12, 1977. Larvae on C. integra, W of Pagosa Jct., Archuleta Co. Colo., Aug. 28, 1977. Larvae on C. integra, 9 mi. E of Hwy. 151 on road to Pagosa Springs, Archuleta Co. Colo., Aug. 28, 1977. 30 eggs on base of stem of C. integra reared, 1 mi. S Cochiti Dam, Sandoval Co. New Mex., Sept. 9, 1977. 5 larvae on C. integra bracts, 18 mi. WNW Tucumcari, San Miguel Co. New Mex., May 13, 1985. Larvae on C. integra bracts, Caprock S of San Jon, Quay Co. New Mex., May 14, 1985. Steven Cary found larvae on C. integra (W), Cooke's Peak, Luna Co. New Mex., May 11-12, 1985. 2 females flew out from under Castilleja lanata, Guadalupe Can., Hidalgo Co. New Mex., Aug. 4, 1986. 17 eggs found on dorsal surface (twisted so facing ground) of 12-mm-long leaflet from base of plant main stem "1.5 cm above ground, 2 mature larvae found on bracts, female oviposition 14:20, all on C. sessiliflora (C. sessiliflora is the only host here because C. integra—the usual host in S Colo.—is absent), S Midway, Pueblo Co. Colo., May 5, 1992. 8 larvae "8 mm long found on C. sessiliflora (W)(the only Castilleja present) bracts; S Gothenburg, Dawson Co. Neb., June 7, 1950 (and adults associated C. sessiliflora there June 30, 1985, June 17, 1987). Adults associated with C. sessiliflora (no inflorescences seen), SW Medicine Lodge, Barber Co., Kans., Sept. 4, 1996. Adults assoc. C. sessiliflora in W Kans. (Steven Spomer pers. comm.). Females oviposit beneath lower leaves, and stage 1-2 larvae seem to eat the lower leaves, whereas older larvae eat the red bracts where they are very conspicuous; even older larvae may eat mostly leaves in late summer when the plants (esp. C. sessiliflora) seldom flower. Three yearly flights. Half-grown larvae hibernate. EGG greenish-yellow, 21-22 vertical ribs on top. 1ST-STAGE-LARVA tan-green, collar and head dark-chitin-brown (note: the "1st-stage" larval head drawn in Scott [1973] is really 2nd-stage). SYSTEMATICS. Ssp. pariaensis (Smith & Brock) was named as a ssp. of C. fulvia, but is obviously intermediate between alma and fulvia in adult traits, because it has two characters like alma (hostplant and single generation), is intermediate in the color of wing uppersides, and has two characters like fulvia (unh postbasal pattern and palpi color). In addition, the color pattern of larval body & head (Scott 1986b) of C. leanira (including fulvia) follows clines or step-clines whose midpoints do not support dividing the species in Smith & Brock's arbitrary manner: older larval ground color is orange (Calif. leanira, W Nev. alma), yellow-orange (W-C Colo. alma, S Utah pariaensis), orange-yellow (S and C Colo. fulvia), yellow (Ariz.) indicating the midpoint of the cline in C Colo.; black bands are very wide in Baja Calif. (Ralph Wells pers. comm.), quite wide in S Calif., narrower elsewhere, indicating a midpoint of variation somewhere N of Los Angeles; the black subdorsal band contains many white dots in

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
<th>Location</th>
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<tbody>
<tr>
<td>Pupal black spot</td>
<td>usually triangular, often narrowly connected to curled mark, rarely connected to curled mark</td>
<td></td>
</tr>
<tr>
<td>Pupal middorsal &amp; subdorsal black crescents A2-3</td>
<td>usually separate</td>
<td></td>
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Sapello, Colo., Aug.

**Rudbeckia laciniata var. aMala**

LARVA orangish-creaM, setae dark-brown, collar gray; head black.

diapause in the lab is very difficult. EGG greenish-yellowish-creaM.


hosts, Mostly weeds, are eaten. Half grown larvae hibernate, and breaking

diaempresa in the lab is very difficult. EGG greenish-yellowish-cream. 1ST-STAGE LARVA orangish-cream, setae dark-brown, collar gray; head black.


Hundreds of larvae on H. puMilus and Helianthus petiolaris (larvae of forms nigra and bicolor on both plants, one form rufa larva on H. puMilus), Green Mt., Jefferson Co. Colo., July 9, 1980.


Half-grown larva on H. petiolaris leaf; cluster of 135 eggs found under H. petiolaris leaf; 1 mature larva found on Iva (Cyclachaena) xanthifolia leaf; cluster of 210 eggs under I. xanthifolia leaf; no eggs found on many Verbesina encelioides; Barr Lake, Adams Co. Colo., Aug. 30, 1991.


100 3rd stage larvae feeding on top of I. xanthifolia leaf (shy hazy due to forest fire smoke so leaftop not too hot for larvae); Barr Lake, Adams Co. Colo., Sept. 5, 1988.


Oviposition 10:59-11:19 138 eggs (I scared her taking photo so she may have laid more eggs) in a two-layered mass (top layer only 25% of eggs) on underside of I. xanthifolia leaf, Senac Creek, Arapahoe Co. Colo., Sept. 8, 1988.

 Larva (form rufa) on top of leaf (eating a strip into it) of Xanthium pannonicum var. strumarium, Barr Lake, Adams Co. Colo., Sept. 8, 1987.

The native bushy H. puMilus is almost the only host in the foothills, but on the plains other hosts, mostly weeds, are eaten. Half grown larvae hibernate, and breaking

**Chlosyne nycteis drusius** (Edw.). Many larvae on underside of leaves of Rudbeckia laciniata var. ampla (W) (now often treated as a species, R. ampla), Sapello Can., San Miguel Co. New Mex., Aug. 23, 1978.

 Larvae and feeding damage
below spiracles along BL scoli T2-AB, a broad tan subventral band on abdomen includes prolegs (edged by a dark brown midventral band except between segments), scoli chitin-brown, the dark-brown lateroventral patch on each abdomen segment is constricted anteriorly & posteriorly to create an interrupted tan band below BL scoli (dark-brown in middle of segments) and just above 3 sublateral tan SV seta bases; head black, dark-brown on lower front. MATURE LARVA blackish-brown, with many cream dots each with one seta, two middorsal rows of cream dots, a cream supraspiracular line just above spiracles & at base of BSD scoli (the line orange just below each BSD scolus, and on one larva partly orange from there to anterior segment), an interrupted cream line runs between BL scoli, base of BL scolus orange-ochre all around except anteriorly, the area between cream supraspiracular line and cream BL line has more cream dots than usual, underside slightly-reddish brown with cream dots, proleg light-brown with dark-brown shield, TI has cream in front of black collar (the cream extending laterally to meet the cream line along BL scoli), ventral neck gland large, scoli black with black needles (except BL scoli have brown basal 1/3, and BSV scoli have brown bases and blackish-brown tips); head black, epicranial groove cream. PUPA dirty-cream (one is yellowish-cream, one pupa blackish-brown with cream motting) with blackish-brown spots; many cones present on abdomen which are orange behind an anterior blackish crescent (middorsal cones [A3-7 large, A2 small, A1 a black dot without a cone], subdorsal [A3-7 large, A2 small, A1 a black dot without a cone], supraspiracular [A3-4, a black spot on A5-8 without a cone]), but the subdorsal cream cone on T2-3 has a black crescent in front edged posteriorly by an orange crescent (both on front of cone); many black spots (top of head has a sinuous line of black spots below two black apotrophe a, a black spot is just anterior to eye, subdorsal brownish spots on TI and front of T2, blackish spot near lateral edge of TI, a blackish spot on A4-8 below spiracles, a subventral blackish spot on A4-7, two midventral rows of black dots on A4-7, a blackish spot is "2/3 out on each leg", end of proboscis and end of middle leg blackish, wing has black marks (black patch on base, large black patch on posterior base, black spot at end of discal cell), 8 postmedian black streaks, black marginal black streaks at ends of veins, 2 black areas near margin), a blackish crescent beside anal groove, cremaster dark-brown; the blackish-brown pupa (adult reared) is blackish-brown except for cream on anal area of wing, a cream patch on middle of outer margin of wing, and mottled-brown-and cream top of thorax and abdomen.

Chlosyne palla calyden (Holl.). Cluster of young larvae on underside of leaf of Erigeron speciosus var. macranthus (W), NW Nederland, Boulder Co. Colo., July 24, 1977. Three egg clusters on underside of E. s. var. macranthus leaves, Ralston Butte, Jefferson Co. Colo., June 20, 1980, a hillside that had burned several years earlier where both hosts and adults were common. Preoviposition 13:30, oviposition site: Tinytown, Jefferson Co. Colo., June 25, 1980. Half-grown larvae hibernate. HALF-GROWN LARVA (Ralston Butte) black with tiny pale dots & many black spines, an ochre band beside a middorsal black line, an ochre band above lateral spines and another ochre band below lateral spines; head black.

Chlosyne whitneyi damoetas Skin. Oviposition egg cluster on underside of leaf of Erigeron leioMeris (S), Hermit Pass, Custer Co. Colo., Aug. 1, 1971. Two egg clusters found on underside of rock beside E. leioMeris and 40 diapausing larvae and 1 pupa reared to adult found near E. leioMeris, Loveland Pass, Summit Co. Colo., Aug. 9, 1978. Four larvae on underside of E. leioMeris (W) leaf, Loveland Pass, July 25, 1978. 11 larvae & 1 pupa found on underside of rocks near E. leioMeris, Loveland Pass, July 15, 1980. Larva found near E. leioMeris, Loveland Pass, July 25, 1981. A female from Loveland Pass July 20, 1977 laid eggs in the lab, and larvae ate E. leioMeris. Adults associated with E. leioMeris, Schafer Gulch Road, Hinsdale Co Colo., July 21, 1980, and at Uncompague Peak, Hinsdale Co. Colo., July 18, 1980, and at Mt. Massive, Lake Co. Colo., Aug. 1, 1982. Half-grown larvae diapause, and there are many (in years of abundance at least, since later years proved that locating larvae is not as easy as I thought) diapausing larvae under rocks near the host even in midsummer when adults and eggs are common, indicating that many larvae take several years to mature. Some larvae probably take 1, 2, even 3 or more years to mature, and thus the life cycle should be described as multiannual (usually biennial or longer). Much of the population at any given time seems to be made up of diapausing larvae, although in some years larvae are very hard to find in midsummer, and thus the population is less susceptible to extinction, because an entire years' crop of adults can be wiped out and the populatation will come back the next year because some of the diapausing larvae will find hostplants and mature. Breaking diapause in the lab is very difficult even with constant light. Larva & pupa (& photo of pupa) from Colo. described by Scott (1966b).
Phyciodes mylitta mylitta (Edw.). 115 eggs in cluster found on underside of leaf of Cirsium vulgaris (M), reared to adults in lab on Sillynum marianum, Copper, Siskiyou Co. Calif., May 19, 1974. Early stages (from eggs laid by female from Thompson Can., Yolo Co. Calif.): MATURE LARVA blackish-brown with tiny cream dots, a blackish middorsal line, a tan line beside it, a blackish-brown line along top of BD2, a tan line running through BD2 scoli, a wide blackish-brown band from bottom of BD2 scoli to just below BSD scoli, light-brown from just above spiracles to underside (a very faint tan line through top edge of BL scoli and a weak light-brown band just below BL scoli, lateral band slightly orange), scoli dark-brown except BL and BSD scoli orangish-ochre; head black with a subdorsal cream stripe (rarely a cream spot at its anterior end), and rarely a small cream crescent above eyes. PUPA mottled brown, varying to ash-gray, many cream-topped bumps (with an anterior brown crescent clasping front of bump) on T2-3-abdomen, a crest from tornus over A4 (front slope of crest brown, rear cream), weaker similar crests on A5-7 and T2, a sublateral brown abdomen band, wing has postmedian (always 5-6 anterior dots in Phyciodes) and marginal cream dots, the usual cream-brown areas on wing.

Phyciodes orseis orseis Edw. Larvae from Siskiyou Co. Calif. (sent by Kenneth Hansen) ate tender flesh on top of bract bases (the part eaten by humans) of grocery-store artichoke Cynara scolymus in lab, though in nature the hostplant is probably Cirsium growing on slopes. Half-grown (stage 3) ssp. orseis larvae hibernate; diapause is difficult to break in the lab even with constant light. MATURE LARVA black with tiny cream dots (overall appearance dark-brown), a middorsal black line edged by a gray (orange at BD1 scolus bases from T3-A9) band (narrow on T1-2), an orangish-cream dash in front of BD2 subdorsal abdomen scoli, these subdorsal scoli have narrow orange-brown bases, a cream line above spiracles (line orange (because of tiny orange spots) in middle of segment at ventral base of supraspiracular BSD scoli), a cream sublateral line touches ventral base of subdorsal BL scoli, these BL scoli have orange bases, underside dark-brown; head black (the following dark-brown areas are visible on shed head capsule, but the living heads appear solid black): some larvae have a dark-brown subdorsal stripe with a dark-brown satellite dot just below it, a tiny dark-brown spot on upper end of frontoclypeus, a brown patch on side of frontoclypeus, and a dark-brown tiny spot above eyes. PUPA mottled light-brown or mottled brown (brown with tiny orange-brown marks esp. on upperside, underside slightly-darker-brown), T1 has a cream subdorsal spot, T3 has a brown subdorsal spot with orange-brown behind and medial to it, wing has a brown band from mid-costa to tornus, inner margin of wing brown, a paler area above inner margin of wing, a subapical brown wing spot, wing has tiny pale marginal and 8 tiny postmedian pale dots, a paler (ochre-brown on front slope, paler tan on rear) crest runs from wing margin above tornus to over the top of A4, and similarly-colored weaker crests are on A5-7 and subdorsally on T2, a weak subdorsal brown abdomen band, a sublateral line of narrow blackish-brown dashes below spiracles on A4-7, a few short blackish-brown subventral and midventral abdomen dashes, rows of small bumps on T2-3-abdomen (these middorsal and subdorsal bumps represent rudiments of larval scoli and are orangish with brown tips); pupal stage 9 days in lab.

Phyciodes orseis herlani Bauer. A female from Glenbrook, El Dorado Co. Calif., June 16, 1972, laid an egg cluster in lab on Cirsium vulgare; the larvae were reared on Cirsium arvense (not on C. vulgaris; Scott 1974a reports the life history, Scott 1986b compares larva with ssp. orseis: a line edging heart-line and a wide lateral band are ochre-brown in ssp. herlani, orange in ssp. orseis).

Phyciodes pallida (Edw.). Cluster of 114 yellow eggs on underside of a 15-cm long leaf of fairly young plant of Cirsium ochrocentrum (W), Red Rocks, Jefferson Co. Colo., June 15, 1987. 3rd-stage larva found on top of C. ochrocentrum leaf "15 cm long of small plant without aerial stem, upperside of leaf tissue eaten in patches 5 mm wide, larva ate Cirsium incanum in lab for several weeks but then diapaused 3rd-stage, S Indian Peak, Jefferson Co. Colo., Sept. 5, 1991. Larvae reared in lab (Scott 1978b) on Cirsium arvense and Cirsium vulgare from eggs laid by a female from Red Rocks, Jefferson Co. Colo., June 29, 1973. 3RD-STAGE LARVA black, a middorsal black band contains BD1 scoli, a broad cream band contains BD2 scoli (these scoli have orange bases except ventrally, and the orange bases touch BD1 scoli dorsally), black dashes run between BD2 scoli in the cream band, next a broad black band contains BSD scoli, a cream line is below it, the lateral BL scoli have orange bases except dorsally and are in a broad black band (except cream is in front of BL scolus, and a diagonal cream line is below BL scolus and rises posteriorly), underside brown, scoli black: head black with a cream anteroposterior dash on top of each side of head; interestingly, the 3rd-stage resembles Phyciodes orseis mature larva (whereas
Physiodes tharos/morpheus morpheus (Fabr.). Six egg clusters and ten clusters of young larvae on underside of leaves of Aster laevis var. geveri (W), Tucker Gulch, Jefferson Co. Colo., July 8 to Aug. 7, 1978, Aug. 5, 1983, and July 18, 1984. Larvae on A. laevigata var. geveri (W), Tinytown, Jefferson Co. Colo., July 30, 1978. Cluster of 39 eggs on underside of A. laevigata var. geveri leaf, Coal Creek Can., Jefferson Co. Colo., July 7, 1985. 7 clusters of lst-2nd-stage larvae found under A. laevigata var. geveri leaves of plants about to flower, Tucker Gulch, Jefferson Co. Colo., July 27, 1999. 1 cluster of lst-stage larvae found on A. laevigata var. geveri leaf underside, Tucker Gulch, Jefferson Co. Colo., July 31, 1989. 2 clusters of 2nd-stage larvae found on A. laevigata var. geveri leaf underside, Tucker Gulch, Jefferson Co. Colo., Aug. 1, 1989. Cluster of 4 2nd-stage larvae found on A. laevigata var. geveri leaf underside, Stove Mt., El Paso Co. Colo., Aug. 19, 1989. Ssp. morpheus (=selenis [Kirby]-pascoensis Wright) has recently been treated as a distinct species, and is reproductively isolated from ssp. tharos in the Appalachians, and apparently in S Minn. and W Neb., probably even in N Colo. in Larimer Co., but in central Colorado I reared many adults from Golden Gate Can. and released females in front of P. tharos/morpheus tharos males at a plains site; courtship occurred readily and hundreds of F1 hybrids were reared (Scott 1988c). This suggests that the two are one species. The two ssp. are allopatric in Colo., except the foothills W of Fort Collins, Larimer Co. (Paul Opler), tharos occupying the plains and morpheus the mountains; they best fit the concept of subspecies in C Colo., but are evidently more distinct than the usual subspecies because they are sympatric northward (and in Neb., Minn., etc.); they are not reproductively isolated in Colo., and remain distinct where they are sympatric evidently because their different flight times rarely allow them to interbreed (and perhaps some reproductive isolation in nature has involved in areas northward where they are sympatric). In 30 years I have caught 2 tharos and 2 morpheus on Green Mtn., Jefferson Co. Colo., 1 1/2 months apart, but this hardly qualifies as sympatry because populations do not exist there and the latter's hostplant does not even grow there. The species name can be cited as P. tharos/morpheus morpheus. Their antennae are the same color (orange) in Colo., whereas they differ in W.Va.-Va.-Penn. where they behave as separate species. Early stages from C Colo. were described by Scott (1986b). Half-grown larvae hibernate. FIRST-STAGE LARVA cream, with subdorsal yellowish-yellow patches, long black setae; head black.


**Phyciodes tharos/morpheus riocolorado** NEW SUBSPECIES. The name is from the Colorado River. Adults of riocolorado are characterized by having the same pattern of dark lines as typical P. tharos/morpheus tharos, but the black borders are narrower, and the overall upperside color is more ochre-orange (less reddish-orange) than other tharos populations (adults vary little in upperside color); antenna clubs are white-and-black. Paratype female shown in color by Scott (1986b, plate 27 228a). This seems to be the only valid ssp. of tharos, as distincta Bauer (type locality Calexico, Imperial Co., Calif.) is a synonym of tharos (unless distincta is used for the southern populations with white-and-black antenna clubs, tharos for northern populations with orange-and-black antenna clubs), and even tharos from central Mexico do not differ appreciably from SE U.S. tharos. The subspecies is not enormously different from ssp. tharos, but the differences between closely-related species of Phyciodes are not large either. (For those nomenclatural purists who might complain about application of details of ICZN Code articles regarding my use of a / and four names, I now state that the citation as far as ICZN Code is concerned is P. tharos riocolorado, and I state that riocolorado belongs in the species tharos, regardless of whether morpheus belongs in tharos.) Types: wetland at Moab, Grand Co., Utah, Sept. 5, 1978, 1 male holotype and 1 female allotype in Mus. Nat. Hist. Los Angeles County, 3 male 4 female paratypes in my coll.---at least part of this wetland is now a park although the spot where I found these adults may be outside park boundary; Austin, Delta Co., Colo., July 19, 1988, 2 male 1 female paratypes in my coll. Other specimens from Delta Co. Colo. are in the Univ. Colorado Museum. Range: the bottom of hot valleys in the Colorado River drainage at least in Utah from Moab upstream to Colorado River tributaries in the Gunnison River system in Delta Co. Colo. Adults associated with *Centaurea* (Acroptilon) repens (which is probably not a hostplant), NE Austin, Delta Co. Colo., July 19, 1988.

**Phyciodes batesii** (Reak). Early stages from Pine Ridge, NW Neb., 1986 (newly-pickled, from Steven Spoer), presented as a comparison to the other Phyciodes: MATURE LARVA brown with tiny cream dots, a dark-brown middorsal line through BD1 scoli (wider around scoli), then a tan band, a dark-brown line through upper part of BD2 scoli, a tan subdorsal line through lower part of BD2 scoli (the second-most-conspicuous band on body), a wide fairly-dark-brown band (brown in intersegmental area) ventrally includes BSD scoli (and has cream dots more frequent above BSD scoli), a wide pale-brown band is formed of a cream-tan irregular line just above spiracles, and a wide tan band with some brown mottling that includes spiracles and BL scoli, and a cream lateral stripe that touches lower part of BL scoli (this is the most conspicuous stripe on body), this stripe edged below by brown, underside light-brown with cream dots, scoli light-brown, T1 collar has a posterior lobe just below midventral plane, T1 brownish-tan, the only bands being a slightly-paler band corresponding to the second-most-conspicuous band noted above, and a pale tan line corresponding to the most-conspicuous band; head black with a subdorsal cream stripe on top of head (its anterior and a cream spot mostly connected to stripe), an irregular tan lateral stripe extends from rear of head forward then above eyes then downward around eyes (and in one of two larvae extends to lower edge of frontoclypeus where it widens), an ochre spot on middle of frontoclypeus. All Phyciodes mature larvae have these same dark bands on body, but in different species the bands may be darker or lighter and some dark bands or pale bands may coalesce; all Phyciodes have black heads with the subdorsal cream stripe. PUPA mottled brown with tiny cream dots, wing has brown streak in discal cell and a brown streak on CuA2, brown below 1A+2A, pale postmedian and marginal dots on wing, a cream area on wing extending up and over A4 on a crest (the rear slope of crest cream, front slope brown), and similar-colored weaker ridges on A5-7 and T2, a subdorsal pale-brown abdomen band edged beneath by dark-brown (this band is characteristic of the P. tharos-group), a lateroventral pale-brown abdomen band edged below by dark-brown, a weak midventral brown abdomen band, rows of bumps on T2-3 and abdomen (as in all Phyciodes), shape like P. campestris and other Phyciodes, crests over abdomen perhaps smaller than on P. tharos/morpheus. All Phyciodes pupae are mottled brown of some shade with tiny cream dots, all have a crest curving from tornus to the top of A4 and smaller crests on A5-7 and a small bipartite (strongest at start and end) crest on T2, all have these crests colored the same (rear slope of crest cream, front slope brown), all have the same dorsal bumps on T2-3 and dorsal-to-lateral bumps on abdomen (these bumps are homologous to larval scoli), all have "5 postmedian (on

I have examined hundreds of these Aster and it is my opinion that there is genetic polymorphism for spreading vs. appressed hairs [other characters of head size and petal number seem very weak] so that different types grow in the same meadow and some plants are intermediate. Whatever the case, the butterflies cannot tell the difference between them.) Egg clusters and larval clusters found on A. ericoides var. falcatus (10 clusters of 33, 74, 52, 48, 86, 38, 88, 57 eggs plus ~50 1st-2nd-stage larvae found on one seedling; eight clusters of 38, 58, 76, 28, 85, 74, 235, 55 eggs on another seedling; two clusters of 135, 81 eggs found on another seedling; other clusters of 36, 19, 57, 32, 18, 57, 25, 14, 47, 118, 46 eggs found on other individual seedlings); all the eggs were on leaf underside of lush seedlings near the ground, the most eggs being on a large 1st-year basal rosette; several Aster hesperius searched had no eggs; Green Mtn., Jefferson Co. Colo., Sept. 17, 1991. Adults associated with A. ericoides; Horsetooth Res., Larimer Co. Colo. May 23, 28, 1930. Adults associated with A. ericoides common and Aster hesperius "4 plants; Wheatridge, Jefferson Co. Colo., Aug. 8, 1986. Preoviposition 11:00 A. ericoides, Green Mtn., Jefferson Co. Colo., Sept. 1, 1990. Adults associated with A. ericoides, N Bear Creek Res., Jefferson Co. Colo., Sept. 24, 1980. Cluster of 60 eggs found on underside of leaf of seedling Aster hesperius along canal, some reared to adults emerged Dec. 17-31; A. hesperius grows only along creaks and ditches, where larvae could be washed away, so it is a less-common hostplant than A. ericoides which occurs in moist meadows and roadsides and is more common; Barr Lake, Adams Co. Colo., Oct. 11, 1988. 2 previpositions on Aster (Eucephalus) glaucodes (W) and adults common near it, Green Mtn. Res., Summit Co. Colo., July 15, 1985. In Colo. occupies both the plains (where the host is mainly A. ericoides, sometimes A. hesperius, evidently sometimes Machaeranthera pattersoni) and the mountains (where several Aster and the related Machaeranthera are hosts). Usually occurs in drier areas than P. tharos/morpheus; the latter also occupies both the plains and mountains, but as different sp./ssp., and generally in moist meadows and creeksides. EGG yellowish-cream. MATURE LARVA (Colo.) dark-brown (overall appearance a little darker than P. tharos/morpheus), with tiny cream dots, a middorsal blackish line through BD1 scoli, a narrow brown band, a dark-brown line of dashes that clasp upper part of BD2 scoli, a subdorsal cream line through BD2 scoli (this line is
interrupted somewhat between segments, unlike the continuous band of P. tharos/morpheus, a wide dark-brown band (dark brown near scoli, brown in intersegmental area) includes BSD scoli (and has more cream dots above BSD scoli that form a trace of a paler line through the middle of this band), a wide lateral cream-brown band is formed of a cream-tan line at lower edge of BSD scoli above spiracles, and a wide tan or light-brown band that includes spiracles and BL scoli, and a cream lateral stripe at lower edge of BL scoli, this stripe sharply-outlined beneath by brown in the middle of each segment, underside light brown with cream dots, scoli dark-brown except BL and BSV scoli tan, and ventral base of BD2 scoli slightly orange-brown, base of BL scoli orange-brown; head black, a subdorsal cream stripe on top of head often with a small cream dot at its anterior end and on vertex (the stripe and dot sometimes fused); a cream stripe (weak in some larvae) on side of head from neck to above eyes, frontoclypeus black (P. tharos/morpheus tharos and morpheus have a white area on frontoclypeus). PUPA (Colo.) mottled brown (overall appearance a little darker at least in some pupae than P. tharos/morpheus), wing mostly cream or tan with brown areas in discal cell, along inner margin, and prior to apex, with small bumps on T2-3 and abdomen, a crest runs from tornus up and over A4 (the front slope of crest brown, the rear crest connected to the cream area on wing), similarly-colored smaller crests on A5-7 and T2, a sublateral blackish-brown abdomen band, a midventral narrow blackish-brown abdomen band, pale-tan postmedian & marginal wing dots.

Phyciodes picta Edw. Ovipositions 10:00-10:15 (~105 eggs), 10:37 (66 eggs), 11:02 (~10 eggs before I interrupted her), 11:16 (~2 eggs before I interrupted her), 12:30 (~7 eggs before I interrupted her), preovipositions 10:40, 11:30, 12:00, 13:00, all on Convolvulus arvensis; ten egg clusters (6, 12, 15, 30, 40, 52, 61, 92, 140 eggs per cluster) and 1st-stage larva found on underside of C. arvensis leaves; 7 larvae and 1 pupa found under boards and dried horse arvensis leaves; 7 larvae and 1 pupa found under boards and dried horse arvensis; 7 larvae and 1 pupa found under boards and dried horse arvensis along railroad tracks, near Howard, Fremont Co Colo., Aug. 12 & 16, 1978. Lab larvae ate C. arvensis well and Aster laevis var. geyeri well, ate a little of Aster porteri and Machaeranthera pattersoni but did not prefer these, and refused Eriogonum divergens (W) and Aster falcatus (W) and Tragopogon dubius (W) and Podospermum laciniatum (W) (the latter four were the only Asteraceae found in same field). P. picta probably originally fed on Aster, and it still eats Aster in the lab, but the natural host is now Convolvulus, a remarkable case of host switching. Adults associated only with C. arvensis along railroad tracks, near Howard, Fremont Co Colo., Aug. 3, 1973 (eggs laid on this plant in lab from this site). Adults associated only with C. arvensis, E Canon City, Fremont Co. Colo., July 7, 1970, Aug. 17, 1970, July 1, 1971, July 19, 1972. Adults associated with C. arvensis, McElmo Creek, 10 mi. E Utah line, Montezuma Co. Colo., Aug. 25, 1977. Because C. arvensis is a weed, P. picta would be a good biological control agent, but unfortunately it is too limited in its choice of habitat, and refuses to populate gardens and cultivated fields. MATURE LARVA (Toll Creek) yellowish-brown with tiny cream dots, a middorsal dark-brown line, a dark-brown line along upper edge of BD2 scoli, a subdorsal cream band along BD2 scoli, a wide blackish-brown band from below BD2 scoli to lower edge of BSD scoli (this band has cream dots frequent just above BD2), a cream line at lower edge of BSD scoli just above spiracles, a band of red-brown spots in cream surroundings just below spiracles, a lateral cream ridge, a dark-red-brown line just below it, underside grayish-tan, prolegs tan, scoli brown except BL and BSV scoli tan; head dark-brown, a cream subdorsal stripe, a cream crescent above and in front of eyes, the face cream. PUPA light mottled brown, similar to other Phyciodes.

Heliconini (=Argynnini)

Boloria. Determining the hosts of Boloria is difficult because females oviposit rather haphazardly in the lab, suggesting that native larvae may be able to eat up to half the herbs and young shrubs present at a locality. Field associations are therefore valuable. The plants at each locality form a preference ranking from main hostplants, to occasional hostplants, to occasional oviposition plants never eaten by larvae, to plants never chosen by females or larvae. Logic argues that the following criteria are necessary to demonstrate that a plant species is a main hostplant of a butterfly which oviposits somewhat haphazardly: 1) adults should oviposit near (or on) the plant in nature (so of course adults must be associated with the plant in nature); 2) larvae must eat (and survive on) the plant in the lab. In order to prove 1), all plants near an oviposition/larva must be recorded and the distances noted. In order to prove
27, lab feeding tests must be conducted. Plants that are eaten in the lab, but are less often oviposited near in nature or are less often associated with adults in nature, can be considered occasional hostplants which the larvae occasionally wander to and eat. Plants that females occasionally oviposit on but larvae refuse are occasional oviposition-site non-hostplants; these plants are of very little interest because haphazard oviposition guarantees many of them. So, lab feeding studies are needed to confirm that an oviposition site is a hostplant, and additional data such as ovipositions and adult association data are required to rank lab-proven hostplants as main hostplants and occasional hostplants. We will have a good picture of Boloria ecology only when main hostplants are determined by these two criteria.

A curious aspect of Boloria is that most species may have very similar lab host preferences, despite great differences in hosts chosen in nature. I found that B. frigga and B. eunomia have nearly identical lab preferences, and Clyde Gillette found that B. freija has nearly the same preferences: they all eat Violaceae, Vaccinium, Polygonaceae, Rosaceae, Salicaceae (though Gillette found that freija refused one Salix sp. but ate Betula); they refuse Ranunculaceae, Gentianaceae, Apiaceae, Crassulaceae, Scrophulariaceae, and Asteraceae. B. belliana is the only species that seems to be monophagous (to Viola) based on lab feeding tests, though B. selene and some others may be monophagous also.

In 1888 and afterward, all plants near an egg were recorded and their distances (cm) to the egg noted, up to 1 m (for instance, "Sibbaldia procumbens 4, 5, 6, 7, 8, 10, etc."); this system is necessary for species which oviposit somewhat haphazardly.

The arctic/alpine species seem to hibernate as unfed stage 1 and unfed stage 4 larvae during successive winters, and in artificial lab conditions stage 1 larvae often bypass diapause but stage 4 larvae always diapause (arctic/subalpine B. titania diapauscs in 1st stage but is probably biennial and also diapauses in 4th stage); apparently lower-altitude (up to subalpine) species only have the unfed stage 4 diapause. An exception is that B. eunomia diapauscs in the 3rd stage.

B. frigga, B. freija, B. eunomia, and B. titania could have annual life cycles, because their diapause stage of 4th, 4th, 3rd, and 1st stage larvae nicely fits their time of appearance in nature: B. frigga and freija fly first (June-July, peak late June), B. eunomia flies next (July-mid Aug., peak late July), B. titania flies last (mid July-early Sept., but they could be biennial, see below for discussion of biennial titania life cycle).

Boloria napaea halli Klots. Adults associated strictly with Polygonum (Bistorta) bistortoides in moist meadows and gentle slopes along valley bottoms, always with dense short flowery vegetation, at two sites on the western slope (Sublette Co.) and two sites on the eastern slope ( Freemont Co.) of Wind River Mts., Wyoming, Aug. 12, 1979, Aug. 8, 1980, Aug. 11-12, 1983. This plant is closely related to Polygonum (Bistorta) viviparum, the known host in Europe and arctic America, which has also been recorded as a host in Wind River Mts. (Jim Troubridge); P. viviparum is usually more common than P. bistortoides, though individual plants are smaller, so perhaps P. viviparum is the most common host here.

Boloria eunomia caelestis (Hemm.). 17 ovipositions were seen. Oviposition 9:19 2 eggs in cluster, oviposition 9:50 3 eggs in cluster, both on underside of leaves of Thalictrum alpinum, oviposition 9:00 2 eggs in cluster on underside of leaf of 5 cm tall plant of Pentaphylloides floribunda, Caribou, Boulder Co. Colo., July 15, 1977. Oviposition 9:13 4 eggs in cluster on underside of Caltha (Psychrophila) leptosepala (W) leaf, Loveland Pass, Summit Co. Colo., July 17, 1977. Unfortunately, nearby plants were not recorded for these records, so most of the potential information on hostplant was lost. Oviposition 9:05 one egg on small Viola labradorica (=bellidifolia)(W) plant, Loveland Pass, Summit Co. Colo., July 28, 1978. Oviposition 9:26 seven eggs in compact cluster on underside of leaf of Salix planifolia seedling (S. planifolia common nearby, Salix brachycarpa 20-30 cm away, Salix wolffii 30-1 m, Betula glandulosa 20-60, 60-80 cm away, Pentaphylloides floribunda 10, 15, 50-1 m away), oviposition 10:05 one egg on underside of Thalictrum alpinum (T. alpinum common nearby, Salix brachycarpa common nearby 5 cm onward, Salix planifolia 40-1 m, Salix wolffii 10, 30-1 m, 40-1 m away, Pentaphylloides floribunda 5-30, 1 m, Betula glandulosa 50, Fragaria [or Sibbaldia?] 25, 30, 40 m away, Polygonum [Bistorta] bistortoides 40 cm away), oviposition 10:22 five eggs in cluster on underside of Thalictrum alpinum (T. alpinum common nearby, Salix planifolia common 5-1 m, Pentaphylloides floribunda 80-90, Betula glandulosa 80, 90), Caribou, Boulder Co. Colo., July 5, 1988. Oviposition 10:15 four eggs on underside of 6 mm-wide Caltha leptosepala seedling (possibly Viola labradorica as these seedling leaves are very difficult to tell apart)(C. leptosepala common 2 cm onward, Salix
Planifolia shrubs 20 cm onward), preoviposition 11:15 near underside of Polygonum bistortoides (Viola labradorica commonly nearby, Vaccinium cespitosum common 5 cm onward, Salix planifolia common 10 cm onward), preoviposition 11:25 near Polygonum viviparum (P. viviparum common nearby, Salix planifolia 5 cm onward), oviposition 11:38 three eggs on underside of 4 mm-wide Polygonum viviparum seedling leaf, (P. viviparum common 1 cm onward, Salix planifolia seedlings 10 cm onward), Loveland Pass, Summit Co. Colo., July 23, 1988. Oviposition 10:18 three eggs on underside of 4 mm-wide Polygonum viviparum seedling leaf (P. viviparum common nearby 0.5 cm onward, Sibbaldia procumbens 4, 12, 30, Viola labradorica 3, 8, etc. onward common, Salix planifolia 15 cm onward, Kalmia polifolia) microphylla 5 cm), Loveland Pass, Summit Co. Colo., July 23, 1988. Oviposition 11:18 three eggs on underside of Polygonum viviparum 4 mm-wide seedling leaf (P. viviparum common nearby 1 cm onward, Polygonum bistortoides 20 cm away, Salix planifolia 7, 20 cm onward, Potentilla diversifolia 18-25 cm, Vaccinium cespitosum 70, Viola labradorica 65, 80), oviposition 13:56 three eggs on underside of leaf of Vaccinium myrtillus oreophilum seedling (V. m. oreophilum common all around, Viola labradorica common 4 cm onward, Polygonum bistortoides common 15 cm onward, Potentilla diversifolia 15-45 cm, Salix planifolia 35, 80, 1 m, Polygonum viviparum 13 & 30 cm), Loveland Pass, Summit Co. Colo., Aug 1, 1988. Oviposition 12:50 two eggs on underside of Polygonum viviparum 4 mm-wide seedling leaf (P. viviparum very common 1 cm onward, Salix planifolia 8, 25 cm onward, Viola labradorica 22-45), preoviposition 9:44 among Salix planifolia & Polygonum viviparum, Loveland Pass, Summit Co. Colo., Aug 2, 1988. Preoviposition 10:30-10:33 among Vaccinium cespitosum on old lichen mound (V. cespitosum common nearby, Viola labradorica 3, 5, 8, 15, 20 cm away, Polygonum viviparum 15, 25 cm away, Salix planifolia 20 cm away), oviposition 10:34 three eggs in cluster on underside of Polygonum viviparum seedling leaf (P. viviparum common 5 cm onward, Vaccinium cespitosum common 3 cm onward, Salix planifolia 10 cm onward, Viola labradorica 12 cm onward), Loveland Pass, Summit Co. Colo., Aug 5, 1988. Oviposition 13:30 two eggs in cluster on underside of Vaccinium cespitosum leaf (V. cespitosum very common 0-1 m, Polygonum bistortoides 5 cm onward, Potentilla diversifolia 15 cm onward, Salix planifolia 25, 70-90 cm), Loveland Pass, Summit Co. Colo., Aug 8, 1988. Oviposition 15:14 two eggs in cluster on underside of Viola labradorica leaf (V. labradorica very common 0-1 m, Vaccinium cespitosum 45 cm onward, Sibbaldia procumbens 1 m, Polygonum bistortoides 80, Salix planifolia 60, 1 m), Loveland Pass, Summit Co. Colo., Aug 15, 1988. Larvae are somewhat polyphagous, eating these plants well in the lab: Salix planifolia, Salix drummondiana, Viola labradorica, V. sororia affinis (=nephrophylla), Polygonum viviparum, Polygonum bistortoides, Vaccinium cespitosum, Sibbaldia procumbens. Larvae eat some of Potentilla diversifolia, and eat a little of Pentaphylloides floribunda and Kalmia polifolia) microphylla. Larvae do not eat any of Thalictrum alpinum, Calthra leptosepala (ate only two bites out of this), Swertia panensis, Angelica grayi, Sedum (Clemeatia) rhodanthum, Pedicularis groenlandica, Ericamer urinus, Senecio. Based on these oviposition records and adult association and the lab feeding tests, Polygonum viviparum is a main hostplant, evidently most often chosen; Polygonum bistortoides may be an occasional hostplant. Salix planifolia is also a main hostplant, based on several ovipositions and presence near many eggs; Salix brachycarpa is an occasional hostplant, chosen less often because it is less common in the willow bogs. Another factor indicating Salix as a major host is that adults usually occur in shrub-willow bogs; perhaps Salix is an important host in early summer when larvae are large and require a lot of food which the Salix shrubs provide (Polygonum viviparum and Viola labradorica are very small plants to supply the needs of 1-7 larvae). However, a colony was found near Divide, Teller Co., Colo. (July 1980, Eric Schonberg) in a horse pasture without any Salix, which is possible because larvae are polyphagous. Viola labradorica is also a main hostplant, based on several ovipositions and presence near many eggs. Vaccinium cespitosum and Vaccinium myrtillus are occasional hostplants, V. cespitosum undoubtedly used more often because it often grows in drier areas within the willow bogs whereas V. myrtillus usually grows only under spruce trees at bog edges. Several Rosaceae (Potentilla diversifolia, Sibbaldia procumbens, Pentaphylloides floribunda) could be seldom-used occasional hostplants, merely based on their presence near several eggs and lab feeding; but P. floribunda is unlikely because larvae do not eat it well. In conclusion, B. eunomia is truly polyphagous in nature as well as in the lab. Females oviposit in clusters of 1-7 eggs on underside of small (typically about 4-10 mm wide) green leaves of seedling plants near the ground in marsh "grass" or grassy areas between willow shrubs; they crawl around on the ground to locate such a leaf and fly if they do not find one. Eggs hatch after 6 days in the lab. 3rd-stage larvae hibernate. Early stages: EGG pale yellow. FIRST STAGE
LARVA tan (becoming greenish in front due to food), A1, A3, A5, A7 browner forming rings around body, setae bases black; head black. 2ND STAGE LARVA mottled brown, (body tan, with browner patches in subdorsal areas between scoli), scoli dark brown; head black. 3RD STAGE LARVA red-brown with dark-brown marks, except area above BD2 scoli to just above BSD1 scoli tan with dark-brown crescents extending posteriorodorsally and posteroinfrently from each BSD1, a middorsal band of brown lenslike marks, a lateral cream line on A2-8 below BL1 scoli (an anterior white crescent on A1, a lateral dash on T1 & T3), a brown crescent above BSU1 scoli, pale-red-brown crescent above proleg: head dark-brown-black with a red-ochre zone around eye area, a red-ochre stripe on each vertex, a red-ochre lenslike patch on lower front.

*Boleoria selene myrina* (Cramer) (=tollandensis [B. & B.J]). Oviposition *Viola* sp., wet grass/sedge meadow with scattered willows SW Westcliffe, Custer Co., Colo., Aug. 15, 1970. Female laid eggs in lab rear to adults on *Viola sororia affinis* (=nephrophylla), Fraser, Grind Co., Colo., Aug. 5, 1981. 1ST-STAGE LARVA cream, with brown seta bases, suranal plate & collar blackish; head black. 3RD-STAGE LARVA gray, many large black conical scoli, suranal plate & collar head black. MATURE LARVA black with usual markings for the species, but the scoli bases slightly-orchangish-cream (very little orange), the long prothoracic scoli shorter than those of *myrina* =sabulocollis (about same length as head width). PUPA black-brown, blacker than "sabulocollis", the golden cones and other cones shorter, (merely conical with no nipple at tip).

*Boleoria selene myrina* (Cramer) (=sabulocollis Kohl.). Adults associated with *Viola pratina* Pursh, Smith Lake, Sheridan Co. Neb., July 17, 1988. Adults associated with *Viola sororia affinis* (=nephrophylla), Timnath, Larimer Co. Colo. (this tiny population became extinct about 1980 when removal of horses permitted overgrowth of Phragmites). Adults associated with *Viola sororia affinis* (=nephrophylla), Elbert Co. Colo., 1972-1984. A weak ssp. with some adults slightly browner on unh base; a Las Animas Co. Colo. mtn. population has browner unh base but is small like *tollandensis*. MATURE LARVA (Scott 1986, plate 3) black with usual markings for the species, but the scoli bases orange (more orange than "tollandensis"), the long prothoracic scoli much longer than those of "tollandensis" (about 1.5 times head width). PUPA (Scott 1988, plate 5) fairly dark brown, lighter than "tollandensis", the golden cones and other cones longer (conical plus a protruding nipple at tip).

Oviposition 11:08 on underside of 4 mm leaf of Vaccinium scoparium seedling (V. scoparium or Vaccinium myrtillus oregnholm common 2 cm onward, Polygonum viviparum common 18 cm onward, Salix planifolia 50, 70, Polygonum bistortoides 90, 1 m), oviposition 13:51 on Picea engelmanni needle in litter (Vaccinium myrtillus oregnholm very common 1 cm onward, Gaultheria humifusa very common 2.5 cm onward, Polygonum bistortoides 8, 40, 90 cm, Polygonum viviparum 25 cm, Vaccinium scoparium 12, 20 cm onward, Kalma [polifolia] microphylla common 25-50 cm), Loveland Pass, Summit Co. Colo., Aug 5, 1988. Oviposition 11:06 on underside of 4 mm wide leaf of Vaccinium scoparium seedling (V. scoparium very common nearby 0-1 m, Vaccinium myrtillus oregnholm common 5 cm onward, Polygonum viviparum 90, Salix planifolia 1 m), oviposition 11:08 on underside of 4 mm leaf of Vaccinium scoparium seedling (V. scoparium common 5-55 cm, Vaccinium myrtillus oregnholm very common 2 cm onward, Salix planifolia 75), oviposition 11:40 on underside of Vaccinium cespitosum leaf of seedling (V. cespitosum very common 1-1 m, Salix reticulata nivalis 7 cm onward, Viola labradorica 2 cm onward, Salix planifolia 22 cm, Polygonum bistortoides 20 cm, Potentilla diversifolia 90), oviposition 11:41 on underside of leaf of Vaccinium myrtillus oregnholm seedling (V. m. oregnholm 8 cm onward, Vaccinium cespitosum common 4 cm onward, Polygonum viviparum 8 cm onward, Vaccinium scoparium 50 cm, Viola labradorica 10-45 cm, Sibbaldia procumbens 20 cm onward, Salix reticulata nivalis 15 cm onward, Potentilla diversifolia 90), Loveland Pass, Summit Co. Colo., Aug 8, 1988 (J. Scott and Marc Epstein). Oviposition 11:00 on underside of Gentianella acuta leaf (G. acuta 2 cm onward, Sibbaldia procumbens 10 cm onward, Vaccinium myrtillus oregnholm 15 cm onward, Viola labradorica 15 cm onward, Polygonum viviparum 14 cm onward), oviposition 12:29 on underside of 7 mm leaf of Gaultheria humifusa (G. humifusa very common 0-1 m, Vaccinium cespitosum common 3 cm onward, Sibbaldia procumbens common 0.5 cm onward, Salix reticulata nivalis 6 cm onward, Polygonum viviparum 18, 25, 50 cm, Polygonum bistortoides 6 cm onward, Viola labradorica 40-90), Loveland Pass, Summit Co. Colo., Aug 10, 1988. Oviposition 10:27 on underside of dead leaflet base of Potentilla diversifolia (P. diversifolia common 0 cm onward, Viola labradorica 0 cm onward, Vaccinium myrtillus oregnholm common 2 cm onward, Polygonum viviparum 20 cm onward), oviposition 10:40 on oval-cross-section rubbery green sedge leaf (Polygonum viviparum common 5 cm onward, Viola labradorica common 2 cm onward, Salix planifolia common 8 cm onward, Kalma [polifolia] microphylla common 20 cm onward, Potentilla diversifolia 22 cm onward), Eisenhower Tunnel, Summit Co. Colo., Aug 15, 1988. Oviposition 10:35 on underside of leaf base of Erigeron ursinus seedling (E. ursinus common 3 cm onward, Polygonum viviparum 7 cm onward, Sibbaldia procumbens 8 cm onward, Vaccinium myrtillus oregnholm common 3 cm onward, Gaultheria humifusa very common 2 cm onward, Viola labradorica 9 cm onward), oviposition 11:10 on underside of sphagnum? moss (or ?Minuartia obtusiloba)? Polygonum viviparum common 2 cm onward, Viola labradorica 2-18 cm, Gaultheria humifusa 7-25 cm, Vaccinium cespitosum common 3 cm onward, Salix reticulata nivalis common 3.5 cm onward, Sibbaldia procumbens 13-50 cm), oviposition 13:31 on top of Vaccinium cespitosum leaf (V. cespitosum common 0-1 m, Salix reticulata nivalis 0.5 cm onward, Viola labradorica 25-80 cm, Polygonum viviparum 50), oviposition 14:27 on underside of petiole of Erigeron ursinus seedling (E. ursinus common 0-45 cm, Salix reticulata nivalis 3 cm onward, Vaccinium cespitosum common 2 cm onward, Viola labradorica 20 cm), Loveland Pass, Summit Co. Colo., Aug 10, 1988. Oviposition 11:37, the female landed on Salix reticulata nivalis and crawled 5 cm and laid egg on underside of Vaccinium cespitosum leaf (V. cespitosum common 5 cm onward, S. reticulata nivalis common 3 cm onward, Viola labradorica 10, 30, 30, 60 cm, Sibbaldia procumbens 22 cm), oviposition 12:35 on underside of leaf base of Trifolium dasvphylum leaf (T. dasvphylum common 1 cm onward, Vaccinium cespitosum very common 1 cm onward, Vaccinium myrtillus oregnholm 3 cm onward, Gaultheria humifusa 1 cm onward, Viola labradorica 5-35 cm, Polygonum viviparum 40 cm, Salix planifolia 30 cm onward, Sibbaldia procumbens 45-60 cm, Salix reticulata nivalis 30 cm, Polygonum bistortoides 35 cm, Potentilla diversifolia 9 cm onward), oviposition 12:36 on top of Vaccinium cespitosum leaf (V. cespitosum common 3 cm onward, Vaccinium myrtillus oregnholm common 0.5 cm onward, Salix reticulata nivalis 6 cm onward, Sibbaldia procumbens 4-50 cm, Viola labradorica 17, 35 cm, Polygonum viviparum 40, 50, Polygonum bistortoides 10, 22, 60), oviposition 14:31 on underside of Vaccinium scoparium stem (V. scoparium very common 5 cm onward, Vaccinium myrtillus oregnholm common 15 cm onward, Viola labradorica 35 cm, Potentilla diversifolia 1 m), Loveland Pass, Summit Co. Colo., Aug 13, 1988. Oviposition
ate none, Erigeron (violet flower, hispid leaf) ate none, Polygonum bistortoides ate none, Artemisia reticulata var. nivalis ate none, Castilleja (red flower) ate none, Castilleja 5 CM of leaves), V. adunca (ate

Taraxacum officinale 2, 5, 15, Potentilla [Drymocallis] 80, Geum (Acomastylis) rossii turbinata 0.5, 3, 4, 5, etc. abundant to 100, Potentilla diversifolia 20), then she flew 20 cm and probed again on S. r. nivalis (I could not find an egg at this spot), she flew 5 m to another S. r. nivalis patch and landed and possibly laid another egg (I failed to watch closely enough to see), Loveland Pass, Clear Creek Co., Colo., July 19, 1989.

Preoviposition fluttering on Salix reticulata nivalis, Uncompahgre Peak, Hinsdale Co. Colo., Aug. 3, 1979, and Hermit Pass, Custer Co. Colo., July 1970. Females oviposit somewhat haphazardly, so lab feeding tests are needed. Unfortunately, few lab feeding tests have been done (except my young lab larvae ate Viola but not Salix babylonica) because first-stage larvae diapause and then die in the lab, so some plants near the eggs that were recorded in my notes have not been listed here but may later prove to be edible to larvae. However, the oviposition records and field association of adults very clearly show that Vaccinium is the favorite hostplant genus by far. Vaccinium myrtillus, Vaccinium cespitosum, and Vaccinium scoparium are all popular as oviposition sites; adults occur most commonly at the edges of bogs and the edges of streams and semishaded valley bottoms where they can oviposit on V. myrtillus and V. scoparium growing under and around spruce trees; out in the open females like to oviposit on V. cespitosum. Viola labradorica is a frequent host, with several ovipositions and occurrences near other eggs, and larvae eat it. Polygonum bistortoides and Polygonum viviparum are surely occasional hostplants, and larvae probably eat them. Salix reticulata nivalis is a frequent host above timberline, rarely below. Salix planifolia and Salix brachycarpa are probably occasional hostplants, if larvae eat then. Gaultheria humifusa and Kalmia polifolia have one oviposition apiece, and several eggs were near the former, but they can be called occasional hostplants only if larvae are found to eat then, because their leaves are rather tough. Potentilla diversifolia and Sibbaldia procumbens were very near several eggs, so are probably occasional hosts as larvae can probably eat them. Erigeron ursinus had several ovipositions, but I doubt that larvae can eat it. Eggs are always laid singly, usually on green plant leaves of young or low plants. First-stage larvae hibernate. The life cycle could be annual, 1st-stage larvae overwintering to cause the late summer adult flight. However, W. Edwards (Can. Ent. 22:62) found that Colo. larvae hibernate in the 4th stage, Alberta larvae in 1st stage and 4th stage. If we believe both my and Edwards' data, larvae diapause in 1st and 4th stage in Colo. and Alta., which means that B. titania larvae must have a VERY slow developmental rate for adults to fly so late in the summer (but since eggs are usually laid near trees perhaps the snow lingers there longer thus delaying larval feeding and adult flight). B. titania often flies above timberline, where most if not all species are biennial. Early stages: EGG tan (light peach). FIRST-STAGE LARVA brown; head black.

Boloria bellona (Fabr.). Oviposition 9:29, she searched the edge of the moist meadow, and landed on Cirsium coloradense var. acaulescens and bent abdomen, then crawled 30 cm to beneath a Pentaphylloides floribunda bush and laid an egg 5 cm from bush on underside of dead horizontal grass blade (Viola adunca plant 1 m away under a Pentephylloides floribunda bush [the only Viola plant seen at this locality]), Taraxacum officinale 2, 5, 15, 20 cm from egg etc., Ivesia 15, 20, 50, Cirsium coloradense var. acaulescens 35, 55, Fragaria sp. 5, 7, abundant 15-100, Potentilla [Urymocalis] ?Fissa 80, 100, Ranunculus 80, Kochia?? 5, 10, 15, etc., Geum 80); preoviposition 10:40 she crawled around in hollows in the marsh "grass": Viola adunca is evidently the host here; W Tabernash, Grand Co. Colo., June 28, 1989. A female caught W Tabernash June 28 laid eggs in lab, which produced 18 adults July 28-Aug. 3, and produced diapausing larvae which were refrigerated several months and in turn produced 23 adults Oct. 24-Nov. 14; in nature there is evidently one main generation June-E July and then most larvae diapause but some larvae develop to produce the partial L Aug. flight seen in nature. 40 of these larvae from W Tabernash were placed in one container for 2 days in lab with leaves of the following plants, and amount of larvae feeding noted, with these results: Viola sororia affinis (=nephrphylia) (ate nearly all of leaves), V. adunca (ate 65% of), Sibbaldia procumbens (ate 6 little holes in leaf for a total of only 5 mm² eaten), Salix planifolia ate none, Salix reticulata nivalis ate none, Castilleja (red flower) ate none, Castilleja occidentalis ate none, Trollius albiflorus ate none, Caltha (Psychrophila) leptosepala ate none, Potentilla diversifolia ate none, Erigeron (white flower) ate none, Erigeron (violet flower, hispid leaf) ate none, Polygonum (Bistorta) viviparum ate none, Polygonum (Bistorta) bistortoides ate none, Artemisia
scopolium) ate none; *Seuon retrost turbinata* ate none; *Vaccinium cespitosum* ate none; *B. bellona* is evidently host-specific to *Viola*, which is amazing considering the broad host specificity of most *Boloria*. Unfed-4th-stage larvae hibernate. E60 conical, cream-tan. FIRST-4TH STAGE LARVA tan on T1-2, tan-cream on T3-A6 (browner on A1, A3, A5, A7), tan on A8-10, a middorsal brown line on T2-3, middorsal brown dash on A1-9, brown band along D1 setae, brown band along S01 setae, probably a brown band(s) on side pronotum and head black. OLDER LARVA dull blackish-gray, with many tiny setae each with a gray circle around seta base, on T2-3 a middorsal black fork (forked anteriorly), on A1-9 a black middorsal Y connected to Y on next segment by a 2 gray wiggly lines, below subdorsal BD2 scolus a narrow white line of subdorsal dashes (these dashes are the most conspicuous pattern on larva, the remaining pattern being less obvious), edging each white dash beneath a black band of dashes, below each black dash a short very narrow white dash just above BSD scolus which is connected to the same dash on the next segment by a white wiggly line, below BSD scolus another white wiggly line above spiracles, below BL scolus a white line on A1-10 only, a midventral weak white band (strong on A7-8, fairly strong A1-2); all scoli have black base, ochre basal half, black distal half, except BL scolus on A1-7 has black base and ochre remainder, BL on A9 is all blackish, BL on A6 is intermediate; head black except coronal sulcus white. PUPA mottled dark-brown, dorsal rim of wing blackish, a 1-mm black spot in middle of wing, brown spot near apex, veins black, on top of AS-7 is a fine white U aimed forward with anteriorly-convex arms (the anterior tip of the U is on a slight bump forming a pivot where the segment swivels from side to side, and each arm is edged anteriorly by black), a blackish abdomen band is next to midventral axis, a wider dark brown abdomen band is just above & another just below lateral axis of abdomen; a T2 middorsal keel has blackish sides, a middorsal ridge is strong on A5-7, weak on A5-4 & A8; many cones are present (head has one cone on each side which is aimed forward and is blackish on top, pearly-gold-with-blue-sheen, subdorsal cones are big on T1, tiny T2, big T3, smaller A1 & A2, brown tiny subdorsal cones are giant on A3, tiny A4-7, brown tiny cones are above spiracles on A2-7 (slightly pearly on A2), a lateral cone on forewing has blackish top).

*Boloria frigga sagata* (B. & B.). 8 ovipositions were seen. Adults associated with shrub *Salix* (*S. planifolia* commonest, *veyeriana* and *monticola* common, *wolfii*, *brachycarpa* and *drummondiana* uncommon) in a willow-Betula glandulosa bog, only one *Viola labradorica* plant found, no Ericaceae seen in bog, Jefferson Creek, Park Co. Colo., June 7, 23, 1988; *S. planifolia* and other *Salix* are the probable hosts here. Oviposition 9:18 on underside of dead brown horizontal 4-mm-wide coarse marsh "grass" between *Salix planifolia* shrubs (*S. planifolia* shrubs 70 cm and 1 m away, *Seuon macrophyllum* seedling 15 cm away, *Salix trifidum brevipes* 40, 50, 60 cm away, *Betula glandulosa* 90 and 100 cm away), oviposition 9:55 on underside of green horizontal leaf of 4-mm-wide marsh "grass" on small mound beside creek, under *Salix planifolia* seedlings (*S. planifolia* 0-100 cm away, *Salix wolfii* 35-100 cm away, *Betula glandulosa* 20 cm onward, *Pentaphylloides floribunda* 25, *Sibbaldia procumbens* 90), preoviposition 9:50 marsh grass (*Salix wolfii* 60 cm away, *Sedum* 5 cm away, *Betula glandulosa* 20 cm away), preoviposition 9:54 on marsh grass clump beside creek, 10 cm from *Salix planifolia* seedlings, preoviposition 10:50 (I scared her away by getting too close) on marsh grass (*S. planifolia* 20 cm away), all willow bog S of Breckenridge, Summit Co. Colo., June 28, 1988. This willow bog had *Salix planifolia* very common, *S. wolfii* common in certain spots, *S. monticola* uncommon, *S. drummondiana* rare, *Betula glandulosa* common, *Viola* and *Polygonum* not seen. Ovipositions 9:45 one egg on underside of 4-mm-wide dead marsh "grass" blade, and the female crawled 2 cm away and oviposited 9:45 one egg on underside of dead marsh "grass" stem, both eggs under and among *Salix brachycarpa* seedlings (*S. brachycarpa* common nearby, one tiny *Salix monticola* seedling 5 cm away, *Betula glandulosa* 40, 80 cm away), oviposition 10:03 in litter under *Salix brachycarpa* seedlings (*S. brachycarpa* common nearby, *Salix monticola* seedling beside egg and another 10 cm away, *Salix wolfii* 45, 90 cm away, *Betula glandulosa* 5 and 25 cm away), oviposition 14:59 on bark hanging from 7-mm-wide dead horizontal twig 4 cm above ground (*Salix wolfii* common nearby from 8 cm [small plants] to meters away, *Salix brachycarpa* 75 cm and farther away, *Pentaphylloides floribunda* 10-40, 50 cm, *Salix trifidum* 2-50), preoviposition 10:47 beside *Salix brachycarpa* and *Salix monticola* seedlings, preoviposition 11:07 at base of *Salix brachycarpa* (common nearby) seedlings, preoviposition 13:08 under *Salix wolfii* 30-cm-tall plants (*S. wolfii* common nearby, *Pedicularis groenlandica* found there also), all N Alma, Park Co. Colo., July 1, 1988. This willow bog had *Salix brachycarpa* commonest, *Salix wolfii* and *Salix monticola* common in certain spots, *Salix planifolia* uncommon though common
In the wettest areas, *Betula glandulosa* somewhat common, while no *Viola* or *Ericaceae* were seen. Oviposition 12:58 one egg on underside of horizontal dead marsh "grass" leaf on moss mound about 1 m from creek and 2/3 m from *Betula glandulosa-Salix wolfii* bush (*Salix planifolia* seedlings 1.5 cm-1 m, *S. wolfii* 50 cm 1 m, *Betula glandulosa* one seedling 10 cm away, shrub 50-1 m, *Polygonum* (Bistorta) bistortoides 1-50 cm away, *Fragaria* (Sibbaldia procumbens?) 10 & 25 cm away, *Salix trifida* 20 cm away), preoviposition 12:57 bent abdomen on underside of dead blade of marsh "grass" between *Salix wolfii* and *Salix planifolia-Betula glandulosa* bushes (*S. planifolia* seedlings 5, 12, 8-1 m, *S. wolfii* 30-70, 50-1.5 m, *Betula glandulosa* 40, 1 m, Caribou, Boulder Co., Colo., July 5, 1988. Oviposition 10:10, she previously preoviposited at 10:09 by bending abdomen under a dead grass blade on a mound containing *Salix planifolia* seedlings (*S. planifolia* abundant 0-200 cm), then flew to a hummocky bog opening 4 X 10 m wide with lots of marsh "grass", and landed and laid an egg at 10:10 under dead horizontal grey grass blade 2 cm from a 10-cm-tall *Salix planifolia* seedling (*S. planifolia* seedlings very abundant 2-100, *Salix wolfii* far away 4-7 m), *Betula glandulosa* seedlings 35-90, bushes 15, 100, *Polygonum* (Bistorta viviparum 17, *Sibbaldia procumbens* 30, 30, 80, *Sedum* *Rhodanthemum* 35, 45, 45, 50, *Umbelliferae* sp. 27, 35, 55, *Thalictrum alpinum* 15, 65, 80, *Pentaphylloides floribunda* 55-70, 50, 100), Caribou bog, Boulder Co. Colo., July 2, 1989. The main hostplant at Caribou is *Salix planifolia*, which was the commonest willow, *Salix wolfii* was also fairly common, *Salix brachycarpa* and *Salix monticola* were rare; *Viola labradorica* was rare here. Adults occur in willow bogs consisting mostly of *Salix planifolia*, with a few *Salix brachycarpa* at the bog edge, Loveland Pass, Summit Co. Colo., many years’ data. Beaver dams are important for *frigga*, because females tend to oviposit near seeding *Salix* growing on filled-in areas of silted-up old beaver dams, silted-up oxbow ponds, and the inside of stream bends. Females roost (the wings aimed downward, the antennae angled to the side about 30° just posterior to the level of the hindwing costa) and rest on older *Salix* shrubs, but they oviposit only in litter near seeding *Salix* in the spaces between shrubs. Many larvae from S of Breckenridge were rearred and their lab food choice tested prior to 4th-stage diapause; various plants were simply added to the rearing jars and feeding damage noted. Larvae ate these plants well: *Salix* (*planifolia, brachycarpa, wolfii, monticola, bebbiana, ampygaelodes, exiawa*, Vaccinium myrtillus oreophilum, *S. scoparium*, *Polygonum viviparum*, P. bistortoides, Potentilla diversifolia, *Sibbaldia procumbens*. Larvae ate some *Viola labradorica*, some *Viola sororia affinis* (=nephrophylla), a little *Kalmia* (polifolia) microphylla. Larvae ate none of *Caltha* (Psychrophiila) leptosepala, *Anemone* (Anemoneastrum) narcissifolia zephyra, *Swertia perennis*, *Angelica grayi*, *Sedum* (Clementsia) rhodanthemum, *Epilobium saxifragum* (recently), *Veronica* (worskoldii) nutes, Pedicularis groenlandica, *Senecio* sp., *Eriogon ursinus*. I accept *Salix planifolia*, *Salix wolfii*, and *Salix brachycarpa* as main hostplants; *S. planifolia* is probably most commonly used because it is the commonest *Salix* in Colorado willow bogs. *Salix monticola* is undoubtedly an occasional hostplant and probably a main hostplant in some bogs, though it is local in distribution in most willow bogs and occurs also at lower altitudes along streams. There is no evidence to indicate that *B. frigga* shows any interest in *Betula*, which is absent in some *B. frigga* bogs, and larvae are not known to eat it. *Viola* and *Polygonum* are rare or absent near *B. frigga* in most bogs so they cannot be main hosts, and *Viola* is a poor lab food; *Polygonum* could be an occasional hostplant. *Vaccinium* might be an occasional host of wandering larvae, but it and *Potentilla* and *Sibbaldia* are not closely associated with *B. frigga* so cannot be main hostplants. Various published hostplants of *B. frigga* (*Betula, Andromeda, Rubus, Drays*) are probably just occasional hosts, although the arctic *B. frigga gibboni* B. & McD. could possibly differ in habits and eat Draya. There is strong evidence for *Salix* being the only main Colo. hostplant; adults frequently occur in willow bog areas having few plants except willow and marsh "grass". Eggs are laid singly, primarily on dead horizontal litter, usually of marsh "grass" (probably a sedge with 4-5 mm wide leaves). Unfed-4th-stage larvae hibernate. Early stages: EGG light-peak (light-orange-brown). FIRST STAGE LARVA mottled reddish-brown or brown, legs & prolegs paler; head black. 2ND STAGE LARVA brownish-black, prothorax tan, a middorsal black line edged by a cream line, scoli black with tan bases, a cream U-shaped crescent beneath each subdorsal scolus, a faint cream line at lower edge of supralateral scolii, a cream sinuous line under sublateral scoli; head black. 3RD STAGE LARVA brownish-black, a middorsal blackish line edged by faint whitish line, a cream U under each subdorsal scolus, a cream transverse dash between the tops of adjacent U's, two rows of faint whitish dashes under supralateral and sublateral scolii; head black. 4TH STAGE LARVA black, underside blackish-brown, a sinuous
white subdorsal band curves under scoli BSD (on T3-A7 this band contains a black spot), scoli black with ochre bases (BSD scoli ochre on basal 2/3) head black. MATURE LARVA black including legs & prolegs, a subdorsal white band from T1-A10 (the white band interrupted slightly on rear of T1); inside white band on T2-A8 a blackish-brown spot precedes a smaller blackish-brown transverse dash (the latter absent A7-8, both spot and dash absent A9-10), the white band short on A10, many scoli (on T1-A9 BSD scoli orangish-ochre on basal 2/3 with black setae, tip black with black setae; on A1-7 BSD scoli brown on basal half with black setae, black on distal half with black setae; on T1-3 & A8 & A10 BSD scoli dark-brown on basal half with black setae, black on distal half with black setae; on T1-A8 BL scoli black; on T1-A8 small black bump like BSD scoli); head black.

Boloria improba acrocneMa 6 & S. Ovipositions 10:35, 10:45, 11:30, 12:50 on stems of Salix reticulata nivalis, Uncompahgre Peak, Hinsdale Co. Colo., July 18, 1980. S. r. nivalis is more common than S. arctica in Colo., perhaps because the alpine zone is drier than in Wyo. Oviposition 11:01 on S. r. nivalis, and oviposition 11:15 on underside of leaf of Polygonum (Bistorta) viviparum, both Uncompahgre Peak, Hinsdale Co. Colo., Aug. 3, 1979. Eggs laid singly. In the lab, small larvae eat holes in leaves of S. arctica, S. babylonica, and several other species of Colo. shrub willows, while older larvae eat entire leaves (see Scott 1982 for the complete life history). Ssp. acrocneMa and harryi are obviously subspecies of improba because the hostplants are very similar, the habitats (tundra swales with dwarf-willow mats), low weak flight (perhaps slightly stronger in harryi), and most wing pattern and abdominal traits are the same (in overall appearance harryi resembles acrocneMa rather than arctic improba). Larvae of the two ssp. are very similar, and pupae are similar also though the shape of some abdomen spots differs slightly (Scott 1986b). Thus the main hosts are prostrate Salixi but Polygonum viviparum is probably an occasional host if larvae eat it. Larvae hibernate as unfed stage 1 and unfed stage 4 during the two winters of its biennial life cycle (some stage 1 but no stage 4 larvae develop without diapause in the lab). Pupae were noted to lie horizontal in a nest of leaves and stems loosely silked together. MATURE LARVA has a middorsal brown-tan band (edged below by a few white wiggles), next a blackish-brown band (the BD2 scoli are on the lower part of this blackish band), next a bright-cream subdorsal line runs just below BD2 scoli, next a wide blackish-brown band includes BSD scoli on its lower edge, a tan line runs along lower edge of BSD scoli (in one larva a weak cream line runs rearward from top and from the bottom edges of BSD scoli on T2-3), area along spiracles and beneath larva dark-brown or brown with tan dots around hairs (the area along BL scoli sometimes has slightly more pale dots), T1 below the whitish subdorsal band is mainly blackish-brown down to the legs, the BD2, BSD, and BL scoli are orange with black needles and tan base, a whitish subventral BSV bump has ~12 black needles; head blackish-brown, a slightly-paler (brown) spot is on the top of each temple and a similar spot is on base of frontoclypeus of some larvae. PUPA has a more-distinct pattern when young then when older, a subdorsal yellowish line is on young pupa but is only on intersegmental membrane in older pupa, wings mostly dark-brown, A5-7 each has a middorsal anterior saddlehorn bump with a long black triangular spot angling posterolaterally from it, a grayish triangular area is behind bump between the two triangular spots, a day before emergence is blackish-brown all over, with the grayer triangular area faint, the subdorsal cream line limited to the 3 movable intersegmental membranes, all these movable intersegmental membranes brown, wings blackish-brown but inside of cells of outer half of wing paler (slightly-blackish-brown).

Boloria freija browni (Higgins). Oviposition 14:39 on Vaccinium cespitosum, oviposition 9:40 on dead grass blade near Erigeron urainus seedling (larvae doubtfully eat this plant), oviposition 9:41 on Umbelliferae seedling with leaflets with minute dark-red mucronate tips (probably Conioselinum scopulorum, possibly Pseudocymopterus montanus or Liquieticum [filicinum var.] tenuifolium [larvae doubtfully eat this plant]), all three ovipositions near abundant V. cespitosum on lower slope at edge of Salix planifolia willow bog, larvae raised on V. cespitosum in the lab until diapause at about 4th stage, Caribou, Boulder.
B. freija is usually found on moist lower slopes at the edge of willow bogs or streams, in contrast to B. eumorpha and B. frigga which only occur inside (throughout) willow bogs.

Speyeria. The Colo. Speyeria can be divided into “wetland” species (including nakanosia, morcania, and atlantis) which usually oviposit near green violets, and “dryland” species (including aphrodite, callippe, edwardsii, and presumably coronis) which oviposit near green violets if present, but at drier sites that lack late summer green violets they oviposit under shrubs etc. where the violets have dried up for the year and will not sprout from dormant roots until the following spring; the dryland species in general may have a longer physiological delay from female emergence to egg laying. (Four unstudied species occur in W Colo.: S. hydeae (Bdv.) and eoleis (Behr) occupy conifer-aspen forest and are presumably wetland species; S. cybele (Fab.) occupies the same habitat and shady oak/Amalanchier thickets and may be a wetland species, and S. zerene (Bdv.) occupies the same habitats as cybele and mesic sagebrush and is perhaps a dryland species.)

Speyeria aphrodite aphrodite (Fab.) (= ethne Hemm.). Oviposition 10:40 under Cerocarpus montanus shrub, E end South Table Mtn., Jefferson Co. Colo., Aug. 28, 1980. Oviposition 11:40 under C. montanus shrub on dead twig, and oviposition or preoviposition under three other C. montanus shrubs, Green Mtn., Jefferson Co. Colo., Aug. 17, 1978. Ovipositions 11:30 and 11:32 among grass in low spots 1.6 m from C. montanus shrubs, Green Mtn., Jefferson Co. Colo., Sept. 6, 1983. Oviposition 11:36 on underside of tiny twig in litter among various plants (no Viola seen), oviposition 11:58 on underside of dead leaf in litter under C. montanus shrub (no violets seen), ovipositions 12:09 and 12:10 on underside of dead twigs in litter under Rhus aromatica trilobata bush (no violets seen), all Green Mtn., Jefferson Co. Colo., Aug. 19, 1984. Oviposition 11:50 in litter (near grasses, Artemisia, Liatris, and Linaria, but no Viola seen), and oviposition 11:29 under hillside C. montanus bush (grassess and cacti nearby but no Viola), Green Mtn., Sept. 5, 1985. Two ovipositions 10:42 on dead stems & twigs in litter in 3 cm wide hollow of flat Carex probably pensylvanica heliophila sward (some grasses and dead plants were nearby, but no Viola), Green Mtn., Sept. 7, 1985. Preoviposition by 2 females in shady 15 cm hollows among grass clumps on sloping flat, Green Mtn., Jefferson Co. Colo., Sept. 11, 1985. Oviposition 11:23 in shade on underside of horizontal stems in litter among Gutierrezia sarothrae, Thlaspi arvense, grass, and Artemisia ludoviciana, W Soda Lakes SE Morrison, Jefferson Co. Colo., Sept. 10, 1987. Oviposition 10:25 on underside of dead grass blade 5 cm from Viola adunca, oviposition 10:26 on underside of tiny twig 5 cm from V. adunca, oviposition 11:44 on underside of pine needle 10 cm from V. adunca, all Corwina Park, Jefferson Co. Colo., Aug. 17, 1984. Oviposition 12:52 on underside of dead grass blade in litter 20 cm from small V. adunca plant, oviposition 11:47 in litter with no violets near, Corwina Park, Aug. 27, 1984. Oviposition 11:05 on pine needle below V. adunca, O’Fallon Park, Jefferson Co. Colo., Aug. 12, 1985. At lower foothills localities (Green Mtn., South Table Mtn., Soda Lakes), no violets occurred near the eggs when the eggs were laid, but in the spring Viola nuttallii is very common under the shrubs (and is also common but patchy on open flat grassland where some eggs are laid) so is the presumed larval host. At localities above the lower foothills (Corwina & O’Fallon Parks) violets are green in late summer and females lay on or near them (mostly V. adunca evidently, rather than V. canadensis which grows along creeks and in shade). Thus females oviposit near green violets if present, but if dried up for the year (in the lower foothills) they usually oviposit under shrubs etc. where Viola nuttallii is likely to sprout the next spring. Females were seen mating as late as L Aug., but most mate in July-M Aug. and then delay laying eggs (reproductive diapause) until L Aug.-E Sep. in the foothills and adjacent plains of the Colo. Front Range, when they travel widely and oviposit. Unfed-1st-stage larvae hibernate.

Speyeria cybele charlottii (Barnes). Adults associated with Viola canadensis


Speyeria mormonia euryvyn (Edw.). Oviposition 14:20 on a twig near the ground between Rumex densiflorus and Potentilla platensis, no violets observed nearby, Keystone Gulch, Summit Co. Colo., Aug. 6-7-8, 1977. Oviposition 11:15 on Achillea lanulosa leaf 30 cm away from Potentilla sp., Salix sp., and Viola, Vail Pass, Summit Co. Colo., Aug. 22, 1977. Preoviposition 5 times in low spot near Vaccinium (perhaps searching for violets?), Loveland Pass, Summit Co. Colo., Aug. 5, 1985. Preoviposition or oviposition (no egg found) 10:16, she probab abdomen into litter next to Carex rupestris drumondiana & Geum (Acomastylis) rossii turbinata (Dryas octopetala hookeri) 3-100, Trifolium dasephyllum 5, 45, Salix reticulata nivalis 7-100, Salix arctica petraea 2-15, Potentilla diversifolia 30, 50, Polygonum (Bistorta) viviparum 4, 7, 15, Artemisia scopulorum 12, 15, 30, 40, Castilleja occidentalis 50); this proves nothing, other than that oviposit haphazardly; Loveland Pass, Clear Creek Co., Colo., July 19, 1985. By adult association, Viola labradorica is surely the main hostplant. Females seem to have little or no delay in egg-laying (reproductive diapause), though they tend to disperse when frosts come to the high mountains in late summer (I have found three females on the plains in L Aug.-E Sep.).

Speyeria callippe meadii (Edw.). Oviposition 13:00 under Cercocarpus montanus shrub on hill (Viola nuttallii was common under these same shrubs in spring 1979), Mt. Zion, Jefferson Co. Colo., July 11, 1978. Oviposition 12:50 on twig in shade beneath clump of Prunus (Padus) virginiana melanocarpa bushes, no violets seen, hilltop at Shingle Creek, Jefferson Co. Colo., July 23, 1984; V. nuttallii occurs at this site. Preoviposition 11:10 bent abdomen in litter under C. montanus bush, preoviposition 11:11 bent abdomen in litter under 25 cm tall Rosa bush, oviposition 11:20 3 cream eggs laid in dead litter in shade under combined Helianthus pumilus/Toxicodendron rydbergii bush on slope just S of hilltop, Mt. Zion, Jefferson Co. Colo., July 11, 1988; V. nuttallii must be the hostplant here. Females flutter around bushes and crawl into shady hollows, where they probe the abdomen down and forward or straight down to lay eggs. Viola nuttallii is surely the major host in the foothills, though other Viola may be used at higher altitude. Females have little or no reproductive diapause, and die before late summer. Unfed-1st-stage larvae hibernate.


Speyeria atlantis atlantis (Edw.) (=electa [Edw.]). Mature larva (reared to adult) found resting on lichen in low spot near creek, 50-150 cm away were Viola sororia affinis (=nephrophyllum) plants, N Fork Clear Creek, Gilpin Co. Colo., June 14, 1989. Preoviposition V. s. affinis (=nephrophyllum), N Fork Clear Creek, Gilpin Co. Colo., July 16, 1988. V. canadensis and V. aduncas are probably also hosts. Scott (1988a) describes early stages.


Speyeria coronis helycyna (Edw.). Adults can be found from late May until mid September; females diapause and evidently oviposit in late summer. By adult association, Viola nutallii must be a major host.

Speyeria edwardsii (Reak.). Oviposition 9:40 2 eggs on undersides of narrow dead stems in litter in shady 4 cm wide nook of grassland (various grasses nearby but no Viola), and oviposition 9:59 on undersides of dead stem in litter in 5 cm hollow of grassland (various grasses, Verbena, and Grindelia were nearby, but no Viola), both flat grassland at Green Mtn., Jefferson Co. Colo., Sept. 5, 1985; Viola nutallii occurs on the flat grassland where these eggs were laid, but is somewhat patchy in occurrence. Oviposition 13:03 on crook of tiny twig in litter (2 cm from Bouteloua gracilis, 2 cm from Gutierrezia sarothrae, 2 cm from dead Thlaspi arvense, many T. arvense tiny seedlings nearby), this spot was a 15-cm-wide area of slightly lower vegetation on a shaley gentle slope with no Viola in sight (and was not a shady nook under a shrub), Soda Lakes SE Morrison, Jefferson Co. Colo., Sept. 3, 1987. Oviposition 11:25 bent abdomen in litter then flew 3 m and laid egg under dead 1-mn-wide twig (no Viola seen though Viola nutallii is present at this site; Linum lewisii 5, 10, 15, 25, etc., Melilotus officinalis 5, 10, 35, etc., Aster ericoides 1, 3, 30, Gutierrezia sarothrae 10, 15, Carduus nutans 7, 30-100, Grindelia 25, Yucca 80, 100, Chrysanthemum nauseosus 3, 3); perhaps Linum is a host?; N Bear Creek Res., Jefferson Co. Colo., Sept. 9, 1981. Preoviposition 11:15 on flat she landed explored ground between grass ~20 times, Green Mtn., Jefferson Co. Colo., Sept. 17, 1991. Viola nutallii must be the hostplant at these sites; it appears only in spring and drops its leaves in early summer. Females evidently diapause and oviposit in late summer. Unfed-1st-stage larvae hibernate. EGG creaM, developing numerous small reddish spots so overall color is reddish-purplish-cream. 1ST-STAGE LARVA dull pale-orangish-yellow, seta bases brown, suranal plate and collar blackish; head black.


LYCAENIDAE
Riodininae

Melanis pronostriqa (identification based on plates in A. Seitz' Macrolepidoptera of the World, vol. 5). The hairy larvae were reared from leaves of Samanea saman (adults and larvae common on this tree), Puerto Asis, Colombia, Aug. 1976, and males patrol around the canopy of this host (and about nearby tops of buildings) from about 17:00 to dusk to seek females.


Apodenia nais nais (Edu.). Oviposition 14:23 on leaf just below inflorescence of Ceanothus fendleri in nature; in lab 18 eggs laid on leaves, 3 on twigs near leaves; near Smith Creek Cgd., June 28, 1977. Oviposition 12:10 on a lower branch of C. fendleri, near Smith Creek Cgd., Custer Co. Colo., July 5, 1973. Oviposition 9:00 on top of leaf next to inflorescence of C. fendleri, Mt. Zion, Jefferson Co. Colo., July 3, 1980. Three females from Mt. Zion, Jefferson Co. Colo., July 6 & 8, 1977, were placed in a plastic box with C. fendleri and Prunus (Padus) virginiensis melanocarpa, and 64 eggs were laid on C. fendleri flowers, 21 on C. fendleri leaves, none on P. v. melanocarpa; larvae were raised on C. fendleri until they hibernated half grown. Edwards (1888-1897) raised Arizona nais on Prunus, and Kendall (1976) reported Prunus as the host of A. nais chiosensis F. However, based on the above data and adult associations, only Ceanothus is used in Colo. Larvae live in a nest of leaves silked together.
**Lycaenini**

_Lycaena phlaeas polaris_ Cour. (= *arctodon* Ferr.). Adults assoc. _Oxvia diqyna_ at several sites in alpine zone of Wind River Mts., Fremont Co. Wyo., Aug. 11-14, 1983, where they occupy nooks in vegetated rockslides.

_Lycaena cupreus snowi_ (Edw.). Oviposition 11:00 on rock next to _Oxvia diqyna_ inflorescence, Hermit Pass, Custer Co. Colo., Aug. 1, 1971. Preoviposition 12:15 _O. diqyna_, Loveland Pass, Summit Co. Colo., July 22, 1988. Pupa with hole in abdomen found on underside of rock within several m of _O. diqyna_, Loveland Pass, Summit Co. Colo., July 26, 1989. Ovipositions 10:35, 10:40, she landed on rock almost touching _O. diqyna_ and laid 2 eggs 2 cm apart on rock just below rock overhang (she never landed on plant as she must have recognized host visually or olfactorily); 7 eggs and 6 eggshells found on rocks (just below the upper edge of rock or on the side of rock) that almost touch _O. diqyna_ Loveland Pass, Summit Co. Colo., Aug. 7, 1950. Adults of ssp. _snowi_ are associated with _O. diqyna_ in nooks of vegetated rockslides or cirques throughout alpine Colorado. In the alpine zone of Wyo.-Mont. this habitat is occupied by _L. phlaeas polaris_ also associated with _O. diqyna_. In N Utah-Wyo.-Mont. _L. cupreus artemisia_ Scott occurs at lower altitude in Canadian-Hudsonian Zone sagebrush and woods openings, where *Rumex* or _Polygonum_ must be the host. Larvae (from eggs laid by females from Loveland Pass, Summit Co. Colo., 1984, 1950) ate *Rumex* in lab, and larvae quit feeding when half-grown or somewhat larger, evidently indicating diapause (probably biennial, the two diapause stages uncertain). Early stages from Loveland Pass: EGG whitish-tan, turning white, camouflaged on the mottled rock (some lichen bumps resemble the eggs also). FIRST-STAGE LARVA cream-yellow, with long dark-brown setae, a brownish subsdorsal spot on each segment, pronotum brown. 2ND-STAGE LARVA tan due to brown hairs. 3RD-STAGE LARVA olive-green, heart-band brown edged by tan, lateral ridge tan, three oblique slightly-paler dashes (the uppermost palest) on each segment between top and side. NEARLY-NATUE LARVA dark-green or yellow-green, heart-band brownish-green (edged by yellowish-green on paler larvae), 2 faint narrow pale-green oblique dorsolateral dashes, lateral ridge slightly yellow-green on paler larvae, these markings all weak. PUPA light brown, a middorsal brown band on T1-3 (weak on A4), subdorsal brown areas on T2-3, a subdorsal brown dot on each abdomen egg, a subdorsal brown spot above fw base; length 11 mm.


under side of dead leaf, 3 eggs on underside of dead leaf, 1 egg on underside of dead leaf, all five leaves in litter under five Rumex triangulivalvis plants; 2 eggs on underside of dead leaf 30 cm from top of plant and 60 cm above ground of Polygonum pensylvanicum; P. coccineum is the commonest known host here, millions growing around the lake just below high water level, and adults are common on it here every year; all Barr Lake, Adams Co., Sept. 8, 1987. Preoviposition 12:48 P. coccineum, she crawls down stem, "60 adults assoc. P. coccineum, Barr Lake, Adams Co., Oct. 8, 1988. Two ovipositions 9:52, 9:52 on top of green leaf near top of plant, another egg found on top of green leaf, and 20 2nd-4th stage larvae and 1 prepupa found on green leaves (usually near leaf base, sometimes on stems) near top of plant, all on P. coccineum (W): females oviposit near top of plants at this site evidently because there was no litter where the plants grew in a slough, and the hosts stand in water after rains; larvae eat holes in leaves or eat leaf tip, pupae are attached by both cremaster and silk girdle; Salida, Chaffee Co. Colo., July 30, 1985. Adults associated with P. coccineum; Wheatridge, Jefferson Co. Colo., July 14, 1986. Adults associated with Polygonum probably coccineum, Battle Mountain, Lander Co. Nevada, Aug. 5, 1974. Adults associated with P. coccineum, Smith Lake, Sheridan Co. Neb., July 17, 1986. Adults associated with P. coccineum, Wheatridge, Jefferson Co. Colo., July 13, 15, 1988. Three yearly flights occur on the plains. Eggs hibernate. Early stages from Salida: EGG white. MATURE LARVA (half-grown larva similar) yellowish-green, with cream bases of the numerous pink setae, a middorsal green band edged by yellow-green, a subdorsal greenish-yellow sinuous line (dorsally convex on each segment) edged by tan-green, a very faint green sinuous band above spiracles, a lateral greenish-cream line, subventral & midventral areas translucent bluish-green; head dark brown. PUPA dark red, creamy-red, reddish-tan, light-reddish-tan, or reddish-yellow in different individuals, all have a middorsal tan to blackish band (weakest on top of T2), a subdorsal tan to blackish band (these bands blackish in the darker pupae), wing veins pale, blackish mottling above wing on T3-A1, the blackish mottling spread over most of pupa in two reddish-tan pupae (the wings sooty-brown in the darkest pupa), spiracles (strangely) on hills, cream, pupa attached by silk girdle and presumably cremaster.

**Lyscena holloides florae (Edw.)** (I treat castro Reak. as a synonym of holloides because most syntypes resemble very-orange holloides, castro lacks a specific type locality, and "first revisers" had treated it as a synonym of holloides; at best, castro is a holloides/florae intergrade population closer to holloides, and therefore is a synonym of holloides). Egg (identical to eggs dissected from female) found on trash base of Rumex densiflorus (W), Keystone Gulch, Summit Co. Colo., Aug. 6-7-8, 1977. Egg (identical to eggs dissected from female) found at base of stem of Rumex triangulivalvis, Fall River Reservoir, Clear Creek Co. Colo., Aug. 10, 1977. Oviposition 13:12 on dirt at base of Rumex acetosella ("Acetosella vulgaris"), oviposition 13:08 on tiny plant next to both R. acetosella and Polygonum arenastrum ("aviculare"), oviposition 13:35 on base of stem of P. arenastrum, all Toll Ranch, Gilpin Co. Colo., July 28, 1977. Oviposition 10:11 on grass blade next to Polygonum douglasii, Jim Creek Cgd., Grand Co. Colo., Aug. 9, 1977. Preovipositions 10:30, 11:10, 11:10 on P. douglasii, then oviposited 11:15 3 cm up on dead Poa pratensis leaf under canopy of Artemisia tridentata (P. douglasii common all around from 2-100 cm), Fraser, Grand Co., Colo., Aug. 5, 1991. R. acetosella, P. arenastrum, and P. douglasii are small plants usually growing on dirt-wound gopher diggings on deep soil of valley bottom forest clearings, while R. densiflorus and triangulivalvis are large. This ecotype/subspecies occurs as low as the Canadian Zone at Critchell 7765' in Jefferson Co. Colo. (to compare with the data of Scott 1979, the number of orange uph lunules on Critchell males is 0-1, 1-3, 2-13, 3-15, 4-10; and the amount of upf orange on females is A [none or a trace] 3-5, B [only postmedian spots] 3-7, C [postmedian band and some median spots orange] 6-6, D [postmedian band solid orange and median part of wing mostly orange] 6, E [mostly orange] 2, F [completely orange] 0; these frequencies have remained stable from 1978 to 1985). One generation per year; wherever in Colo. that temperature limits the species to one yearly flight, the florae ecotype occurs, in which adults vary in appearance from very dark to resembling holloides (Scott 1979); where two or three flights can occur, the holloides ecotype flies. The florae ecotype has nothing to do with Lyscena dorcas (Kirby), which eats Pentaphylloides floibunda=Potentilla fruticosa (Scott 1979). Eggs hibernate. EGG greenish-white when laid, turning white.

**Lyscena heteronea heteronea** (Bdv.). One egg on umbel-subtending bract of E. subalpinum (="E. umbellatum var. major"; E. subalpinum and E. umbellatum are sympatric and do not interbreed throughout much of Colo.), Toll Ranch, Gilpin Co. Colo., July 30, 1977. Mature larva found dead (attacked by ant) on

*Lycaena rubidus rubidus* (Behr) (includes form *sirius* [Edw.]). Ovipositions 12:30 (1 egg on chip of wood), 12:30 (1 egg on 3 cm tall plant similar to *Thalictrum*) within 10 cm of *Rumex tranquillivalvis* (W), Toll Ranch, Gilpin Co. Colo., July 28, 1977. Oviposition 11:30 on trash at base, oviposition 11:50 on twig at base, both on *R. tranquillivalvis* (W), Toll Ranch, July 30, 1977. Oviposition 12:20 on twig at base, oviposition 12:30 on dead leaf at base, both on *R. tranquillivalvis* (W), West Chicago Creek, Clear Creek Co. Colo., July 31, 1977. Oviposition 12:21 on underside of litter under *R. tranquillivalvis*, and at 12:40 a female flew up from underneath *Rumex crispus* (no egg found), N Fork Clear Creek, Gilpin Co. Colo., Aug. 10, 1987. Ovipositions 11:05, 11:09, 11:14, female crawled 20 cm down stem of small *R. tranquillivalvis* and placed eggs near plant base beneath narrow stems in litter, Silverton, San Juan Co., Colo. Aug. 10, 1991. Two eggs laid 12:30 on dirt at base, and 45 eggs found on trash at base (eggs identical to eggs dissected from females), all at base of *Rumex densiflorus* (W), Keystone Gulch, Summit Co. Colo., Aug. 6-7-8, 1977. Egg found on twig at base of *Rumex aquaticus occidentalis* (W), E Idaho Springs, Clear Creek Co. Colo., Aug. 10, 1977. Five eggs found at base of *R. a. occidentalis* (W), N of Idledale, Jefferson Co. Colo., Aug. 21, 1977. Oviposition or preovip. 12:10 she probed many times with abdomen and 2 eggs found under plant, 4 eggs found under nearby plant, all on *R. a. occidentalis*, Fraser, Grand Co. Colo., Aug. 5, 1991. Egg found at base of *R. crispus*, N of Idledale, Jefferson Co. Colo., Aug. 21, 1977 (eggs from last three sites identical to eggs dissected from females—*L. xanthoides* and *L. helioides* eggs can be easily separated from those of *rubidus*). Oviposition, female crawled 20 cm down stem of *Polygongum douglasii* 3X at 12:14, basked, then crawled down *P. douglasii* and nearby plants, crawled around in litter and at 12:30 laid up to 4 eggs in litter (I found only 2 of them, 1 cm from *P. douglasii* base); 2 preovipositions 11:55 *P. douglasii*, Fraser, Grand Co. Colo., Aug. 1, 1939. Elsewhere in *Colo.*, adults are associated with *Rumex venosus* on the northeastern plains in Weld Co., with *Polygongum coccineum* (=*P. amphibium* var. *amersum*) at Elbert, Elbert Co., July 3, 1978, and with *Rumex aquaticus occidentalis*, *densiflorus*, and *uthensis* at various mountain sites. The typical habitat is near a creek. The large-leaved Polygonaceae may be preferred to the small-leaved, but both are chosen without much preference. Eggs hibernate. E66 greenish-white when laid, becoming white.

*Lycaena xanthoides dione* Scud. Oviposition two eggs 12:30 on debris at base of *Rumex tranquillivalvis*, Red Rocks, Jefferson Co. Colo., July 12, 1973. Two eggs (compared to eggs dissected from female) found at base of *Rumex aquaticus occidentalis* (W); three eggs (compared to eggs dissected from female) found at base of *Rumex crispus*; N of Idledale, Jefferson Co. Colo., Aug. 21, 1977. Males and females seen in meadow with 3-4 *Rumex crispus* and '200 *Polygongum coccineum* (=*P. amphibium* var. *amersum*); Wheatridge, Jefferson Co. Colo., July 14, Aug. 6, 1990. Adults do not occur on the vast *P. coccineum* stands at Barr Lake, Adams Co., Colo., that are submerged in spring, so they may not be a host, or the eggs may not survive submergence. Eggs hibernate. E66 white (no doubt greenish-white when laid).

Oviposition 12:07 on dead leaf next to R. acetosella, Jim Creek, Grand Co. Colo., Aug. 9, 1977. Oviposition 11:30, she landed on R. acetosella 2 cm from Polygonum douglasii and crawled down to ground and laid egg on litter bit near base of 3-cm-tall Fragaria virginiana glauca (egg was 5 mm from fairly large R. acetosella plant without inflorescence, and 2 cm, 4, 7, 8, 9, 9 cm from other R. acetosella, egg 5 mm from mostly-eaten P. douglasii, and 4 cm, 6, 7, 8, 11 cm from other P. douglasii); oviposition 11:31, the same female then laid an egg on litter bit at base of sedge (egg 2, 4, 4, 8, 10, 14 cm from R. acetosella, 4, 6, 7, 7, 10 cm from P. douglasii): both eggs were 10-15 cm from flowering R. acetosella and 10-15 cm from flowering P. douglasii; oviposition 11:58, she landed on R. acetosella and crawled down plant 2X and then crawled 9 cm toward base of small sagebrush and laid 3 eggs on litter about 3-4 cm from each other (1 on a 3-cm-long twig, 1 on a 0.3-mm X 2-mm twig, 1 on seedling Fragaria virginiana glauca stem) among 3 P. douglasii plants (5, 6, 7, 8, 10, 15 cm from P. douglasii, 9, 10, 10 cm from R. acetosella); Fraser, Grand Co. Colo., Aug. 2, 1950. Female seen at Polygonum douglasii patch, Fraser, Grand Co. Colo., Aug. 1, 1950. The small ssp. editha would seem to be adapted to small hostplants, the large ssp. dione and xanthoides to the larger Rumex. Yet both R. acetosella and P. douglasii are hostplants, and females definitely seem to prefer the introduced R. acetosella to the native P. douglasii, evidently because the former has much larger leaves. Eggs hibernate.

Eggs hibernate. Egg greenish-white when laid, becoming white.


Eunaeini


Satyrium (Harkenclenius) titus titus (Fab.). Female landed on leaf of Prunus americana shrub and crawled down stem to ground and oviposited in litter 8 cm from stem, Chinney Gulch, Jefferson Co. Colo., July 10, 1978. About 100 adults seen in a 10-m X 10-m area on pure stand of Prunus (Pawda) virginiana melanocarpa growing on sand, just E of Sand Dunes, Medano Creek, Alamosa Co. Colo., Aug. 1, 1978. Female landed on leaf at tip of 40-cm-tall seedling of P. v. melanocarpa (Prunus [Cerasus] pensylvanica was 20 m away also, but seedling was probably P. v. melanocarpa) and then walked down stem to base and laid 5 eggs in cluster on rock at 10:00, the eggs merely glued on (not in a copious mass of glue), Tucker Gulch, Jefferson Co. Colo., July 30, 1987. Female rested on young P. v. melanocarpa then flew to another, Tinytown, Jefferson Co. Colo., Sept. 4, 1991. The usual larval host is P. v. melanocarpa, based on adult association. The habit of crawling down the host stem to oviposit on trash at the base occurs also in Satyrium fuliginosum, host Lycana, and Plebeius melissa. Eggs hibernate.

Satyrium (Fixsenia) favonius autolycus (Edw.) (=viola S. & T.). Adults associated with Quercus gambelii (normal-leaf var. gambelii and shallowly-lobed-leaf var. undulata which may be a hybrid between Q. gambelii and Quercus grisea), Cottonwood Creek, Baca Co. Colo., July 3, 1973.

Satyrium californica (Edw.). Oviposition 10:30 3 eggs laid in glued cluster at base of leaf petiole of Prunus (Pawda) virginiana melanocarpa; oviposition
S. oviposition: they can place eggs that are depressed on twig, oviposition 10:15 2 eggs glued in crevice at joint of stem, oviposition 10:15 2 eggs glued in depressed scar on twig, oviposition 10:45 3 eggs glued in hole in twig, all on Cerocarpus montanus; Lookout Mtn., Jefferson Co. Colo., July 8, 1977. Two females crawled over twigs of C. montanus for 90 minutes searching for oviposition sites, Genesee Mtn., Jefferson Co. Colo., Aug. 1, 1984. 3 egg clusters of 5, 4, and 1 eggs per cluster (each cluster cemented in crevice with clear copious glue) found in healed crevices on twigs of C. montanus, Genesee Mtn., Jefferson Co. Colo., Aug. 8, 1984. Adults associated with Purshia tridentata; SSW Hot Sulfur Springs, Genesee Mtn., Jefferson Co. Colo., July 4, 1980. Female crawled on and probed P. tridentata branches 12:57-13:32, outer branches first, and finally ended up near base of bush and laid 5 eggs 13:33 (oviposition took 80 sec.) on branch under strip of loose bark 7 mm wide beneath 5-mm-wide horizontal branch "7 cm above ground, covering eggs was a transparent curtain of glue secreted by female; 5 eggshells found on bark of 5-mm-wide branch of P. tridentata halfway from tip of branch to base; 3 previpositions 10:30-11:15 crawling down P. tridentata branches and probing; SSW Hot Sulfur Springs, Genesee Mtn., Jefferson Co. Colo., July 11, 1980. Evidently somewhat polyphagous on a variety of shrubs and small trees. Females (oddly) glue eggs in clusters (averaging 3.7 eggs) with a very copious clear glue, such that some eggs appear completely immersed in the glue, but the glue actually forms a thin film covering them, a "glue window". The film evidently provides protection against ants and desiccation. Obviously phylogenetically close to S. acadica, because of similarity of egg sculpturing, placement of eggs in holes, glue window, late-afternoon-early evening mating time, and presence of orange cap on bluish unh spot. Eggs hibernate. EGG whitish-green, becoming slightly-grayish white, with numerous small hills each forming the hub of a spokelike set of 5-6 ridges, the hills narrower than those of S. acadica, micropylar crater very shallow. 

SatyriuM acadica (Edw.). Oviposition Salix exigua twig, Canon City, Fremont Co. Colo., July 10, 1970. 4 ovipositions by one female watched from 12:05 to 13:03: she crawled down stems of S. exigua saplings, then landed on sapling 2.5 m tall, crawled 1 m down and at 12:17 laid 3 eggs into hole 1.7 mm wide (the scar where a twig broke off) on 11-mm-wide trunk and applied a glue window in hole covering eggs flush with top of outer egg; she then landed on S. exigua leaf and crawled 1 m down trunk and crawled onto a touching Salix lucida lasiandra branch of tree and probed abdomen 10 min. but was then scared away by ants, she crawled down a 1-m-high S. exigua sapling to its base in the grass, where she crawled around the 1-cm-wide trunk probing abdomen, then crawled up a little & bashed; she flew to another 2.5-m-tall S. exigua, crawled down it "1 m and laid 3 eggs at 12:45 (plus a narrow glue window around upper egg) into a hole 0.7 mm wide on 6-mm-wide trunk (the hole an exit hole made by some stem-boring bug) 4 mm below old twig base scar; she crawled 5 cm farther down trunk and laid one egg at 12:46 into hole 0.6 mm wide (exit hole of wood-boring bug) on 7-mm-wide trunk (a very narrow glue window was around one side of egg); she flew then crawled down two 1.5-mm-tall S. exigua saplings to ground and crawled around base of trunk in grass, crawled up and flew at 13:00 she crawled down 2-m-tall sapling to 70 cm below tip and laid 5 eggs into a hole-crack 1.1 X 0.3 mm wide (in middle portion of crack "4 mm long) on a 5-mm-wide branch (she made a glue window covering about half of the area of the first several eggs that were visible from outside the twig)(the crack led into an internal chamber made by a twig boring bug, which was filled with frass at one end and had a dead aphid at other end), she probed abdomen at a spot 4 cm farther down trunk, then flew up to 4-m-tall S. exigua and disappeared; Wheatridge, Jefferson Co. Colo., July 24, 1980. The female covers much of her eggs with a glue window as does SatyriuM californica. Three of the egg holes were formed by some unknown tiny stem-boring insect and all three were packed with frass in the lower part of the internal chamber. Females display amazing physical dexterity during oviposition: they can place eggs that are 0.6 mm in diameter into holes only 0.6 mm in diameter, obviously by compressing the egg during its exit from the abdomen, and it takes the female only "45 sec. to lay 3 eggs; the last oviposition also involved placing 4 of 6 eggs in the cavity ABOVE the level of the exit hole, proving that the extended ovipositor can be curved while the eggs are compressed and laid. Lab females lay eggs into holes in twigs. Associated with S. exigua in the rest of Colo. (Yuma, Jefferson Cos.) also, so evidently monophagous. Eggs hibernate. EGG purplish-brown when laid, the areas exposed to air (not covered by glue) becoming tan within 8 hours, whole egg becoming tan-white, covered with numerous small hills each forming the hub of a set of 5-6 ridges, micropylar crater fairly shallow with rim (rim red-brown when young). 

SatyriuM sylvinus sylvinus (Bdv.). Oviposition on twig of Salix exigua, Mirage, Saguache Co. Colo., Aug. 9, 1970. 2 eggs found on fork of a 7-mm-wide S. exigua stem beside (just above) a 10-cm-long branch of 15 leaves, eggs 60-cm
Satyrius liparops (Lec.). One egg (compared with eggs dissected from female) found on Prunus (Padus) virginiana melanocarpa twig, preoviposition on P. v. melanocarpa twigs (note: **Acer pseudopendunculatum**, a hostplant I reported in *J. Lepid. Soc.* 22:159 and 1966 Lepidopterists' News #3 at this site, is erroneous); Lakewood, Jefferson Co. Colo., July 9, 1977. Female crawled down *Prunus americana* twigs 9:50-10:06, then crawled on a leaf some then crawled 4-5 cm toward base of horizontal stem and oviposited 10:13 on underside of 2-mm-wide *P. americana* red-brown twig just distal to a 4-leaf twiglet with 1-mm-wide stem, 14 cm from end of last leaf of branch, *40 cm* above ground; the same female flew 5 m W to a *P. v. melanocarpa* bush, landed on leaf and crawled *30 cm* down twig probing the twig with ovipositor, laid egg 10:45 into a 2-mm-deep crevice made by bark splitting away from a side twig, on vertical gray trunk *12 mm* wide, *60 cm* above ground and *10 cm* basal to leaves; the same female landed on *P. v. melanocarpa* leaves and crawled down twig probing abdomen mostly at joints of twigs, and laid egg 10:49 on 3-mm-wide reddish-brown vertical twig just above and in a joint with a side twig *1.5 mm* wide (2 cm below an inflorescence peduncle, *60 cm* above ground) *20 cm* from branch tip); a second female landed on leaf of a **50-cm-tall P. americana** plant and crawled down twig probing often until she got just *2 cm* above ground plants *15 cm* above ground and laid egg 11:58 in crevice 1 mm deep consisting of peeled bark that stuck out *1 mm* from side of gray trunk *8 mm* wide, *2 mm* below a gray 3-mm-wide side branch; preovip. 10:22 *P. americana*; all eggs laid in full or partial shade Falcon County Park, Jefferson Co. Colo., July 10, 1990. Eggshell found in crotch of 4-mm- and 3-mm-wide stems *30 cm* into canopy of *Crataegus occidentalis* (macracantha) var. *occidentalis* tree *2.7 m* tall (egg sculpturing identical to known *liparops*); Falcon County Park, Jefferson Co. Colo., July 30, 1990. Eggs hibernate. EGGS dull dark-brownish-red with numerous long sharp spines from entire surface, micropyle pit surrounded by *15 wide villi-shaped projections that extend farther than the spines.*

Satyrius celenus falacer (God.). Adults associated with *Quercus gambelii* in Jefferson, El Paso, Fremont, Custer, Saguache, Routt, Delta, and Garfield Cos. Colo., and Colfax Co. New Mex. However, two adults were found not near *Q. gambelii*: an adult in Lakewood, Jefferson Co. Colo., and several adults in Golden Gate Can., Jefferson Co. Colo., where perhaps *Prunus* (Padus) virginiana melanocarpa was eaten, or immigration occurred.

Satyrius celenus albidus Scott. Adults associated with *Quercus gambelii* in Routt, Delta, and Garfield Cos. Colo.

Satyrius auretorum (Bdv.). Oviposition *Quercus* sp. (live oak, leaves similar to those of *Q. chrysolepis* and others), Cascade Fall, Yosemite, Calif., July 8, 1964.


Satyrion fuliginosum (Edw.). Oviposition on lower stems of Lupinus andersonii (Ha), females walk down the host stem and lay on stems or trash near the base, Sonora Pass, Mono Co. Calif., July 12, 1974. Oviposition near base of Lupinus meionanthus (Ha), Carson Pass, Alpine Co. Calif., July 20, 1974. Oviposition 10:15, she landed on Artemisia and fluttered short distances of 1/4 m from plant to plant, then landed on Lupinus prunophilus (formerly a ssp. of L. armmophilus) and crawled 20 cm down stem and laid 2 eggs, one on top of the other, on side of a 3-mm-wide stem 2-3 cm above ground, then she fluttered from plant to plant again and at 10:20 landed on another L. prunophilus and crawled down stem and crawled on litter under plant for 2-3 cm and bent abdomen straight down into a hole in litter 4 mm (the abdomen remained still for several seconds so I think an egg was laid, but I searched through the litter and could not find the egg; however from past experience, eggs laid into litter by Plebeius melissa and Speyeria etc., or dropped into litter by Cerconia, are very difficult to find), SSW Hot Sulfur Springs, Grand Co. Colo., June 30, 1988. Adults associated with L. prunophilus (a few Lupinus caudatus also present), SSW Hot Sulfur Springs, Grand Co. Colo., June 24, 28, 1988. Oviposition 13:40-13:58 L. prunophilus, I scared her up from one L. prunophilus plant and she fluttered weakly to another and crawled down it but was in sun so fluttered to a third plant, crawled down one leaf and got stuck on a cuplike 2nd leaf but after much turning crawled over it and down stem to litter below SSE base of plant, probed abdomen straight down for 2 minutes, moved 3 cm to SE and probed litter 1 min., then crawled 1 cm N and probed litter 1-2 min; 4 eggs were later found in the litter (other eggs could have been missed in the tedious search), in 2 clusters of 2 eggs each, eggs were just laid into holes in litter and not attached to twigs; larvae are probably associated with ants, because "20 ant head capsules were found in litter searched for these eggs", and "20 5-7-mm-long vicious-biting red ants swarmed up out of the litter at the base of this plant when I collected the litter, and all the nearby plants also had ant nests (ants were common near 1989 eggs also); SSW Hot Sulfur Springs, Grand Co. Colo., July 4, 1988. Assoc. with L. caudatus (previously misidentified as L. argenteus), 1 mi. N Dillon, Summit Co. Colo., July 15, 1985. Adults associated with L. caudatus, NE Hayden, Routt Co. Colo., July 6, 1989. Eggs hibernate. EGG pale whitish-blush-green with a tinge of tan, no micropylar crater, microscopically appearing like fresh-snow polygonal "mounds" ("mounds" actually the valleys between the ridges), each mound surrounded by a "slushy-ice" blue-green ring (the ridges and translucent knoblike narrow pillars occur on these darker rings, each pillar at the center of 5-6 radiating ridges). Other eggs tan, with each pillar forming the hub of 5-6 low ridges like spokes of a wheel; these eggs seem to owe their different appearance to the darker tan cuticle, which makes the pillars look wider, making the ridges slightly visible, and turns the "snow" valleys into tan flats. Blue-green may be the color of newly-laid eggs (persisting in the lab due to the death of the eggs?), tan the color of older eggs.

Callophrys groehner eryphon (Edw.). Adults assoc. with Pinus ponderosa var. scopulorum in most of Colorado, including Boulder, Jefferson, and Custer Co., where it is undoubtedly the larval host, and some sites in Pueblo and Fremont Co.; but in Fremont and Saguache Counties Pinus edulis Engelm is the only conifer at many localities where it must be the host.


Callophrys augustinus augustinus (Westwood). Adults are ssp. augustinus in C

Adults assoc. with A. u. adenotricha throughout the Colorado mountains east of the continental divide. In the lab, females from Indian Creek Cgd., Douglas Co. Colo., June 3-6, 1973 laid many eggs on A. u. adenotricha flowers near the pedicel (only one egg was laid on a leaf, next to a flower). C. augustinus larvae evidently eat flowers and growing fruits (J. Cook, Can. Ent. 38:214, also found that larvae first eat flowers, then feed on fruits, then mature larvae prefer leaves), whereas C. pollesi larvae evidently eat young leaves. Eggs laid singly. EGG light green.

Callophrys augustinus iroides (Bdv.). In SW Colo.-W N.M. adults are NOT associated with A. uva-ursi adenotricha. Adults common on Amelanchier sp. (though several were nectaring on its flowers thus it might not be a host), Gobernador Can., Rio Arriba Co. N. M., May 10, 1983. Adults associated with shrub Arctostaphylos, Creel, Chihuahua, Mex., March 30-31, 1969. SW Colo.-Mexico populations are possibly somewhat polyphagous as in Calif.


Callophrys gryneus nelsoni (Bdv.). The usual host is Calocedrus decurrens, so it is interesting that on top of the Sierra Nevada at Loon Lake, El Dorado Co. Calif., June 9, 1974, adults were common resting and flying about Juniperus occidentalis, the only species of Gymnosperm present and undoubtedly the host plant. Adults of this population have the white unh median line usually weak, and thus are typical nelsoni; eastward below the Sierras in Calif._Nev., Callophrys gryneus chalcosiva (Clench) has a strong white unh median line and also eats Juniperus.


Callophrys gryneus siva-gryneus. Adults associated with Juniperus, Gothenburg, Dawson Co. Neb., June 7, 1990, June 15, 1991. Adults here are intergrades where the two ssp. meet and interbreed; many resemble siva, some resemble gryneus, and some lack the unh postbasal bar of gryneus but have the kinked postmedian line of gryneus; the postbasal bar is evidently inherited in a dominant/recessive fashion because it is either present or absent.

Oviposition 10:54 between C. fendleri bract and inflorescences, Tinytown, Jefferson Co. Colo., June 11, 1982. Oviposition 11:25, 11:30, 11:35 and 1 egg found, all tucked inside red-edged bracts of young 5-mm-long C. fendleri inflorescences, Tinytown, Jefferson Co. Colo., May 21, 1982. Ovipositions 11:11, 11:57, 11:58, 12:00, and 1 other egg found, all eggs tucked out of sight between bract and flower bud of C. fendleri, eggshell found on flower bud near a first-stage larva whose head AND PROTHORAX were inserted into flower bud of Ceanothus herbaceus, Ralston Buttes, Jefferson Co. Colo., May 29, 1988. Oviposition 9:30 and preoviposition 9:32 on Eriogonum umbellatum var. umbellatum flower buds, Crawford Hill, Tucker Gulch, Jefferson Co. Colo., June 18, 1989. Preoviposition 12:00 on E. u. var. umbellatum flowers, Apex County Park, June 23, 1980. Oviposition 11:28 on flower bud of E. u. var. umbellatum (W), Chimney Gulch, Jefferson Co. Colo., June 28, 1978. Ovipositions 11:51, 11:52, 11:53, 11:56, tucked deep between unopened E. u. var. umbellatum flower buds, Van Bibber Creek, Jefferson Co. Colo., June 13, 1989. Female seen resting on Eriogonum jamesii var. flavescens flower buds, but no eggs found, Coal Creek, Jefferson Co. Colo., July 16, 1991. Lab larvae eat C. fendleri flower buds (but not the old hard fruits), eat E. u. var. umbellatum flower buds and occasionally leaves if buds are unavailable, and eat E. subalpinum (=umbellatum var. major) leaves when buds are unavailable. It is clear that both C. fendleri and E. u. ver. umbellatum are hosts in nature (thus populations occur at some sites where C. fendleri is absent), even at the same site, and females seem to prefer to oviposit on whichever plant happens to be in the proper young flower bud stage. Many larvae were raised to pupae and adults in the lab. Pupae hibernate. Early stages (Tucker Gulch): EGG light bluish-green. FIRST-STAGE LARVA greenish-cream, prothorax cream; head orange-brown. MATURE LARVAE vary from green to red, but all have conspicuous subdorsal ridges edged medially by dark ground color, a lateral pale band edged above by dark ground color. These larval variants were found: 1) Mature larva green, subdorsal ridges pink (cream edged by reddish), lateral ridge pinkish-cream, a light-green oblique subdorsal dash; 2) Mature larva green, middorsal band reddish-tan, subdorsal ridges red, lateral ridge red, an oblique dark-red subdorsal dash; 3) Mature larva red, the subdorsal ridges edged medially by dark-red, an oblique pink dash extending ventroposteriad of anterior end of each subdorsal ridge, area between subdorsal & lateral ridges reddish-green on A3-6, a dark-red line just above red lateral ridge; 4) Mature larva red, a cream lateral line, a cream subdorsal oblique dash. PUPAE also vary (pupa #1 came from larval type #1 I think, and the other color phases may also correspond to larval phases somewhat): 1) pupa pinkish-cream, head & thorax with a green tint, wings green, the posterior edge of T1-t3-A1-5 & edge of wing all red (including 2 short red oblique subdorsal offshoots of red edge behind segments A1-5), a middorsal slightly darker band; 2) pupa ochre-red, thorax & wings yellow-brown, with a few blackish spots on dorsal part of wing case, small black subdorsal & middorsal abdomen spots; 3) pupa dark-red, wings dark-red-brown, with black spots on dorsal part of wing case, some black middorsal & subdorsal abdomen spots; 4) pupa red-brown, thorax & wings dark-red-brown, with black spots on dorsal part of wing case, some black middorsal & subdorsal abdomen spots.

Callophrys sheridanii sheridanii (Carp.). Oviposition 9:35 on top of tiny young 4 mm leaf in center of Eriogonum umbellatum var. umbellatum, Mt. Zion, Jefferson Co. Colo., April 30, 1988. Oviposition 10:59 on top of leaf blade next to new growth, oviposition 10:59 on side of petiole of young newly-grown leaf, oviposition 11:02 on top of petiole of young leaf next to new growth (all 3 ovips. by one female); oviposition 11:19 on top of new leaf blade next to new growth, oviposition 11:20 on tiny new leaf buds (both ovips. by one female); all in center of E. u. var. umbellatum plants; ovipositing females flutter slowly and land on plants resembling E. u. var. umbellatum, often on Heterotheca villosa; Indian Peak, Jefferson Co. Colo., April 21, 1989. Oviposition 13:10 underside of young leaf blade next to very young partly-expanded E. u. var. umbellatum leaves, she then landed on "4 E. u. var. umbellatum plants, then flew over 3 Eriogonum jamesii var. flavescens plants without landing on them, Green Mtn., Jefferson Co. Colo., April 24, 1988. Adults (large variety) assoc. with Eriogonum jamesii var. wootenii (W), Cloudcroft, Otero Co. New Mex., April 21, 1972. EGG light green. FIRST-STAGE LARVA light yellow, prothorax grayish-yellow; head chitin-brown.


FIRST-STAGE LARVA light orangish-yellow; head chitin-brown. MATURE LARVAE are incredibly variable in color (Table 3), but all have a narrow middorsal line edged by darker dashes, two oblique paler subdorsal dashes (the upper shorter) aimed posterolaterally (between these two obliques is the lower part of a paler check mark; the shorter upper part of the check is horizontal), and a row of lateral dashes edged by darker color.

Table 3. Mature larvae of Colo. Strymon melinus.

<table>
<thead>
<tr>
<th>Overall Color</th>
<th>Ground Color</th>
<th>Mid-dorsal Line</th>
<th>Edge of Middorsal Line</th>
<th>Obliques</th>
<th>Lateral Dashes</th>
<th>Edge of Lateral Dashes</th>
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<td></td>
</tr>
<tr>
<td>marks</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>dark-green</td>
<td>yellow</td>
<td>dark-green</td>
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</tr>
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<td>green</td>
<td>dark-green</td>
<td>green edging</td>
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<td>green</td>
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<tr>
<td>yellow-green</td>
<td></td>
<td></td>
<td>lower arm of yellow-green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>marks</td>
<td></td>
<td></td>
<td>check-mark</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>maroon</td>
<td>tan</td>
<td>maroon</td>
<td>white patch</td>
<td>with pink center</td>
<td></td>
</tr>
<tr>
<td>white marks</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>greenish-tan</td>
<td>red-brown</td>
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<td>red-brown</td>
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<tr>
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<tr>
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<td>red</td>
<td>whittish-pink</td>
<td>red</td>
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<tr>
<td>white and red marks</td>
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<td>lower arm of pinkish white</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>crimson with</td>
<td>crimson</td>
<td>pink</td>
<td>crimson</td>
<td>red edges</td>
<td>pink</td>
<td></td>
</tr>
<tr>
<td>pinkish-white marks</td>
<td></td>
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</table>

Everes conyntas (God.). Ovipositions 14:00, 14:09, 14:11 Trifolium repens flowers, 10 mi. E of Colorado Springs, El Paso Co. Colo., Sept. 8, 1971. Ovipositions 11:30, 12:09 T. repens calyx, N Idledale, Jefferson Co. Colo., Aug. 21, 1977. Oviposition 13:38 T. repens leaf, Comanche Creek E of Kiowa, Elbert Co. Colo., Aug. 11, 1978. Adults associated with T. repens, NE Conger, Freeborn Co., Minn. June 16-18, 1988, June 19, 1987. 1 larva (much different from H. isola in appearance) found in papyri Trifolium fragiferum seed heads picked and placed into boxes, ate flowers/fruits and bored into green seeds inside the brown pappery calyx, reared to adult, Barr Lake, Adams Co. Colo., Sept. 28, 1987. Oviposition 14:58 on brown petal on underside of ball head, female bent abdomen in flowers 14:50, 14:55, all on Trifolium hybridum, NE Alden, Freeborn Co., Minn., June 23, 1991. Oviposition 12:04 on side of stem 1 cm from branch tip, oviposition 12:05 on outside base of 2 mm long bract at base of immature inflorescence, both on Lotus corniculatus, east stop 1 mi NE Underwood, Pottawattamie Co. Iowa, May 30, 1989. T. repens is probably the main Colo. host based on its abundance and the fact that adults occur only along creeks or wet swales on the plains and lower foothills in Colo. (E. conyntas is sympatric with E. amynuta at Hardscrapble Can. in Custer Co., and Tucker Gulch, gulch N Idledale, and gulch NE end Green Mtn., all in Jefferson Co., whereas amynuta occurs on drier slopes gulches etc. in the mountains.) Eggs are laid on flowers, so larvae probably usually eat flowers/fruits, less often leaves. EGG: (Colo. & Iowa) whitish-green. 1ST-STAGE LARVA yellowish-green; head black. Mature larva/pupa (Barr Lake): MATURE LARVA maroon with lighter bands and a slight frosting of pale points, a middorsal dark-brown band (formed of minute black points), two gray slightly-oblique (sloping rearward on each segment) subdorsal bands (the upper wider) with a diffuse gray anterior spot below the lower oblique band, a paler (gray) lateral band; prepupa turning green with reddish-brown top with markings). PUPA wings translucent-light-olive-green, abdomen tan, top of thorax greenish-brown, a brown middorsal band (narrow on thorax, on abdomen interrupted between segments), a weak diffuse brown subdorsal patch on T2 and T3, a black subdorsal dash on A1 and A2, a brown subdorsal spot on A3-7, pupa covered except on wings with 1-mm white hair.

based on other published records, E. amyntula prefers these tendril-plants; however A. flexuosus is also a popular host (and it is the most popular legume hostplant for Colorado butterflies that eat legumes--it also has the smallest leaves of Colo. legumes, fitting a known trend that the plants least visible to herbivores tend to be the most edible). L. leucanthus (and probably the other Lathyrus and Vicia) dries up by Sept., so is eaten only by the first generation; Astragalus flexuosus is green for later generations. Eggs are usually laid in or near junctions (pedicel-stem, stem-petiole), so larvae probably eat leaves as often as, or more often than, flowers/fruits. EGG greenish-white with long hair, the pillars a little closer together than E. amyntula, the ridges (but not pillars) larger than E. amyntula. 1ST-STAGE LARVA yellow-cream, suranal plate and pronotum with a slight tan tinge; head black.

buds, Tinytown, Jefferson Co. Colo., May 21, 1982. Ant workers were found on larvae on *Jamaica* at Tinytown: *Camponotus modestus, Formica podzolica, F. neocubifiberis, Tapinoma sessile* (David M. Wright will report details). Larvae of at least some taxa of North American *Celastrina* eat many plant species of numerous families, and females oviposit only on plants in the proper flower bud stage, so the plants oviposited upon change during the season. But in Colorado *Jamaica americana* is far the most common host for the *lucia*-type, which has adapted only to it (only one generation occurs in Colo. so there is no adaptation to later-blooming hosts); *Holodiscus dumasus, Cornus sericea, Physocarpus monoaynus, Prunus virginiana melanocarpa, Deana arbores*, and *Humulus lupulus americanus* are chosen only rarely. *Cornus* is a popular host in E U.S. and Calif., but the plant is rare in Colo. *C. lucia*-type forms (*violacea, lucia, lucimargina, and marginata*) occur all over wooded north-facing slopes, from gulch bottoms to ridgetops on the N-slopes, and the hostplant *J. americana* also occurs on N-facing slopes from just above the gulch to just below the ridgetop. *J. americana* is an ancient plant, fossilized in volcanic ash near Creede Colo. The forms of *C. "lucia-type"* are distributed in an interesting manner in Colo.- N.M.: form *violacea* is everywhere, but forms *lucia, lucimargina, Scott,* and *marginata* occur only south to Jefferson Co. on the eastern slope of the continental divide (where they are uncommon: only a dozen or so *lucia* have been found in Jefferson Co.; in El Paso Co. the closest adults to *lucia* that I have found are 2 with slight enlargement of central dots on only one hindwing); in contrast, these three forms are common on the wetter western slope of the continental divide (common south to the San Juan Mts., and south to NW New Mex. near Dulce Lake, Rio Arriba Co.), where the black unblotted blotch of *lucia* is often extremely large (4.5 mm long, the largest I have seen anywhere in N. Amer.). Evidently the wetter conditions on the western slope cause this difference. *C. "lucia-type"* form *neglecta* (whitish adults of a second generation) is very rare in Colo. (1 female Little Fountain Creek, 7000', El Paso Colo. Aug. 8, 1971; 1 male 4 mi. S Beulah, Wet Mts., Pueblo Co. Colo. Aug. 4, 1982); I consider these to be *C. lucia*-type because *C. neglecta* is unknown there. One deformed male resembling form *violacea* was found Aug. 15, 1986, at O’Fallon Park, Jefferson Co., Colo. (only *violacea* occurs at this site): this late date could suggest that form *violacea* is genetic. Also, several reared 1988 pupae of *violacea* produced deformed adults in the lab in Aug. (most pupae diapause and do not hatch even in the lab) which also resembled *violacea* and not *neglecta* or *C. neglecta* hop-ecotype (in contrast, lab *C. neglecta* hop-ecotype produced whitish *C. neglecta* hop-ecotype adults), which also seems to indicate that *violacea* is genetic. It is tempting to claim that the wing pattern differences between the two are genetic because in my rearings *violacea* always produced *violacea* and *C. neglecta* hop-ecotype always produced *C. neglecta* hop-ecotype (and the lack of seasonal forms in Calif.- Ariz.- W Texas *Celastrina* seems to indicate that the absence of form *violacea* in those whitish populations is genetic); however, my lab rearings merely used the environment of my basement rather than carefully-controlled environmental chambers, and in E U.S. W. Edwards and C. Oliver have raised form *neglecta* from form *violacea* (but it is possible that only one or two E U.S. taxa have the capacity to produce environmental forms, whereas these forms are genetically fixed in the other taxa including the Colo. taxa: but this will have to be proven). Early stages (from Red Rocks, Mt. Zion, Tinytown, Crawford Gulch, Raisin Butte): E66 pale bluish-green, becoming greenish-white. FIRST-STAGE LARVA yellow-cream (slightly yellower than *C. neglecta* hop-ecotype and *C. neglecta* lupine-ecotype), with a faint darker-yellow middorsal band, after feeding turning greenish inside, prothoracic shield yellow-cream, D2 very short or short (apparently averaging shorter than *C. neglecta*), L3 short (apparently averaging slightly shorter than *C. neglecta*); head black. MATURE LARVAE have a darker middorsal band and a darker oblique band on prothorax, a middorsal darker band (consisting of large square spots on T2-S-A1, anteriorly-directed smaller triangles on A2-6 or rectangles on A2-31, a variably-shaped spot on A7, a band on A8-10), on each segment a paler dash beside the middorsal band, then a darker slightly oblique streak or dash (sometimes faint, in which case a large pale spot is formed of the adjacent pale dashes), then a strongly-oblique pale streak, below it a dark streak (varying to black in the darkest larvae), then a weak pale spot or short dash, a darker area, and a lateral pale band along the larva; head brown. But the overall larval color varies between larvae, from yellow-green (only 1 larva seen) to bluish-green (only 1 larva seen) to pale-green to green with tan middorsal band to green with maroon-and-white markings to brown with white markings (only 1 larva seen)(Table 4); the variation is continuous from the paler to browner larvae, and all the variants except the extremes are common. Greenish larvae are most common; the larvae are generally less yellow-green than *C. neglecta* hop-ecotype. PUPA
abdomen & wings ochre (paler than *C. neglecta* hop-ecotype), head and top of thorax mottled dark-brown (in *C. neglecta* hop-ecotype the head, thorax, and abdomen are all mottled slightly-reddish brown with the top of abdomen only slightly paler), a middorsal dark-brown band on thorax and abdomen, a black spot on shoulder of wing, a subdorsal black spot on T3 (small), A1 (big; these two spots are adjacent), A3 (tiny), A4 (small, twinned), A5 & A6 (twinned, large in some pupae, tiny in others); as emergence nears, the eyes and proboscis tip turn black before the rest of pupa. Pupae differ from *C. neglecta* hop-ecotype by having the abdomen (& usually the wings) usually paler (*C. neglecta* hop-ecotype have thorax more similar in color to abdomen & wings), thus the top of thorax appears darker, though the difference is not enough to identify all pupae. Pupae hibernate.

Table 4. Mature larvae of Colo. *Celastrina "lucia-type"* form violacea.

<table>
<thead>
<tr>
<th>Overall Color</th>
<th>Ground Color</th>
<th>Mid-dorsal Band</th>
<th>Subdorsal &amp; Obliques</th>
<th>Lateral Band</th>
<th>Edge of Laterals</th>
</tr>
</thead>
<tbody>
<tr>
<td>red-purple</td>
<td>red-purple</td>
<td>dark red-purple</td>
<td>pink</td>
<td>pink</td>
<td>red-purple</td>
</tr>
<tr>
<td>brown &amp; white</td>
<td>greenish-white</td>
<td>brown</td>
<td>white &amp; -</td>
<td>tan-white</td>
<td>pale-maroon-brown</td>
</tr>
<tr>
<td>green, maroon, white</td>
<td>maroon</td>
<td>white &amp; maroon (black below)</td>
<td>greenish-white &amp; pale-olive-green</td>
<td>greenish-white</td>
<td>translucent-pale-maroon</td>
</tr>
<tr>
<td>green with maroon &amp; cream</td>
<td>maroon-brown</td>
<td>cream &amp; green</td>
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<td>pale-maroon</td>
<td></td>
</tr>
<tr>
<td>light-green with maroon &amp; cream</td>
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<td>greenish-white &amp; pale-olive-green</td>
<td>greenish-white</td>
<td>translucent-pale-maroon</td>
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</tr>
<tr>
<td>brown, white, green</td>
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<td>brownish-cream &amp; tan (black below)</td>
<td>brownish-tan</td>
<td>cream</td>
<td></td>
</tr>
<tr>
<td>green with brown middorsal</td>
<td>green</td>
<td>greenish-cream &amp; green</td>
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<td></td>
</tr>
<tr>
<td>green with light-brown middorsal</td>
<td>light-brown &amp; green</td>
<td>light-green &amp; green</td>
<td>light-tan-green</td>
<td>green</td>
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<td>pale-blue-green &amp; slightly-tan-blue</td>
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<td></td>
</tr>
<tr>
<td>mottled pale-blueish-green</td>
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<td>greenish-white &amp; green</td>
<td>greenish-white</td>
<td>green</td>
<td></td>
</tr>
<tr>
<td>mottled green</td>
<td>green</td>
<td>pale-green &amp; green</td>
<td>yellow-green</td>
<td>green</td>
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</tr>
<tr>
<td>green</td>
<td>green</td>
<td>dark-green</td>
<td>lighter-green</td>
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</tbody>
</table>

Celastrina "lucia-type" form lucia (Kirby). Oviposition 12:07 on side of Jamesia americana flower bud, Ralston Buttes, Jefferson Co. Colo., May 28, 1988. Forms marginata and lucia are obviously the same species as form violacea, as they fly together (forms violacea, marginata, lucimargina, and lucia fly at the same time and in the same habitats), have the same hostplant, and are connected to violacea (and to forms marginata and lucimargina) by numerous adults intermediate in wing pattern. A mature lucia larva from Lake Ontario (Jim Troubridge coll.) is light green with slightly-paler-green markings, pronotum light brown; the pupa from there resembles Colo. violacea in its middorsal band and black spots and also has a paler (ochre) abdomen, though the head-thorax-wings are greenish-tan; so perhaps the paler (ochre) pupal abdomen is characteristic of C. "lucia-type".


19:30 on male flower bud of H. l. americanus, Red Rocks, Jefferson Co. Colo., June 15, 1987. 5 larvae found on H. l. americanus flowers, Red Rocks, Jefferson Co. Colo., July 20, 1987. 20 eggs found on H. l. americanus male flower buds (even though female cones are more common than male flower buds), Red Rocks, Jefferson Co. Colo., July 4, 1988. Hatched egg found on H. l. americanus male inflorescence, Coal Creek Can., Jefferson Co. Colo., July 1, 1988. 8 larvae found on male flowers of H. l. americanus, W Idledale, Jefferson Co. Colo., July 24, 1987. 1 larva found on H. l. americanus flowers, Mother Cabrini Shrine, Jefferson Co. Colo., July 23, 1987. 7 eggs found on H. l. americanus male flower buds, Chimney Gulch, Jefferson Co. Colo., June 24, 1988. 5 eggs found on H. l. americanus male flower buds, Red Rocks, Jefferson Co. Colo., June 25, 1988. 8 eggs found on base of sepals of male flower buds of H. l. americanus, Mother Cabrini Shrine, Jefferson Co. Colo., June 26, 1988. Male flew out from H. l. americanus vine, Wheatridge, Jefferson Co. Colo., July 11, 1988. 7 larvae found on H. l. americanus flower buds (3 larvae half grown, 4 larvae three-fourths grown), Chimney Gulch, Jefferson Co. Colo., July 15, 1988. A 3/4-grown larva found on H. l. americanus male flower buds, Apex Gulch, Jefferson Co. Colo., July 17, 1989. 8 larvae found on H. l. americanus male flower buds (two 1/3-grown, two 3/4-grown, 4 half-grown), Apex Gulch, Jefferson Co. Colo., July 18, 1989. Oviposition 13:40, preovipositions 12:12 and 13:20, and 18 eggs (1 on side of stem near buds, 1 on side of bract below buds, 15 tucked in among buds) found, all on H. l. americanus flower buds; Red Rocks, Jefferson Co. Colo., June 18, 1990. Oviposition 12:07 and 1 egg found, on male H. l. americanus flower buds; Red Rocks, Jefferson Co. Colo., June 19, 1990. 5 larvae 6-10-mm long found on male H. l. americanus flowers, reared to 4 diapausing pupae; Wheatridge, Jefferson Co. Colo., July 7, 1990. 2 mature larvae found on male H. l. americanus flower buds; Wheatridge, Jefferson Co. Colo., July 14, 1990. 1 egg, 8 eggshells, and 31 larvae found on male flower buds, 2 sp. of ants palping larvae, most reared to pupae and some used for adult emergence test, 1 egg 1 eggshell found on female flower buds, all on H. l. americanus; Red Rocks, Jefferson Co. Colo., July 5, 1991. 2 eggshells 1 half-grown larva found on H. l. americanus male flower buds, Wheatridge, Jefferson Co. Colo., July 6, 1991. 22 larvae found on H. l. americanus male flower buds, most reared to pupae used for adult emergence test, 2 species of ants palping larvae, Coal Creek, Jefferson Co. Colo., July 9, 1991. Ant workers were found on larvae on Humulus: Förmica podzolica at Red Rocks, Tapineoma sessile at Red Rocks, Apex Gulch, Coal Creek. C. neglecta hop-ecotype is restricted to Humulus (hops), and only occurs where this plant grows, generally only in gulch bottoms. Humulus lupulus is evidently native to the Colo. mountains, because the leaves of the native H. l. americanus are more incised than those of the cultivated variety H. l. var. lupulus, although some hybridization may have occurred; the large Coors Brewery in Golden, Jefferson Co. Colo., was started in 1873, and the first Colo. brewery (Rocky Mountain Brewery, later Zang's Brewery) was started in Denver Nov. 1859, and these and other breweries could have planted cultivated hops to flavor their beer (the pinecone-like female "catkins" are used for beer), and C. neglecta may have discovered the abundant and non-harvested male inflorescences and founded a population on Humulus. But such plantings were few if they occurred at all, hops are not cultivated in the area now (beer hops are grown in Idaho etc.), and all the evidence indicates that H. l. americanus and C. neglecta hop-ecotype have been present in Colo. for thousands of years (H. l. americanus fossil leaves have even been found in Oligocene Florissant shale). The species status of C. neglecta hop-ecotype was previously considered dubious because all the wing pattern and hostplant differences between it and C. luctia-type form violacea could be environmental: C. neglecta hop-ecotype resembles the extremely rare summer C. lucia-type form neglecta, and several E. U.S. workers have reared neglecta from violacea. Also, mature-larval color pattern of lucia-type and C. neglecta hop-ecotype are very similar in Colo., and I am not certain that there is any difference (both vary the same way). I once thought that C. neglecta hop-ecotype develops from eggs laid by early-emerging C. lucia-type form violacea, with most of the pupae of both forms (except for the early violacea) hibernating. But in 1891 a late spring resulted in both flights overlapping much more than usual with only a week or two average difference, obviously a time too short for one to produce the other. In my opinion there is seldom enough time in nature for lucia-type larvae to grow on Jamesia americana flowers and pupate in time for the C. neglecta hop-ecotype flight; both have just one yearly generation (considerable time was spent at C. neglecta hop-ecotype sites without seeing any adults in May and L July to Sept.), except for the very few whitish adults found in Aug. at sites where C. lucia-type form violacea flies that I am calling C. lucia-type form neglecta. And I have now reared both C. neglecta hop-ecotype and C. lucia-type form violacea in Colo., and nearly all
the pupae of both forms hibernated at least in my lab conditions. Three lab rearings of C. neglecta hop-ecotype were done: 1973 pupae were not refrigerated and several adults with unh even whiter than normal emerged from pupae in early Aug. while most pupae stayed in diapause and never emerged; 1987 pupae dis paused and did not produce adults; 1989 pupae were refrigerated and about half produced adults of normal white appearance 5 weeks after removing them from refrigeration in early Jan. and the remaining pupae did not produce adults.

David Wright experimented on emergence of both species using pupae that I sent and he found that C. neglecta hop-ecotype pupae take longer to hatch after removal from refrigeration than C. lucia-type, which explains the difference in timing of their flight periods. And C. neglecta hop-ecotype seems to be a separate species from lucia-type for other reasons: the hostplants differ almost completely (C. neglecta hop-ecotype is completely restricted to Humulus whereas C. lucia-type eats Jamesia americana and rarely others); C. neglecta hop-ecotype is very local only in gulch bottoms near Humulus (mainly in sunny rocky or steep areas because the hostplant grows well on rockslides though some plants grow on other shrubs), whereas C. lucia-type occurs on wooded north-facing slopes (from the gulch bottom to the ridgetop) during every year the start of the C. neglecta hop-ecotype flight overlaps the end of the lucia-type flight (they fly together at EVERY C. neglecta hop-ecotype site except Mother Cabrini Shrine & Wheatridge) so that worn male C. lucia-type could mate with emerging female C. neglecta hop-ecotype (in Colo., C. lucia-type typically peaks in late May, C. neglecta hop-ecotype in mid June); in addition, the two differ in pupal color and slightly in first-stage larval morphology. It seems that Colo. C. neglecta hop-ecotype is a distinct biological species that rarely if ever mates with C. lucia-type, though it is possibly not totally reproductively isolated. C. neglecta hop-ecotype is analogous to C. neglectamajor Opler & Krizek of eastern U.S., because adults are white in both, and both fly several weeks after form violacea (William H. Edwards, 1868-1897 etc., used the name pseudargiolus for C. neglectamajor, which varies in size from large to the size of violacea); however, Colo. C. neglecta hop-ecotype is the same size almost as form C. lucia-type form violacea, whereas C. neglectamajor is often larger, and the hostplants differ between C. neglecta hop-ecotype and C. neglectamajor (usually Cimicifuga racemosa for neglectamajor). In E U.S. C. neglectamajor has often been considered a separate species. I sent 1st-stage larvae of both Colo. C. lucia-type form violacea and C. neglecta hop-ecotype to David M. Wright, who has been studying Celastrina in eastern U.S.; he compared them to eastern material and found that Colo. lucia-type and C. neglecta hop-ecotype are not related to C. neglectamajor (which has first-stage larvae somewhat different from those of other eastern Celastrina); he found that first-stage larvae of Colo. C. lucia-type form violacea and C. neglecta hop-ecotype are very similar, except two setae (D2 and the most posterior abdominal L seta) average slightly longer in C. neglecta hop-ecotype than Colo. violacea. Thus, C. neglecta hop-ecotype is not related to eastern C. neglectamajor. Early stages (from Chimney Gulch, Apex Gulch, Red Rocks): EGG pale bluish-green, becoming greenish-white. FIRST-STAGE LARVA slightly-yellowish cream (slightly yellower when fatter), prothoracic shield cream, D2 short, L3 half-length of other L's; head black. MATURE LARVAE have a darker middorsal band and a darker subdorsal oblique band on prothorax that edge a dark-filled paler triangle (some green larvae have prothorax green on top with a middorsal greenish-white patch), a middorsal darker band (consisting of large square spots on T2-3-A, anteriorly-directed smaller triangles on A2-6 (or rectangles on A2-3), a variably-shaped spot on A7, a band on A8-10), on each segment a paler dash beside the middorsal band, then a darker slightly oblique streak or dash (sometimes faint, so that a large pale spot is formed of the adjacent pale dashes), then a strongly-oblique pale streak, below it a dark streak (varying to black in the darkest larvae), then a weak pale spot or short dash, a darker area, and a lateral pale band along the larva; head brown. But the overall larval color varies between larvae from yellowish-green to blue-green to green with cream marks and brown middorsal band to brown with cream or yellow markings to brownish-red with cream markings (Table 5); the variation is continuous from the paler to browner larvae, and all the variants except the reddest larvae were reared from Red Rocks in 1973, yellow-green to reddish larvae were reared from Apex Gulch and Chimney Gulch in 1989, but only green larvae were reared from Red Rocks and Apex Gulch in 1987 (probably due to small 1987 sample size). Yellowish-green larvae with whitish marks are most common. Mature C. neglecta hop-ecotype larvae are similar in color pattern to C. lucia-type form violacea, and show the same continuous variation from mostly-green to mostly-brown larvae, so I am not sure that mature larvae differ in color pattern; the small differences between larval variants shown by Tables 4-6 may be due to small sample sizes. Mature larvae are variable, but the variation
in both Celastrina species occurs mostly along one green-to-brown gradient, so Celastrina larvae are much less variable than Strymon melinus larvae. PUPA mottled slightly-reddish brown (on head, thorax and wings, and abdomen, though top of abdomen is usually a little paler), a middorsal dark-brown band on thorax and abdomen (thicker on abdomen), a black spot on shoulder of wing, a subdorsal black spot on T3 (small), A1 (large, adjacent to that on T3), A2 (tiny or absent), A3 (small), A4 (larger, twinned), A5 (large, twinned), A6 (largest, twinned): some pupae have these subdorsal black spots mostly absent except moderate in size on A1, A5-6); as emergence nears, the eyes and proboscis tip turn black before the rest of pupa. C. neglecta hop-ecotype pupae apparently show a real difference from C. lucia-type form violacea/lucia pupae, because they are more uniformly mottled brown and the wings are slightly more translucent brown (lucia-type pupae have a darker top of thorax contrasting with paler ochre abdomen & wings), though the difference is not enough to identify all pupae. Pupae hibernate.

Table 5. Mature larvae of Colo. Celastrina neglecta hop-ecotype.

<table>
<thead>
<tr>
<th>Overall Color</th>
<th>Ground Color</th>
<th>Mid-dorsal Band</th>
<th>Subdorsal &amp; Obliques</th>
<th>Lateral Band</th>
<th>Edge of Laters</th>
</tr>
</thead>
<tbody>
<tr>
<td>brownish red &amp; tan (prepupa)</td>
<td>light brown</td>
<td>reddish red</td>
<td>reddish-tan &amp; dark red-brown</td>
<td>browning red</td>
<td></td>
</tr>
<tr>
<td>red-brown</td>
<td>light brown</td>
<td>red-brown</td>
<td>cream &amp; dark red-brown</td>
<td>tan</td>
<td></td>
</tr>
<tr>
<td>brown &amp; yellow</td>
<td>grainy brown</td>
<td>maroon green</td>
<td>yellow &amp; brown (black below)</td>
<td>yellow brown</td>
<td></td>
</tr>
<tr>
<td>olive green, yellow, red-brown</td>
<td>olive green</td>
<td>red brown</td>
<td>light-yellow &amp; brownish green</td>
<td>light greenish brown</td>
<td></td>
</tr>
<tr>
<td>green, cream, brown</td>
<td>green brown</td>
<td>cream and green (dark green below)</td>
<td>yellowish green cream (maroon brown at rear of each segment)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>light green &amp; brown</td>
<td>light olive brown</td>
<td>light-olive brown</td>
<td>browning green tan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>light yellow, maroon brown</td>
<td>light olive brown</td>
<td>light-yellow &amp; light-green (dark green below)</td>
<td>light-yellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green, cream, brown</td>
<td>pale chestnut brown</td>
<td>cream &amp; tan (dark-green below)</td>
<td>cream tan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green white</td>
<td>green brown</td>
<td>white &amp; green</td>
<td>white light-green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green &amp; pale-green</td>
<td>green dark green</td>
<td>pale green</td>
<td>pale green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>blue green</td>
<td>blue green</td>
<td>light-green &amp; blue-green</td>
<td>tan-green green</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Celastrina neglecta lupine-ecotype. Electrophoresis done by David M. Wright (pers. comm.) on adults I sent proved that this is the same taxon as Celastrina neglecta hop-ecotype, but I think its host preference differs genetically.

Oviposition 11:10 flower buds on lower part of inflorescence (3 other eggs found on flower buds farther up), oviposition 13:20 on tiny 3-mm leaf buds in joint 5 cm from base of inflorescence (3 other eggs found on flower buds of inflorescence), oviposition 14:03 on flower buds, oviposition 14:10 on lower side of big leaflet near base, oviposition 14:11 on tiny leaf buds at base of leaf 4 cm from end and 2 cm below inflorescence (4 other eggs found on this hairy inflorescence), all on Lupinus argenteus var. (white flowers with no banner spot, glabrous plane leaves); no eggs were found on Astragalus flexuosus flower buds; gulch bottoms and lower N-facing slope, Tinytown, Jefferson Co. Colo., June 24, 1990. 13 eggs (11 on flower buds, 2 on underside of leaves near flower buds) found on L. argenteus white var., preovipositions 10:40, 13:39, 13:50; all in gulch or low on N-facing slope, Tinytown, Jefferson Co. Colo., June 25, 1990. Oviposition 15:06, 15 eggs found, all on L. argenteus white var. flower buds; valley bottom, Tinytown, Jefferson Co. Colo., June 26, 1990. 5 eggs found on flower buds of L. argenteus white var.; gulch, Tinytown, Jefferson Co. Colo., June 27, 1990. 1 egg found on L. argenteus white var. flower bud; no eggs found on Physocarpus monogynus; Tinytown, Jefferson Co. Colo., June 28, 1990. Oviposition 12:22 young flower bud; 13 larvae from 4-12 mm long found on inflorescences (the older larvae on seedy inflor. or on pods), reared to 6 diapausing pupae, 2 black ants seen on one mature larva; all on L. argenteus white var.; Tinytown, Jefferson Co. Colo., July 15, 1990. Oviposition 12:18 L. argenteus white var. flower buds, Tinytown, Jefferson Co. Colo., July 1, 1991. 5 ovipositions (11:35 on inflorescence 1.5 cm long, 11:53 4 mm, 11:55 4 mm, 11:57 & 11:58 8 mm), 14 eggs found (1 on 1 cm young leaf beside 5 mm inf., 4 eggs on 4 cm inf., 1 on 4 mm, 2 on 2 cm, 1 on 2 cm, 4 on 2 cm, 1 on 2 cm), all on young L. argenteus white var. inflorescences, Tinytown, Jefferson Co. Colo.. June 11, 1992. Oviposition 12:17 (on inflor 2 cm long), eggs found (1 on 4 cm inflor, 1 on 3, 4 on 3, 2 on 2, 1 on 2.5, 6 on 2.5, 2 on 3, 4 on 4, 5 on 2.5, 2 on 3, 1 on 3, 3 on 1, 2 on 2, 3 on 2, 2 on 2, 1 on 2, 1 on 1.5, 2 on 3, 4 on 3, 1 on 2), females refuse to oviposit on older inflor 4 cm on longer, all on L. argenteus (white var.) inflor., Tinytown, Jefferson Co. Colo., June 13, 1992. Oviposition 10:03 inflor. 1.5 cm long (4 other eggs found on it and 1 egg found on 5 mm new leaf just below inflor.), oviposition 10:04 1 cm inflor (3 other eggs found on it and 3 on 1.5-cm new leaf 2 mm away), 1 egg found on 2.5-cm inflor., all on L. argenteus white var., female landed on Steellaria but flew, landed on AneMone canadensis several times but flew; Tinytown, Jefferson Co. Colo., June 17, 1992. Preoviposition, went past Prunus virginiana melanocarpa flowers and landed on Clematis hirsutissima several times but departed, Tinytown, Jefferson Co. Colo., June 12, 1992. 2 ovipositions on Trifolium repens young heads (she landed on immature head 3 cm from L. argenteus white var. and laid egg 10:30, ignored 2 more heads, then ovip. 10:47 on head "12 cm from Lupinus)

60 I. repens heads searched but no eggs found; oviposition 11:39 on 2 cm L. argenteus white var. inflorescence, 11 eggs found on L. argenteus white var. inflor. (3 on 2 cm inf., 5 on 3, 3 on 1.5); Tinytown, Jefferson Co. Colo., June 15, 1992. All these L. argenteus records involve a variety with white flowers with no banner spot, and plane (non-folded) glabrous (except a few hairs ventrally) leaves widest 2/3-3/4 from base to tip (it is not ingratus, which flowers describe as having white flowers but with a banner spot and folded glabrous leaves); this var. is not widespread, but seems to occur on deep valley bottom soil. The usual widespread variety has light blue flowers and leaves V-shaped in cross section that are widest in middle, the leaf uppersides glabrous or sometimes somewhat hairy, and seems to prevail on ridges and S-facing slopes, implying that flower color could possibly be influenced by soil, but the current taxonomic nomenclature of L. argenteus is obviously preliminary. Females seem
to be host-specific to this *Lupinus* white var., and never showed much interest in any other plant, except for the 2 ovipositions on *Trifolium repens* very near *Lupinus*, which is obviously just a rare secondary host; thus *C. neglecta* lupine-ecotype seems to have genetically adapted to this *Lupinus* host despite occurring only 2 km W of where *C. neglecta* hop-ecotype probably occurs. Egg pale-bluish-green like all *Celastrina*, becoming greenish-white, sculpturing gives the appearance of conspicuous knobs all over egg in oblique view (each knob resembles an octopus body with ridges radiating outward like arms), but dorsal view shows craters on top (all *Celastrina* have the same egg sculpturing). FIRST-STAGE LARVA yellowish-cream (yellower when fatter), with a touch of greenish dorsally (bluish-green on T1), D2 short, L3 short but perhaps longer than *lucia*-type form *violacea*, similar to *C. neglecta* hop-ecotype. HALF-GROWN-LARVA yellowish-cream (heart band darker green, slightly paler edging of heart, 3 oblique paler-green dashes between heart & side, lateral band paler green; or larva cream-green (heart slightly darker), some larvae pale green with cream dashes (beside dark heart & the obliques & lateral band), one larva cream-green with weakly-pink heart-band. MATURE LARVAE (Table 6) more variable than half-grown larvae (like other *Celastrina*): one larva green with gray heart-band and the usual lines (edging heart, 3 obliques, lateral ridge) are paler green; one larva is also green but differs by having the heart-band brownish-gray (the band’s edging and the upper obliques are greenish-cream); four larvae are yellow-green with heart-band reddish-brown, the paler lines yellow-cream (cream edging heart, upper two obliques cream, lower one oblique pale green, lateral ridge cream), and one of the four yellow-green larvae has a dark reddish-brown acute triangle flaring laterally from the top of the front of A1 (one of these five, with green supralateral areas and very creamy obliques beside the heart, appears fairly similar to the most common *C. neglecta* hop-ecotype form); one larva (prepupa) has the red more widespread on top of body. On average, more larvae are creamy (cream-green) in color than in other *Celastrina* ecotypes, esp. half-grown larvae most of which were greenish-cream; however if 100 rather than 10 larvae had been reared, various brown forms etc. may have been found, so I cannot say conclusively that the larvae differ in color from other *Celastrina*. PUPA brown on head & thorax, warm orange-brown on wings & abdomen, a middorsal brown band (blackish on T1, weak T2, formed of dashes on abdomen), subdorsal blackish spots (small on wing base, small on T3, large on front of A1, in pairs [one above & in front of other] on A2-6 [spots rare on A2], largest on A4-5 where the pairs are fused into one large spot), subspiracular blackish dots on A5 and sometimes A6, (these abdomen spots are small on most pupae but were very large on one pupa which in addition had giant blackish subspiracular patches on A5-7 and blackish dashes on A5-6 just lateral to midventral axis), eyes & antenna clubs blackish-brown; attached to substrate by cremaster and a silk girdle at rear of A1. Pupae the same as *C. neglecta* hop-ecotype, but some hop-ecotype pupae are orange-brown on front of abdomen and have middorsal brown band usually darker (but only 6 *C. neglecta* lupine-ecotype pupae were reared so these differences may be just individual variation). *C. lucia*-type form *violacea* pupae the same, but *violacea* abdomen much paler yellow-brown. Pupae hibernate.

Table 6. Mature larvae of Colo. *C. neglecta* lupine-ecotype.

<table>
<thead>
<tr>
<th>Overall Color</th>
<th>Ground Color</th>
<th>Mid-dorsal Band</th>
<th>Subdorsal &amp; Obliques</th>
<th>Lateral Band</th>
<th>Edge of Lateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>green, faint lines</td>
<td>green</td>
<td>gray</td>
<td>paler-green</td>
<td>paler-green</td>
<td>green</td>
</tr>
<tr>
<td>green, weak lines, gray heart</td>
<td>green</td>
<td>brownish-gray</td>
<td>greenish-cream</td>
<td>green</td>
<td>green</td>
</tr>
<tr>
<td>yellow-green, brn heart</td>
<td>yellow</td>
<td>red</td>
<td>yellow-cream</td>
<td>yellow</td>
<td>green</td>
</tr>
<tr>
<td>green</td>
<td>brownish-cream</td>
<td>yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yellow, red band</td>
<td>red</td>
<td>olive-green</td>
<td>green</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Mature larvae of Colo. *C. neglecta* lupine-ecotype.


divaricarpa, Medicago sativa) or perhaps because some are less popular; Glycyrrhiza lepidota and Trifolium pratense are probably not preferred. Obviously larvae eat flower-buds-fruits of numerous Fabaceae. E. lygdamus whitish-green. FIRST-STAGE LARVA pale greenish-yellow; head black. Mature larva & pupa (Guy Hill): MATURE LARVA ground color pale-green (but overall appearance variegated greenish-white with maroon middorsal band because of numerous cream markings), a middorsal narrow maroon band (widest anteriorly, brown on A7-10), on each segment a cream band edging middorsal band, a faint greenish-cream dash (forming the inside of an anteriorly-directed cream check mark composed of the cream areas described last and next), an oblique cream dash (forming the long arm of the check mark), a green streak just beneath it, a less-oblique narrower cream dash, a diffuse broad cream band, a greenish-cream band above and below a wide lateral cream band, body covered with white setae shorter than those of Stryreus melanus. PUPA pale brown except abdomen pale-yellow-brown, with scattered tiny brown spots, a middorsal black line on thorax (widest on front of pronotum), a middorsal band on abdomen composed of brown spots, pronotum edged laterally with black, a weak brown subdorsal spot on front of T2, A1, A4, A5, attached by cremaster & silk girdle. Pupas hibernate.


Euphilotes batoides centralis. Although the following are only association records, the intense restriction of adults of Euphilotes to their larval hostplants makes association records very useful. Adults associated with Eriogonum jamesii var. jamesii throughout Pueblo, Custer, Fremont, Chaffee, and Saguache Co. Colo., which is surely the only hostplant there. Adults near centralis assoc. with E. umbellatum var. subaridum (R), top of Westgard Pass, Inyo Co. Calif., July 7, 1974.

Euphilotes batoides constocki (Shields). Adults assoc. with Eriogonum umbellatum var. Furcascum (R), Big Pine Meadow, Tulare Co. Calif., July 7, 1974. Euphilotes batoides ellisi (Shields). Adults assoc. with Eriogonum corymbosum var. orbigulatum (R), NE Gateway, Mesa Co. Colo., Aug. 23, 1977. Euphilotes batoides fall-flying ssp. This ssp. has the host of ellisi and resembles it except the unh orange band is very narrow as in the fall-flying Mojave Desert ssp. Adults assoc. with Eriogonum corymbosum var. valutinum (R), E Aztec, San Juan Co. New Mex., Aug. 27, 1977.


Plebeius allandon rustica (Edw.). Oviposition 12:08 and 25 eggs (21 on underside of leaves, 1 on top of leaf, 4 on calyx) found on Androsace septentrionalis, NE of Salida 8500', Chaffee Co. Colo., July 12, 1971.


Plebeius idas anna (Edw.). Oviposition 14:00 Lotus oblongifolius var. nevadensis (C), Scott Camp Creek, SW of Shasta City, Siskiyou Co. Calif., Aug. 3, 1974.


San larvae (2/3-grown to Mature) swept from associated with Astragalus bisulcatus, oviposition. 13:00 on second plant var. AlaMosa, AlaMosa Scott Sept. 3 other eggs found there, NW Gardner, Huerfano Co. Colo., June 16, 1973.

Eggs laid 10:40 on dead twig and grass stem beneath A. druMMondii, Central Plains Experiment Station, Weld Co. Colo., June 17, 1976. Oviposition 10:47 on stem of A. druMMondii after landing on leaf and walking down stem 3 cm., Green Mtn., Jefferson Co. Colo., June 7, 1985. Two eggs laid 10:40 on dead twig and grass stem beneath A. druMMondii (6), plus 32 eggs found on debris beneath plants, 8 eggs on stems several cm above ground, all on A. druMMondii, Austin Bluffs near Pulpit Rock, NE Colorado Springs, El Paso Co. Colo., Sept. 2, 1971: one egg on ground beneath, 1 egg on lower stem, of Lupinus argenteus, Austin Bluffs, Sept. 6, 1971 (L. argenteus plants were commoner than A. druMMondii here but few eggs were found on L. argenteus, indicating that females prefer A. druMMondii for oviposition); all eggs were placed near the ground, and ovipositing females land on leaves then crawl down the stem to the base to oviposit. Oviposition 9:50 on underside of A. druMMondii leaf after walking down stem, Green Mtn., Jefferson Co. Colo., June 3, 1986. Adults associated with A. druMMondii; Horsetooth Res., Larimer Co. Colo. May 25, 1950. 3 eggs found on Astragalus parryi (2 on lower leaf underside, 1 on lower stem underside); 1 egg found on A. flexuosus stem base; Tinytown, Jefferson Co. Colo., Aug. 30, 1950. 3 eggs found (1 basal leaf underside, 2 on lower stems) of A. parryi: Red Rocks, Jefferson Co. Colo., Sept. 4, 1950. Fifteen eggs laid on Astragalus miser var. oblongifolius (W), E Alamosa, Alamosa Co. Colo., Aug. 16, 1974. Egg found on 2-mm-wide stem base of Astragalus hallii; mouth Beaver Creek, Grand Co. Colo., July 11, 1980. Adults associated with Astragalus bisulcatus, Soda Lakes SE Morrison, Jefferson Co. Colo., Sept. 9, 1987. 6 eggs found on A. bisulcatus stem bases; N Bear Creek Res., Jefferson Co. Colo., Sept. 24, 1988. Oviposition 11:42 on Thlaspi arvense seedling after crawling down stem of A. bisulcatus, W Soda Lakes SE Morrison, Jefferson Co. Colo., Sept. 10, 1987. Oviposition 11:30, she crawled down stem and laid on underside of leaflet 1/3 up from base to top of Astragalus agrestis (=dasyglottis), Guy Hill, Jefferson Co. Colo., June 9, 1988. Larva on flowers of Oxytropis sericea raised to adult Central Plains Experiment Station, July 1976, J. Scott and David Wagner. Oviposition 11:15 on twig on ground after walking down stem of Medicago sativa, 14 mi. N Camp Cottonwood, Montezuma Can., San Juan Co. Utah, Aug. 25, 1977. Oviposition 12:20, she crawled down stem of two young M. sativa plants and bent abdomen on stem base of both and laid 2 eggs on second plant (1 egg on dead horizontal grass blade ~5 mm from stem base, 1 egg on green stem base); Wheatridge, Jefferson Co. Colo., Aug. 11, 1990. Oviposition 13:00 on underside of leaf of Eriogonum subalpinum (=E. umbellatum var. major) (R), Keystone Gulch, Summit Co. Colo., Aug. 6-7-8, 1977 Glenn R. Scott (this is apparently an error in oviposition by the female, but is interesting nonetheless, because several other Lycaenidae [Calliphryus affinis, Pilobus acmen] eat both Fabaceae and Eriogonum as larvae). Adults associated with Sphaerophysa salsula (W); this plant resembles Astragalus with red flowers, inflated pods, and linear branches, and was the only possible host where P. melissa was very common, so is surely the hostplant here), 9.7 mi. S. junction highways 285 and 17, Saguache Co. Colo., Aug. 17, 1986. 1 egg and 2 eggshells found (2 on stem base, 1 on green grass blade ~1-2 cm from stem) on S. salsula, 6 larvae (2/3-grown to mature) swept from S. salsula (3 larvae parasitized but 1


Oviposition 13:25 on dead grass blade at base, & 1 egg found on leaf upperside, both on *M. officinalis* (many plants searched); 9 eggs (3 stem base, 6 leaf undersides mostly of seedlings) found on *Astragalus bisulcatus* (only 6 plants searched); no eggs found on *Medicago lupulina* despite many searched; N Bear Creek Res., Jefferson Co. Colo., Oct. 4, 1990. HOSTPLANTS: *Astragalus drummondii* is obviously very popular; *A. bisulcatus*, *A. miser* var. oblongifolius, *A. adsurgens* var. robustior, and *Sphaerophysa salsula*, *Astragalus flexuosus*, *A. parryi* are less popular; other hosts are probably not preferred (except the following three *Astragalus* probably have few hosts because they are less common) including *Medicago sativa*, *Melilotus officinalis*, *Trifolium fragiferum*, *Astragalus racemosus*, *A. hallii*, *A. argastis*, *Oxytropis sericea*, *Lupinus argenteus*, *L. caudatus*, *L. prunophilus*. *Lupinus* is not preferred, and *Medicago Lupulina* may be shunned. Eggs hibernate. EGG white. MATURE LARVA green with numerous tiny white hairs, heart dark-green edged by a greenish-cream line, three faint oblique (angled downward posteriorly) dashes, a lateral strong yellowish-white line. PUPA green, abdomen yellowish-green, outer half of wings tan, head and abdomen near cremaster tan-green.

*Plebejus melissa* form or ssp. *anetta* Nab. (*anetta* has unth orange spots slightly smaller than lowland ssp. *melissa*; if the Calif. and Utah populations are genetically distinct, the Calif. Sierra form would be *fridayi* F. Cheh. If the types of *fridayi* were from high altitude). Oviposition 11:36 *Astragalus whitneyi* (N), peak top SE of Sonora Pass, alpine zone, Mono Co. Calif., Aug. 25, 1974.

HOSTPLANTS. A. aegrestis has the inflorescence in a sphere, which perhaps tricks the female into thinking it is Trifolium; no Trifolium occur at Guy Hill. A. alpinus also has the inflorescence in a sphere, though the sphere is not as compact as that of A. aegrestis. A. (Euastragalus) aegrestis and A. (Atelopragna) alpinus are in different subgenera, so it would seem that their sphaerical inflorescence (rather than biochemical similarity to Trifolium) tricks P. saepiolus to lay on them; whatever the mechanism, they are popular, even preferred, hostplants where they occur. Most foothills to lower montane zone populations are widespread on slopes and sues associated with A. aegrestis (Green Mtn. and Guy Hill, Jefferson Co.), although one population on the plains (creek E Marshall, Boulder Co.) is associated with Trifolium repens. (1 female caught in Lakewood, "5 miles E of the mountains, Jefferson Co. Colo., June 7, 1988, had unknown association); upper montane and subalpine zone populations occur in meadows and slopes on Astragalus alpinus; on moist alpine tundra, adults are widespread because several cushion-plant Trifolium are widespread there. EGG bluish-green.

Plebeius saepiolus insulanus Blackm. 1 egg and 1 eggshell found on Astragalus alpinus sepals, S Blue River towm, Summit Co. Colo., July 1, 1988. Adults associated with A. alpinus, Silver Creek, Hinsdale Co., Colo., July 17, 1988. 2 eggs found between A. alpinus petals and sepal lobes, W Tabernash, Grand Co. Colo., June 28, 1988. Egg found on underside of A. alpinus sepal lobe Fraser, Grand Co. Colo., July 31, 1990. 30 eggs found on Astragalus aegrestis flowers (most found under sepal lobes, some tucked between petal bases)(12 of the 36 were found on one flower head), 1 egg found between Trifolium pratense petals; obviously A. aegrestis is the favorite host here because eggs were very easy to find on it, difficult to find on Trifolium; 1/2 mi. N Silverthorne, Summit Co. Colo., July 3, 1988. Evidently the host-specificity is the same as ssp. whitmeri. FIRST-STAGE LARVA pale yellowish-cream, after feeding becoming greenish inside; prothoracic shield and head chitin-brown.


Oviposition 10:37 on leaf underside of Potentilla prob. uniflora (leaf upper side dark-green, leaf underside white) growing in T. nanum cushion plant, Loveland Pass, Clear Creek Co., Colo., July 20, 1989. One solid-green larva attached with silk girdle beneath rock raised to adult, Loveland Pass, July 15, 1985. Three prepupae and 9 pupae on underside of rocks, Uncompahgre Pass, Hinsdale Co. Colo., July 15, 1985. Eggs evidently hibernate, and Emmel & Shields (1980) reported that nearly mature larvae of ssp. shasta hibernate; thus high altitude shasta populations are apparently biennial, hibernating as eggs the first winter, then as nearly mature larvae the second winter. E96 slightly-greenish-white. Larva/pupa from Uncompahgre Peak: MATURE LARVA (prepupa) dark-green, with black subdorsal spots on abdomen. PUPA greenish-tan, top of thorax green or greenish-tan, abdomen greenish-cream or pale-yellow, head and end of abdomen tan, outer part of wings sometimes tan, a middorsal brown band (narrow and weak on thorax).


Eriogonum, Nighthawk, Douglas Co. Colo., July 30, 1984. Adults associated with E. effusum, Chimney Gulch, Jefferson Co. Colo., July 2, 1988. Adults associated with E. effusum, Red Rocks, Jefferson Co. Colo., Sept. 21-22, 1987. Adults associated with E. effusum, Barr Lake, Adams Co. Colo., Aug. 23, 1988. P. e. texanus feeds on a wide variety of Eriogonum, because adults are associated with Eriogonum corymbosum var. velutinum (R) at ridge 3 mi. S Cortez, Montezuma Co. Colo., Sept. 6, 1978, assoc. with Eriogonum annuum Nutt. (R) at Hwy. 285 11 rd. mi. N Espanola, Rio Arriba Co. New Mex., Sept. 9, 1977, assoc. with Eriogonum cernuum var. cernuum at Kerr Gulch, Fremont Co. Colo., Aug. 15, 1973, assoc. with E. c. var. cernuum (R) at Trout Creek 5.6 mi. SW jct. of huys. 285 & 24, B500', Chaffee Co. Colo., Aug. 29, 1977, and assoc. with Eriogonum wrightii var. wrightii (R) at 3 mi. W. Alma, Catron Co. New Mex., Aug. 9, 1988. Adults seen rather local and always occur near the Eriogonum hosts. It has been conjectured that acmon migrates northward each year on the plains, but this is doubtful: on the plains of S Colo. (Scott & Scott 1980) there are 7 records from May 4-June 8, 10 from June 26-July 31, 8 from Aug. 18-Sept. 14: on the plains near Denver acmon does seem most common L Aug.-E Sept., but flies in L Apr.-June also. Early stages from Bandimere Speedway: MATURE LARVA olive-green with red marks, Ti reddish-green, the rear slightly-reddish-green, a red middorsal band (wider anteriorly), on each segment is a narrow red longitudinal dash beside middorsal band, next a brown subdorsal slightly-oblique dash edged below by pale-olive-green and then another narrower brown dash, a white lateral band is edged above and below by a thick red band. PUPA wings translucent-pale-yellow, remainder slightly-reddish-pale-cream-yellow, with a weak pattern: orbit brown, a weak reddish flush around pronotum margin, a red flush at wing bases (except on front of T2), T3 notum with slightly-reddish margin, a faint red middorsal line on T2 and a weak red middorsal band on abdomen, four rows of weak reddish-tan dashes (the second row oblique) on abdomen, below them a red curved lateral band on abdomen (sharply-edged above with creamy-yellow).

Plebejus acmon lutzi (dos P.). Oviposition 14:26 two eggs inside corolla of Eriogonum subalpinum, she probed abdomen into E. subalpinum flowers many times; E. subalpinum was common at this site, only one Eriogonum umbellatum var. umbellatum plant seen; 1/2 mi. N Silverthorne, Summit Co. Colo., July 3, 1988. Adults associated with E. subalpinum, NW Tabernash, Grand Co. Colo., June 24, 1989. Adults associated with E. subalpinum, Moffat Tunnel, Gilpin Co. Colo., July 2, 1989. Adults associated with E. subalpinum (no umbels around stem of my specimen) previously misidentified as Eriogonum heracleoides var. heracleoides by J. Reveal, though possibly the specimen sent to him was E. heracleoides, Talamantes Creek, Moffat Co. Colo., July 8, 1972. 10 eggs (9 on hairy calyx), 1 on bract sheath around flower cluster) found on Eriogonum jamesi var. flavescens flower buds, and adults assoc. with it; Stove Mtn., '5500', El Paso Co., Colo., June 23, 1980. 3 eggs found on bract, a 4-mm-long larva found eating flower buds, all on E. jamesi var. flavescens, Coal Creek, Jefferson Co. Colo., July 16, 1981. Adults associated with E. u. var. umbellatum, NW Nederland, Boulder Co. Colo., July 2, 1989. 4 eggs found on E. u. var. umbellatum (1 outside hairy bract, 1 inside bract, 2 on side of flower buds) E. subalpinum also occurs here); SSN Hot Sulfur Springs, Grand Co. Colo., July 11, 1980. 2 eggs found on bracts below umbels of E. u. var. umbellatum; Golden Gate Can. State Park, Gilpin Co. Colo., July 25, 1980. Adults associated with E. u. var. umbellatum (no other Eriogonum present); Dory Hill, Gilpin Co. Colo., July 9, 1980. Oviposition 12:14 on side of E. u. var. umbellatum corolla while resting on top of flower; Apex Gulch, Jefferson Co. Colo., Aug. 27, 1930. Adults associated with Eriogonum pauciflorum var. pauciflorum (R), hill N I-90, 8.2 mi. SE Wall, Pennington Co. South Dakota, July 19, 1986.

Plebejus acmon spanganelloides Burd. This little-known creature, characterized by much-smaller orange uph lunules and a darker-gray unh, is treated as a subspecies, because most altitudinal "forms" have proven to be genetically-distinct ssp. when reared under low-altitude conditions. It occurs above timberline in the Olympic Ms. Washington, the Alberta Rockies, and Colorado. 25 eggs seen on Eriogonum jamesi var. xanthum (E. "flavax" var. xanthum) found on bracts sheathing flowers, many on calyx); McClellan Mt., 12800', Clear Creek Co., Colo., July 16, 1980. Egg found on E. l. var. xanthum bract sheathing flower; Mt. Bross, 13200', Park Co. Colo., July 17, 1950. 20 eggs (17 bracts, 3 flowers) found on E. j. var. xanthum, McClellan Mt., 12800-13000', Clear Creek Co., Colo., July 30, 1991. Adults are associated with E. l. var. xanthum at all of the following alpine zone locations in the Front Range, Swatch Range, and Sangre de Cristo Ms.: McClellan Mt. 12800', Clear Creek Co. Colo., July 15, 1980; Mt. Bross 13200', Park Co. Colo., July 31, 1982; Mt. Massive 12500', Lake Co. Colo., Aug. 1, 1982; Baldy Peak 12000', Custer Co. Colo., 29, July 1970; Dry Lakes 11500', Custer Co. Colo., July 16, 1968. It is also known from
Horseshoe Mtn. and Halle Valley, both alpine zone in Park Co. Adults fly about 10 cm above the host and are very local (because the plants grow only in local colonies) and uncommon. Egg whitish-green. 1ST-STANCE LARVA cream. 2ND-STANCE LARVA mostly cream with tan lines; one larva is cream with light-pink marks (middorsal line pink, 2 strong and 1 weak diagonal pink subdorsal dashes, a pink band above lateral cream ridge and a tan band below it. 3RD STAGE LARVA varies in color; some larvae yellow-cream, some yellow-green, some dull red; all have the same dark and pale lines and dashes (middorsal dark band edged by pale, 2 1/2 oblique pale pale dashes below it, a lateral pale ridge edged by dark); head black. LARVA 5-MM-LONG grayish-green, a subsdorsal cream band, 3 faint creamy-green oblique dashes, a lateral cream band.

_Plebejus lupini monticola_ (Clem.). Adults associated with _Eriogonum un bellatum var. fucosum_ (R), Big Pine Meadow, Tulare Co. Calif., July 7, 1874.


Oviposition 11:20 on half-grown _M. lupulina_ fruit, 5 eggs found on _Astragalus bisulcatus_ flower buds, 10 eggs found on _Astragalus acrestis_ flower buds, 6 eggs found on _Astragalus drummondii_ flower buds, 1 egg found on _Melilotus officinalis_ flower bud (few eggs were found on this indicating it is not a popular host), no eggs found on _Oxytropis sericea_ flower buds (but most buds too old); Green Mtn., Jefferson Co. Colo., May 27, 1991. Oviposition 13:10 on very young flower buds, oviposition 13:12 flower buds, and 1 egg found on sepal, all on _Oxytropis lamberti_; 8 eggs found on _Astragalus flexuosus_ flower buds; 9 eggs found on _Astragalus parryi_ flower buds; no eggs found on _Lupinus argenteus_ (obviously shunned by females); Apex County Park, Jefferson Co. Colo., May 29, 1981. 6
eggs found on sepal Astragalus adsurgens var. robustior, S. Table Mtn., Jefferson Co. Colo., May 30, 1991. 4-mm-long larva probably H. isola found on A. a. var. robustior flower, Tapinoma sessile ant workers found on larvae; N fork Clear Creek, Gilpin Co. Colo., July 11, 1991. 6 eggs found on Astragalus egestis sepals, 1 egg found on Astragalus flexuosus sepal, Green Mtn., Jefferson Co. Colo., June 3, 1991. Ovipositions 12:30, 12:40, 12:45 on Oxytropis lamberti flower buds, 2 eggs found on Astragalus flexuosus flower buds, Mt. Vernon Historic Site, Jefferson Co. Colo., June 4, 1991. Oviposition 10:45 and 12 eggs found on Astragalus parrvi sepal, 11 eggs found on Astragalus flexuosus sepal, no eggs found on Thermopsis divericarpa, Tinytown, Jefferson Co. Colo., June 5, 1991. Oviposition 10:26 Medicago lupulina flower buds, 3 eggs found on Melilotus officinalis flower buds, 11 eggs found on Astragalus egestis flower buds, 4 eggs found on Oxytropis lamberti flower buds, 8 eggs found on Astragalus flexuosus flower buds, 12 eggs found on Astragalus drummodii flower buds, 0 eggs found on one Astragalus adsurgens plant, 0 eggs found on one Astragalus shortianus plant, 0 eggs found on Lupinus argenteus, 0 eggs found on Thermopsis divericarpa, 0 eggs found on Psoralea tenuiflora, Lookout Mtn., Jefferson Co. Colo., June 6, 1991. 1 egg found on Oxytropis lamberti flower bud sepal; 4 eggs found on Astragalus sparsiflorus var. malacculus flower buds; no eggs found on Oxytropis multicens; W Deckers, Jefferson Co. Colo., June 11, 1991. 2 eggs found on Astragalus (gracilis) parviflorus flower buds; 1 egg 2 eggshells found (2 on flower buds, 1 under leaf) on Amorpha canescens; S Gothenburg, Dauson Co. Neb., June 15, 1991. 2 eggs found (on sepal tip, 1 on base of flower pedical) on Coronilla varia, Lakewood, Jefferson Co. Colo., June 9, 1991. HOSTPLANTS: 25 legumes are known so far, and evidently most legumes are suitable; in decreasing order of number of records they are Astragalus flexuosus, Astragalus egestis, Astragalus parrvi, Trifolium pratense, Dalea candida var. gilophylla, Dalea tamesii, Astragalus drummodii, Oxytropis lamberti, Astragalus missouriensis, Glycyrrhiza lepidota, Astragalus adsurgens var. robustior, Astragalus bisulcatus, Trifolium repens, Melilotus officinalis, Astragalus sparsiflorus var. malacculus, Medicago lupulina, Amorpha canescens, Trifolium pratense, Medicago sativa, Coronilla varia, Astragalus (gracilis) parviflorus, Dalea purpurea, Trifolium rustic, Melilotus elbe, Rhynchosia texana. Oxytropis and Glycyrhiza I would have thought would not be popular but they both have a number of records; Melilotus is not preferred, and Medicago lupulina and Trifolium pratense are probably not preferred either. Some legumes seem to be shunned: Lupinus argenteus, Oxytropis multicens, Thermopsis divericarpa, Psoralea tenuiflora. When adults are scarce (in most years) they usually occur in moist habitats and choose hosts normally found there rather than dryland legumes such as Astragalus, though in 1991 adults were widespread including in dry areas. Larvae must greatly prefer flower buds/flowers/fruit. EARLY STAGES from Barr Lake: No diapause in lab. EG6 light bluish-green or greenish-white. FIRST-STAGE LARVA yellowish-cream-tan; head dark brown. NATURE LARVA overall appearance usually whitish-green with red marks and ground color whitish-green (some larvae pale-green with red & green marks and ground color pale-green; others green with red & green marks and ground color yellow-green), T1 with a long transverse dorsal reddish stripe, T2 with a large red middorsal circle, a wide middorsal white- edged band of joined maroon circular spots on T3-AS tapers posteriorly to a middorsal band on A7-10 (on larvae with pale-green and yellow-green ground color, the rear of each middorsal red spot is green and the spots are connected by green constrictions), a short red-brown dash on front of segment below middorsal band (absent in greener larvae), then a long oblique (pointed posteroventrally) red-brown dash (green in pale-green ground color larvae, dark-green in yellow-green ground color larvae), then a narrower oblique (less oblique but still angled posteroventrally) red-brown dash (light-green in pale-green ground color larvae, green in yellow-green ground color larvae), a lateral row of short red dashes (each curved dorsoposteriorly) above a row of long red dashes, a white row of dashes between these two lateral rows; head very small, brown. Mature larvae are not as variable as many other Lycaenidae, so the color pattern is useful for identification. PUPA light-yellowish-green with a tan tinge, underside pale- green, abdomen light-yellow on top and side with a middorsal light-green line and 6-7 oblique light-raddish-brown bands extending posterolaterally to a lateral light-raddish-brown band, below this on abdomen a shorter lateral reddish-brown band edged below by cream then a reddish-brown lateral line, pupa attached by silk girdle and cremaster; another pupa the same but abdominal pattern very faint, a third pupa light-green with a tan tint, abdominal pattern very faint with slightly darker light-green marks. Prior to adult emergence, the eyes and proboscis tip turn blackish before the entire pupa does. Pupal stage 10 days in lab.
Pirun pirus. Ovipositions 13:15, 13:16, 13:22 on underside of Agropyron (Elytrigia) repens leaves, oviposition 14:38 on underside of A. (E.) repens leaf and another egg found on underside of a leaf of same plant, oviposition 14:07 on underside of Agrostis gigantea leaf, Wheatridge, Jefferson Co. Colo., July 7, 1988. 12 eggs (2 empty) found on underside of Dactylis glomerata leaves, 5 eggs found on underside of Bromus (Bromopsis) inermis leaves, 4 eggs found on underside of Agropyron (Elytrigia) repens leaves, 4 eggs found on underside of Agrostis gigantea leaves, 1 larva found on underside of Agropyron (Elymus) canadensis leaf, Wheatridge, Jefferson Co. Colo., July 8, 1988. 8 eggs (1 eggshell was empty but a 1st-stage larva was found on topmost leaf folded upward and tied with 7 silk cables) found on underside of Agropyron (Elytrigia) repens leaves, Wheatridge, Jefferson Co. Colo., July 11, 1988. Oviposition 9:19 on underside of Agropyron (Elytrigia) repens leaf and another egg found on underside of same leaf, oviposition 9:47 on underside of A. (E.) repens leaf, 5 eggs found on underside of A. (E.) repens leaves, 4 eggs found on underside ofAgrostis gigantea leaves, 3 eggs found on underside of Dactylis glomerata leaves of one large clump, Wheatridge, Jefferson Co. Colo., July 13, 1988. 5 larvae in nests on Agropyron (Elytrigia) repens, 5 larvae in nests on Bromus (Bromopsis) inermis, Wheatridge, Jefferson Co. Colo., Aug. 12, 1988. 1 larva found in Bromus (Bromopsis) inermis leaf nest, 1 larva found in Phalaris (Phalaroides) arundinacea leaf nest, 75 larvae (all 1 cm long) found in Agropyron (Elytrigia) repens leaf nests, 1 larval shell (shell identified as pirus rather than Oarvisa garita because distance from tip of leg to wingtip 2.7 mm, proboscis extends only to wingtip, pupa leaf nest resembled pirus, and P. pirus is common but O. garita has never been found at the shaded site where the pupal shell was found, though garita occurs 40 m away in a Bromus (Bromopsis) inermis meadow) found in A. (E.) repens leaf (the leaf constricted partially by feeding, then 1 cm distal to the constriction was a 35 x 5 mm silk mat on the leaf top on which the pupa was attached, head toward the leaf base, the pupa attached by the cremaster and a silk girdle circling the pupa over T3 just behind T2), Wheatridge, Jefferson Co. Colo., Aug. 22, 1988. 1 empty larval nest found on Dactylis glomerata, 1 empty larval nest found on Bromus (Bromopsis) inermis, 1 larva found in Agrostis gigantea leaf nest, 1 larva and 5 empty larval nests (3 with molted head capsules) found on Agropyron (Elytrigia) repens, Wheatridge, Jefferson Co. Colo., Aug. 29, 1988. 1 larva 1 cm long found in leaf nest, 1 empty leaf nest found, both on Agropyron (Elymus) canadensis, Falcon County Park, Jefferson Co. Colo., Aug. 30, 1988. 1 larva found in Dactylis glomerata leaf nest, Chimney Gulch, Jefferson Co. Colo., Aug. 30, 1988. 1 larva in rolled leaf nest and 15 empty larvae on Agropyron (Elytrigia) repens, 2 larvae in rolled-leaf nests and 10 empty nests on Bromus (Bromopsis) inermis, 2 empty rolled-leaf nests on Agrostis gigantea, all 3 larvae were 9-10 mm long with 1 mm wide black heads with a touch of orangish-brown (3rd stage) and were diapausing (not feeding), Wheatridge, Jefferson Co. Colo., Oct. 1, 1988. One 9 mm long 3rd-stage diapausing (non-feeding) larva found in rolled leaf nest on Bromus (Bromopsis) inermis, 15 empty larval nests found in B. inermis, 1 empty larval nest (typical nest, the leaf base untouched for 55 mm, then the leaf bared to the midrib for 20 mm, the next 80 mm of the 3.6-mm-wide young leaf rolled upward into a tube with the usual silk threads inside the tube, the remainder of leaf eaten beyond tube) found in Calamagrostis canadensis, Wheatridge, Jefferson Co. Colo., Oct. 3, 1988. 1 empty larval nest found on Phalaris (Phalaroides) arundinacea (typical nest, the leaf constricted to midrib basal to tube, tube covered with silk inside and also leaf edges connected by 5-7 multi-strand silk cords on basal half of tube), Wheatridge, Jefferson Co. Colo., Oct. 4, 1988. 1 empty larval nest (typical, leaf chewed to midrib for 22 mm basal to tube) found near top of Agropyron (Elytrigia) intermedium plant, Mt. Vernon Historic Site, Jefferson Co. Colo., Oct. 7, 1988. A very dense very local colony occurred in Wheatridge in 1988 & 1989, enabling observations to be easily made; the colony numbered a hundred or more adults daily, and was concentrated in an area only about 40 x 10 m (with scattered individuals widespread elsewhere), centered on a large flowering Cirsium arvense patch next to trees beside a cattail slough. 1 empty larval nest on Agropyron (Elytrigia) repens, Cherry Creek, Denver, Denver Co., Colo., Oct. 20, 1988. 10 larvae and 4 empty larval nests found on Agropyron (Elytrigia) repens, 2 larvae and 2 empty nests found on Agrostis gigantea, 1 larva found on Bromus (Bromopsis) inermis, 2 larvae found on Agropyron (Elymus) canadensis; 7 larvae had head facing leaf base, 6 facing away from leaf base, all larvae half-grown and in standard drooping nests except 1 larva in a nest of 2 leaves silked together and drooping (both leaves chewed to
midrib basal to nest) and 1 larva in nest of 2 leaves silked together; Wheatridge, Jefferson Co. Colo., June 5, 1899. Oviposition 11:19 on Agropyron (Elytrigia) repens (repens 0-100) leaf underside in understory of Melilotus alba & Cirsium arvense and in shade of Salix amygdaloides trees; 14 eggs found on Bromus (Bromopsis) inermis leaf undersides, and 1 egg found on Dactylis glomerata leaf underside, most of these 15 eggs in shade of Eleagnus angustifolia trees; Wheatridge, Jefferson Co. Colo., July 11, 1899. 2 eggs found on Phleum pratense leaf underside, 1 egg found on Bromus (Bromopsis) lanatipes leaf underside, Tucker Gulch, Jefferson Co. Colo., July 13, 1899. 1 egg found on Muhlenbergia racemosa leaf underside (M. racemosa common nearby, Phleum pratense, Poa, Agropyron (Elymus) canadensis, Agrostis gigantea within 1 m also), Apex Gulch, Jefferson Co. Colo., July 15, 1899. 1 egg found on Dactylis glomerata, 1 egg found on Bromus (Bromopsis) inermis, 1 egg found on Agropyron (Elytrigia) intermediate, Chinney Gulch, Jefferson Co. Colo., July 16, 1899. 1 egg found on Elymus striata leaf top, Apex Gulch, Jefferson Co. Colo., July 17, 1899. 1 empty larval nest found on Agrostis gigantea, S Cooley Gravel Quarry, Jefferson Co. Colo., Aug. 10, 1899. 1 larval nest (probably Piruna) found on Agropyron (Elymus) trachycaulum (nest of 2 leaves, the lower leaf bared to midrib below larva, the upper leaf bared to midrib above larva), Mt. Falcon, Jefferson Co. Colo., Aug. 26, 1899. 6 larvae (one 4th-stage larva was 8-mm-long with dark patterned head 1.0 mm wide, five 5th-stage larvae were 10-mm-long with white-and-reddish-brown-striped head 1.2-1.3 mm wide) found in typical leaf nests on one Bromus (Bromopsis) lanatipes clump, the only B. lanatipes plant seen (many nearby Agropyron (Elymus) trachycaulum plants had no larvae), perhaps a dying female landed on this clump and laid all her eggs there, N-facing slope on Beaver Brook Trail, Jefferson Co. Colo., Aug. 28, 1899. A 10-mm-long 4th-5th-stage larva with head 1.2 mm wide found in a new Agropyron (Elymus) ambiguus leaf nest of 2 leaves (the head toward leaf base), and a nearby leaf had old abandoned nest with leaf chewed down to midrib; small eggshell base (size of Piruna) found on Muhlenbergia racemosa leaf underside; Lookout Mtn., Jefferson Co. Colo., Sept. 2, 1899. 2 blackish eggs with Trichogrammatid exit hole found on underside of 3-mm-wide dead lower leaves of same Bromus (Bromopsis) lanatipes plant, N-facing non-woody slope among cliff rocks, Red Rocks, Jefferson Co. Colo., Sept. 4, 1899. 5th stage larva 10-mm-long with striped head 1.3 mm wide found in silked-leaf nest on Agropyron (Elymus) trachycaulum, Lookout Mtn., Jefferson Co. Colo., Sept. 4, 1899. 2 recently-dead 4th-stage 12-mm-long larvae with heads 1.1 mm wide found in Bromus (Bromopsis) inermis leaf nests (one had head facing leaf base, one facing away), 1 empty larval nest found on Dactylis glomerata, 5 empty larval nests found on Agropyron (Elytrigia) repens, N-facing slope and creek at Wheatridge, Jefferson Co. Colo., Sept. 18, 1899. Oviposition 8:55 on horizontal Dactylis glomerata leaf underside (4 cm above ground on leaf 2.5 mm wide, 4.5 cm from tip); oviposition 9:25 on Agropyron (Elytrigia) repens (25 cm above ground on leaf 3 mm wide, 11 cm from leaf tip); egg found on Agropyron cristatum desertorum leaf (27 cm above ground on leaf 2-3 mm wide, 10.5 cm from leaf tip); all three eggs in complete or partial shade near creek; Lakewood, Jefferson Co. Colo., June 27, 1990. 18-mm-long larva found on Agropyron (Elymus) trachycaulum (larva resting 14 cm from tip just beyond chewed constriction and facing leaf base, resting on top of leaf because leaf was only 3.5 mm wide, too narrow to be rolled into a tube), on sunny W-facing gulch bank; empty larval nest found on Bromus (Bromopsis) lanatipes, Tinytown, Jefferson Co. Colo., June 28, 1990. Egg found on Agropyron (Elytrigia) repens leaf underside (50 cm above ground on 3-mm-wide leaf, 4 cm from leaf tip); egg found Agropyron (Elymus) trachycaulum (40 cm, 5 mm, near tip on leaf pointing upward); egg found on Agropyron (Elymus) ambiguus (45, 4.5, 15); egg found A. (L.) ambiguus (30, 5.5, 25); egg found A. (L.) ambiguus (35, 7.25); egg Bromus (Bromopsis) lanatipes (30, 5, 19); egg Bromus (Bromopsis) canadensis were also searched; some eggs in gulch, some on N-facing slope; Red Rocks, Jefferson Co. Colo., June 30, 1990. Egg found on Agrostis gigantea leaf underside (24 cm above ground on 4-mm-wide leaf, 6 cm from leaf tip) in shaded gulch; egg found Agropyron (Elymus) ambiguus leaf underside (30 cm, 3 mm, 13 cm) on very sunny N-facing slope; Tucker Gulch, Jefferson Co. Colo., July 1, 1990. Egg found on Bromus (Bromopsis) lanatipes leaf underside (50 cm above ground on 6-mm-wide leaf, 7 cm from leaf tip), in gulch in partial shade; Tinytown, Jefferson Co. Colo., July 2, 1990. Oviposition 12:15 on Agropyron (Elymus) canadensis leaf underside, 2 eggshells found 7 & 10 mm away beneath same leaf, 1 1st-stage larva in silked tube cinched by 6 multistrand silk ropes on same leaf (20 cm above ground on 4-mm-wide leaf, 9 cm from leaf tip), in shade of bush on SE-facing gulch bank; Falcon County Park, Jefferson Co. Colo., July 10, 1990. Female bent abdomen on Festuca arundinacea, then oviposited 11:09 on young
Agropyron (Elytrotria) repens sprout (10 cm above ground on 3-mm-wide leaf underside, 3.5 cm from leaf tip), then same female oviposited 11:11 on older A. (E.) repens plant on leaf underside (30 cm above ground on 3-mm-wide leaf, 10 cm from leaf tip), all under 5 canopy of tree but partial shade was mostly due to intermixed taller plants; 4 eggs found on Leersia oryzoides (leaves 5 mm wide 8 cm from leaf tip on underside of leaf, 5-10-underside, 4-7-ups, 8-8-ups); these leaves are very thin and have recurved hooks so grasp nearby plants and often turn upside down, in tree shade next to water; Wheatridge, Jefferson Co. Colo., July 14, 1980. 2 larvae 1 cm long found on Bromus (Bromopsis) inermis in shade of tree; Wheatridge, Jefferson Co. Colo., Aug. 23, 1990. Larva found 8 mm long on Agropyron (Elymus) canadensis in typical dangling nest; larva 11 mm long found Dactylis glomerata; partly shaded gulches; Tinytown, Jefferson Co. Colo., Aug. 29, 1930. Larva 14 mm long found head downward in Agropyron (Elymus) trachycaulus nest of 3 leaves "8 cm above ground; N Oak Creek Cgd., Fremont Co. Colo., Sept. 11, 1950.

HOSTPLANTS: All 16 grasses are hostplants: Agropyron (Elytrigia) repens (93 eggs or larvae or nests found) and Bromus (Bromopsis) inermis (58) are no doubt the commonest hosts because the plants are so common (but they are eaten less often than these numbers suggest in the most natural habitats), Dactylis glomerata (22) and Agrostis gigantea (18) are less common so are less-often used (but D. glomerata is favored where it occurs), Bromus (Bromopsis) lanatipes (12) and Agropyron (Levms) ambiguus (6) grow mostly on N-facing slopes (though females do sometimes oviposit on N-facing slopes) so are eaten less often than common gulch grasses, Agropyron (Elymus) canadensis (9) is spotty in occurrence so is less often used, Agropyron (Elymus) trachycaulus (5) is less often used because the plants grow mostly on slopes, (the last 5 grasses are the usual hosts in the most natural habitats), Phleum pratense (2) is also spotty in occurrence but may be used more often than the 2 records indicate, Muhlenbergia racemosa (2) and Glyceria striata (1) are uncommon gulch bottom/creakside plants so are uncommon hosts, Leersia oryzoides (4), Agropyron (Elytrigia) intermedium (2), Phalaris (Phalaroides) arundinacea (2, a very large grass, height up to 2 m, leaves up to 2 cm wide), Calamagrostis canadensis (1) all occur at very few sites so are seldom hostplants, and Agropyron cristatum desertorum is mostly planted on road banks for soil stabilization so is seldom in the right habitat. The hosts are "hay" grasses, all have wide (3-15 mm) leaves, all are tall (30-150 cm), most have rhizomes and grow in individual clumps rather than tight clumps (few exceptions: A. trachycaulus, A. cristatum, and B. lanatipes grow in clumps, D. glomerata grows in a sprawling clump up to 30 cm or more wide, each blade much longer than the leaves of other hosts, A. [E.] ambiguus grows in giant clumps or patches up to 150 cm wide and often has rhizomes), and all have somewhat stiff leaves (except D. glomerata, G. striata, & L. oryzoides), leaves are more floppy and rather succulent, though the latter's leaves are tougher and have sawtooth edges). D. glomerata seems to be the most preferred hostplant because few plants had many eggs, and its leaves are the most succulent of all the grasses, but it has more leaves per plant so the comparison is unequal; the other hosts may have no differences in preference, and the number of records on these hosts mostly depends on their abundance. In the lab, larvae ate Poa pratensis, B. inermis and D. glomerata, but survival was low in the lab and larval growth rates were very slow compared to Hesperiiinae larvae (P. pirus has only one generation per year, despite the small food requirements of its small adults). Philomites australis (=communis), a very tall single-stem grass, occurs at Wheatridge and may eventually be found to be a hostplant but was too uncommon and too far from the concentration of adults to have eggs or larvae. Many clumps of Festuca arundinacea were searched but no eggs or larvae were found, even when adjacent A. (Elytrigia) repens had larvae, so F. arundinacea is apparently not used despite its wide leaves (it closely resembles D. glomerata in its large clumps and sprawling very long wide leaves, but its leaves are much tougher, like straps). Most of the hostplants are widespread in range, and several are introduced from Eurasia. However, P. pirus has a much smaller range than these grasses, and is often very local where it occurs, so hostplants are not limiting factors. Most ovipositions, eggs, and larvae occur in shaded or semi-shaded areas, such as the shade under trees (Salix amygdaloides, Eleagnus angustifolia, Salix exigua, Ulmus sibirica, Hacer nagundo, Populus sergentii) or bushes (Cornus stolonifera) or the shade within a dense Cirsium arvense patch where the 1.5 m C. arvense plants shade the 0.5-1 m grasses; the preference for shade prevents their occurrence in most hayfields and pastures, and explains why P. pirus almost always occurs along creeks or gulch bottoms or near trees (some immatures were found on N-facing slopes also, so females occur there sometimes). Most eggs are laid on younger more tender individuals of the preferred grass species, though some eggs are laid on old tough leaves. Poanes zabulon taxiles and Ochlodes sylvanoides also choose wide-
leaf tall "hay" grasses mostly in shade; I think the reason for *P. z. taxiles*
and *Piranus*'s preference for shade is that half-grown larvae hibernate, and the
grasses in shade stay greener longer in the year so that in a dry year only the
grasses in shade would stay green long enough for the larvae to become big
enough to diapause. By late Aug. in the sunnier areas the grass plants that
fruited that summer are starting to dry, and by Oct. 1 they are mostly dried out
and only the young grass shoots near the ground are still green, whereas in the
shade next to water or in shade under trees some grasses stay green even until
mid Oct. So larvae in sunnier areas would often have to transfer and crawl
around to find a young green shoot, which would increase mortality and cause
more energy expenditure to make a new silk nest. However, larvae do withstand
drying of their host fairly well, as long as it becomes green later: "5 larvae
from Wheatridge, Jefferson Co. Colo., "Oct. 5, 1988, were overwintered in a
refrigerator, and one lived until March 1989 when it was placed on a potted
*Dactylis glomerata* plant, which it ate for a week, then the leaves around it
dried and turned brown, yet the larva remained alive in the same dried nest for
TWO MONTHS (I thought it was dead), when it was given fresh leaves and emerged
as an adult July 1989. Perhaps shade preference is a genetic holdover from the
ancestors of *Piruna*, a tropical group reaching the U.S. from hotter Mexico.

**LARVAL NEST:** The larva chooses a leaf generally at or near the top of the
curl, curls the leaf upward with silk and fastens the leaf edges together with a
mat of silk all over the inside of the tube and the edges secured with "7-8
multi-strand cords of silk. The larva lives in the tube, usually with head
facing the leaf base and the tube closed behind the larva, and eats the sides of
a 20-30 mm length of the leaf **basal** to the nest except for the midrib, and eats
the leaf tip distal to the tube. Thus the typical nest has much of the leaf
base intact and angled upward 30-40°, then the bare midrib extends outward and
curves downward for 20-30 mm, then the hanging leaf nest is rolled into a tube
with the larva resting inside, head usually upward (toward leaf base), and the
leaf tip is missing (eaten). Most larvae (and pupae) rest with head facing
upward (toward leaf base) but about 30% had head pointing downward (away).

Leaves that are propped upward by touching other plants may have other
modifications of this nest, for instance two nests had the tube formed of a leaf
and an adjacent leaf, and one leaf that had two larvae had two separate chewed
constrictions of the leaf, and in the lab a larva sometimes made a nest in which
nylon netting formed one side of the nest (proving that tactile stimulus from
the tube rather than darkness is sought by a nest-building larva), but the larva
always lives in a leaf tube and always eats the leaf near the nest down to the
midrib. This chewed-to-midrib type of leaf nest is unique within Hesperiidae in
my experience, and enables larvae to be found even more readily than eggs.

The nest is similar to those of *Vanessa atalanta* and *Polyommatus satyrus*, which cut
the *Urtica* leaf petiole slightly to make the leaf droop and then live in the
rolled leaf; however there are differences (both have to chew the petiole very
little to make the leaf droop, *V. atalanta* and probably *P. satyrus* eats the end
of the leaf distal to the larva, and *P. satyrus* rolls the leaf downward instead of
upward). **Hibernation Stage:** Larvae have 5 stages, and 4th- and 5th-stage
larvae about 1 cm long hibernate most often, 3rd-stage larvae hibernate
sometimes, judging by the size of larvae found in nature at the end of Aug.-Oct
3 (nearly all larvae reach diapause size by Aug. 22) and June 5, and the high
mortality of these larvae in the lab due to cessation of feeding. They seem to
hibernate in the larval nest, because 4 diapausing larvae were still in their
chewed-to-midrib larval nests Oct. 1-3 (when placed on leaves in the lab, these
4 rolled the leaf into a tube cinched by "7 silk cords, and did not feed), but
most larvae in nature were empty by late Aug., perhaps due to predation. The
strong larval diapause of Heteropterinae contrasts with Hesperiinae; most
Hesperiinae that I have reared have not diapaused as larvae in the lab (except
for *Stina* and *Amblyscirtes*) even when it is known that they hibernate as larvae
in nature. **Description of Early Stages:** E66 slightly-greenish cream, a depression on top,
hemispherical, with faint vertical ribs on lower third of egg. Egg smaller than
*Poanes zabulon taxiles*, greenish-cream versus cream, hemispherical versus more
tapered on sides, with faint vertical ribs on lower third of egg versus
unribbed. **First-stage Larva** cream with darker-cream heart line, turning
greenish after feeding with green heart-line, the stripes of later stages hardly
noticeable; collar and head black, head width 0.4-0.5 mm. **2nd-stage** Larva light
green, with weak stripes like later stages, collar black; head black, head width
0.5 mm. **3rd-stage larva** light green, with a wide cream band beside middorsal
green line, a subdorsal narrow cream line edged by green (T1 has only the
subdorsal cream line which turns medially to join its fellow on other side of
body just behind head), collar black; head dark red-brown, an ochre ventral area
near eyes, an ochre vertical streak (faint dorsally) extending upward in front
of eyes, a narrow weak ochre streak beside lower half of coronal sulcus and upper half of adfrontal sulcus, head width 0.7-0.8 mm. 4TH-STAGE LARVA green to greenish-white, a wide pale-green band next to middorsal green band, a subdorsal narrow pale-green line, some larvae have a very weak supralateral pale green line on abdomen, A10 greenish, collar black; head dark brown, a cream vertical band extending upward from just in front of eyes, a shorter cream spikelike vertical band extending upward just behind eyes, head width 1.0-1.1 mm. 4th-stage larvae vary greatly on the body, which always has two paler fairly wide stripes beside a middorsal line, and always has a narrower paler subdorsal stripe; larvae vary from mostly greenish-white with green lines (1 middorsal, 2 subdorsal on each side), to mostly green with paler green bands (a wide band beside middorsal line, a narrow subdorsal line). 4th-stage larvae vary greatly on the head, which varies from mostly reddish-brown to mostly cream: the darkest heads are entirely blackish-brown with one cream stripe extending dorsally from just in front of the eyes and two very faint cream-brown stripes parallel to the cream stripe, the palest heads have the frontoclypeus tan, edged above with black, adfrontal areas and beside coronal sulcus reddish-brown, tan beside that, then a narrow reddish-brown line beside adfrontal areas, a broad white vertical band, then a reddish-brown broad band extending dorsally from eyes (narrowing at the top and curving toward middorsal notch), this band edged laterally except at top by white, side of head tan, the narrow rim beside neck black. 5TH-STAGE LARVA green with pattern like 5th-stage larva, and some of the variation in head of 4th stage still present; head width 1.3 mm. MATURE (5TH-STAGE) LARVA green, covered with thousands of tiny cream hairs, a dark-green heart-line, a pale-green band beside it, then a subdorsal white line edged by dark-green, then a pale-green narrow band (all these lines & bands extend 2/3 onto A10 also) the side and ventrum green, side of proleg pale-green, a silvery lateral trachea faintly visible; head light olive-green, an orange-brown stripe extends upward from eyes 1-4 then narrows and terminates as it reaches top of head, this stripe edged posteriorly by a cream band similarly narrowed at top and edged anteriorly by a cream band which is still wide at the top and is very narrow just in front of eyes (all 3 bands end at the same spot near top of head), coronal sulcus & adfrontal cleavage line pale-green, labrum & around mandibles white, eyes black (eye #3 large, #4 smaller, #5 still smaller, #1, #2, #6 tiny), head width 2.0 mm.

P. pirus larvae are easily distinguished from Poanes zebulon taxiles larvae by the head (in pirus rectangular, black when small in stages 1-3 or striped when larger in stages 4-6; in taxiles round and reddish-brown), and the leaf nests differ. PUPA slightly translucent, green on thorax & head & front of wings, yellowish-green on rear of wings & abdomen, a greenish-cREAM band on T2-A8 just beside middorsal green band, then a narrow subdorsal yellowish-cREAM line on T2-A8 (weak A8-10), a very slightly-pinkish translucent-cream anterior-projecting slightly-upturned head horn 0.8-1 mm long, a cream spot just beyond proboscis tip, cremaster translucent cream, "1.5 mm long, T1 spiracle not elevated above surface of pupa, wingtip unnotched, antenna-wingtip distance 3.5-3.7 mm, leg-wingtip distance 2.6-2.8 mm, proboscis extends only to wingtip, pupa length 15-16 mm, pupa attached by cremaster and by silk girdle between T2 & T3 extending down over rear of T3 at its anteriormost point then attached to silk of leaf nest, most pupae have head upward in nest. Pupal stage lasts 13 days for males.

"11 days after pupation the wings become yellow-white, the adult eye becomes visibly orange and is centered under pupal orbit (orange adult eye lies under anterior half of pupal eye and under pupal orbit and slightly beyond pupal orbit)(in other words, pupal eye does not correspond exactly with adult eye), then T2 becomes darker and turns yellow, the eye becomes bright orange-red, abdomen tip becomes tan; at "12 days the eyes, thorax, & wings become blackish (the antenna club ochre), the abdomen greenish-yellow, abdomen tip light brown, legs red-brown; then the entire pupa becomes dark the day before emergence. An internal longitudinal lateral trachea just beneath surface forms a narrow white line on R2-3 (weak on A8-9), and on A5-6-7 a transverse ventral trachea is visible that bulges posteriorly midventrally. Tracheae are visible on wings of young pupa: Sc and R1 are covered distally by antenna, R4-5 splits from R1 basad of R2-3, M1-2-3 are wholly visible and M3 branches near base of M whereas M2-3 fork near end of disal cell, CuP branches from base of Cu just basad of CuA, only one A vein visible ("1A & 2A"), beneath these tracheae on 1-2 day old pupa are visible apparent veins, and on wing base at base of Sc & R is a flap that beats once per second (evidently a valve to pump blood into wing). ADULT BEHAVIOR. Adults never bask with forewings spread less than hindwings (the basking posture of Hesperiinae-Megathyminae, and a shared derived trait of their evolutionary branch). I saw more than 100 basking adults, and they always spread all four wings equally wide, from 15° to (most often) about 70° from vertical; in hot weather they raise the wings vertically. 4 females were
observed to close the wings vertically to avoid detection when males flew overhead. When feeding they usually spread all wings 80-70° also, but sometimes close them. They may close the wings when resting especially in cold weather, and they roost with wings closed. Adults feed often on flowers of *Cirsium arvense* and *Medicago sativa*. Males patrol all day about the canopy of plants, usually 1/2 m to 2 m above ground, to seek females, often changing direction or going up or down to dip into nooks and follow the canopy, and they also patrol through the *Cirsium arvense* stand between the plants about 1/3 m above ground. Patrolling males that meet each other may zigzag together for a short distance, or chase rapidly briefly, or circle about each other briefly, before separating. Males fly faster than females; females usually rest on vegetation (commonly 1/3 m above ground), and have a slower more flutty flight than males, while ovipositing females hover, and hover between plants under the canopy and hover into the shade beneath trees and shrubs (all eggs were laid about 10-40 cm above ground, commonly 15-20 cm). In unsuccessful courtship, the male pursues the female, both hover for 1-10 sec, she lands if she was flying, she flutters her spread wings for 1 sec or longer (the wings varying from 45-70° from vertical during each stroke—both sexes keep wings mostly spread during courtship), and the male lands behind her and may also flutter his wings the same way and may bond his abdomen to attempt to mate. Female wing fluttering is a rejection dance. Unreceptive females often fly fast to try to escape from the male, after hovering next to him briefly or after being courted on a plant. A mating pair was seen at 15:07; the female of the pair flew when disturbed. One male had a sparrow beak mark on a forewing, and 3 males were caught in spider webs.

**Megathyminae**

**Megathyminini**

**Megathyminus streckeri streckeri** (Skin.). 4 eggs on leaves of young *Yucca* sp. plants, SW Villa Grove, Saguache Co. Colo., June 17 & 19, 1966.


**Megathyminus beulahae gayleae** S. & T. Larvae from *Agave striata falcata* reared to adults, 73 mi. N Saltillo, Coahuila, Mex., Sep. 19-20, 1969. Larvae make cigar-shaped tents as do *M. yuccae* and *M. ursus*. MATURE LARVA creamy, top of A10 (suranal plate) dark-red-brown, collar red-brown down the middle, with a paler-brown middorsal line (no blackish-brown lateral sclerite just below collar); head dark-red-brown, with an inverted Y-shaped mark consisting of cream along coronal sulcus and cream lateral to the adfrontal cleavage lines, this mark widest near the junction of the sulcus and cleavage lines and very narrow at the 3 extremities of the mark.

**Megathyminus ursus violae** S. & T. Larvae raised *Yucca* sp., Franklin Mts., Tex., March 23 & April 1-2, 1968. Half-grown/older larvae hibernate. MATURE LARVA creamy-yellowish-white, top of A10 (suranal plate) dark-red-brown, collar red-brown down the middle, partially divided middorsally (no blackish-brown lateral sclerite just below collar); head dark-red-brown, with an inverted Y-shaped mark consisting of cream along coronal sulcus and cream lateral to the adfrontal cleavage lines, this mark widest near the junction of the sulcus and cleavage lines and very narrow at the 3 extremities of the mark.


**Aegialeini**

**Aegiale hesperiaris** (Walk.). Larvae in leaves (trapdoors on underside of leaf) of mature *Agave americana* plants, Sierra de la Gavia N Saltillo, Coahuila, Mex., Sep. 19, 1869.


**Agathyminus hoffmanni** (F.). Larvae in *Agave americana* leaves (trapdoors on underside of leaf), Sierra de la Gavia N Saltillo, Coahuila, Mex., Sep. 19-20,

Anagathmus remingtoni "valverdiensis" F. (a weak ssp. or synonym; estelleae (S. & T.) is also a ssp.). Larva raised A. lecheguilla leaves (trapdoors on upperside of leaf), N of Bracketville, Tex., 21 Sep., 1969.

Hesperiinae

The only non-hay grass among published hostplants is *Poa*, which I think is an error (all references to *Poa* are based on A. Shapiro 1966, Butterflies of the Delaware Valley, Phil.: Amer. Ent. Soc.); most of my records were recorded near a *Poa pratensis* lawn, and the females showed absolutely no interest in the lawn, and sped across it to oviposit on taller hay grasses under shrubs, beside a house, along roadsides, in roadside ditches, and at the edge of a soybean field.

**NEST:** 1st-stage larvae live in a rolled-leaf nest near narrow leaf tips, and eat the leaf basal to and sometimes beyond the nest; older larvae live in rolled-leaf nest. Egg pale-orangish-yellow when laid, developing tiny red spots (except on top) which enlarge and mostly coalesce into a red blotch around most of sides, so overall appearance of egg becomes orange; egg elliptical in dorsal view, lower edge rounded without a flange. 1ST-STAGE LARVA light-yellow; collar & head black. 3RD-STAGE LARVA light-grass-green, heart slightly darker; collar & head black. MATURE LARVA green, slightly lighter next to the dark-green heart-line, collar black on posterior half and white on anterior half (a brown subdorsal spot is near lateral and of white half). 5th-stage has wax glands on *A5* (the only Hesperiinae I know that has wax glands on any segments other than *A7*); head black with weak ochre stripe along coronal sulcus, ochre around rim of face in anterior view, an ochre spot medioventral to eyes. PUPA yellow-orange; wings & proboscis & appendages tan (but proboscis black-brown near wingtips & beyond wings), head & T1 blackish-brown except outer part of eye orange-brown & base of orbit tan, front of T2 blackish-brown with bluish-bloom, large brown subdorsal areas on T2-6 (5-weak on A7) are connected in broad longitudinal bands (which are blackish and near middorsal axis on T2), large brown lateral areas on *A4* (weaker on A7), anal margin of wing dark-brown, wing veins dark-brown distally, A9-10 top red-brown, tarsi & distal 1/2 of antenna checkered, proboscis extends beyond wings about to end of A5, setiferous bump near proboscis on A5 & A6 (a black-brown or orange-brown spot beside it on A5), a ridge (interrupted ventrally, subspiracularly & subspiracularly) circles abdomen on *A5* (ridge strongest on *A7*), subdorsal lenticles on T1 *A12789* (tiny or absent on A34), cremaster very wide like a ducbill; wings and antennae turn orange before hatching. HIBERNATION: 8 mm long larva (4th-stage); five larvae this size diapausd and refused to feed in lab.

**Carisma garita (Reak.).** Oviposition 10:09 on *Poa annulata* (W), Red Rocks, Jefferson Co. Colo., June 25, 1978. Oviposition *Poa pratensis* (F), Central Plains Experiment Station, Weld Co. Colo., June 20, 1976. Oviposition 10:00 *Agropyron* (Elymus="Sitanion") *longifolius* (="Sitanion hystrix") (B), Round Mt., Custer Co. Colo., July 15, 1969. Oviposition 10:15 probably *Muhlenbergia filiculmis* (previously misidentified as *Blepharoneuron tricholepis* (B)), 2 mi. NE Rosita, Custer Co. Colo., July 14, 1970. Oviposition 10:15 *Stipa robusta* (previously misidentified as *S. cumbiowna* (B)), Buil Domingo Mine, Custer Co. Colo., July 9, 1969. Oviposition 12:02 (egg pale green) on underside of leaf of small *Bouteloua* (Chondrosum) *oracilis* plant (*B. oracilis* was also nearby and was 20-30% of nearby grasses, *Koeleria macrantha* (W) was 5 cm from egg and 50% of grasses, *Stipa comata* (W) 10-15 cm from egg and 20% of grasses), Guy Hill, Jefferson Co. Colo., June 25, 1986. Egg (#77) found on *Bouteloua oracilis* (*B. oracilis* thick 0-1 m, *Stipa comata* 28, 50, 60, 80, 100 m, *Koeleria macrantha* 28, 40, 70, *Orzyopsis exigua* 28, *Carex* probably *pensylvanica heliophila* 60-1 m, egg (#78) found on *Bouteloua oracilis* (*B. oracilis* thick 0-1 m, old *Bromus* (Anisantha) *tectorum* a few cm, *Stipa comata* 75, 80), both eggs reared to pupae, N Beaver Brook, Jefferson Co. Colo., June 22, 1988. Oviposition 11:13 (#33) *Stipa comata* (*S. comata* 5, 8, 15, 15, 20, 25, 25, etc. onward, *Poa pratensis* thick 4 cm-1 m, *Bouteloua oracilis* 10-35, *Agropyron* (Elymus="Sitanion") *longifolius* 70, 80), Guy Hill, Jefferson Co. Colo., June 27, 1988. Preoviposition 11:40 *Bromus* (Bromopsis) *inermis*, Wheatridge, Jefferson Co. Colo., July 13, 1988. Oviposition 11:45 and a second egg found 40 cm away, both on underside of *Bromus* (Bromopsis) *inermis* leaves (*B. inermis* common nearby, *Poa pratensis* scattered in understory 20 cm onward), eggshell (sucked dry by some Hemiptera) found on underside of *Bromus* (Bromopsis) *inermis* leaf (*B. inermis* thick all over, *Dactylis clomerata* 25 small plant, small sedge common 5 cm onward, *Poa pratensis* fairly common in understory 20 cm onward, *Phleum pretense* 1 m), egg found on underside of young *Bromus* (Bromopsis) *inermis* leaf (*B. inermis* thick all over, small sedge 30, 30, *Agropyron* (Elytrigia) *repens* 30, 60, scattered, *Poa pretensis* common all over in understory, *Phleum pretense* 80), Wheatridge, Jefferson Co. Colo., July 15, 1988; at this locality, *C. garita* occurs only in one meadow dominated by *Bromus* (Bromopsis) *inermis*, where females spend most of their time just resting, and males rest and patrol, so adults must have very small movements here. 1 egg found on *Bouteloua oracilis* leaf (*B. oracilis* common 0-1 m, *Stipa comata* 15-100 m, *Sporobolus cryptandrus* 40-100 m, *Bromus tectorum* scattered 5-100 cm, *Carex* probably *pensylvanica heliophila* 40-100 cm),
Bouteloua gracilis (B. gracilis common 0-100, Bromus japonicus scattered 5-100, Stipa comata common 40-100, Aristida purpurea 45, 45, 50, Andropogon gerardii 50-100, 55-200, Bouteloua curtipendula 35-100, Stipa tectorum scattered 10 cm onward), Chimney Gulch, Jefferson Co. Colo., June 27, 1989. Egg found on Stipa comata (S. comata 25 cm away, Acroopyron [Elymus = "Sitania Vienna"] longifolius abundant 8 cm onward, Stipa tectorum 1, 3, 5-100, Festuca saximontana 20, 30-40, Dianthus parryi 45-55, Bouteloua gracilis 15, 25-100, Koeleria macrantha 50, 65), Guy Hill, Jefferson Co. Colo., June 19, 1989. Oviposition 12:01 on Stipa comata (S. comata 10, 10, 10, 20, etc. common to 100, Carex perhaps foenea [no inflorescence] abundant 2-100, Acroopyron [Pascopyrum] smithii 50), (before laying this egg she landed on Stipa comata 3X and bent abdomen but refused to lay, she did not land on Carex perhaps foenea, and ignored Poa agassizensis), NE Hayden, Routt Co. Colo., July 8, 1989. Oviposition 11:55 under Poa agassizensis leaf (P. agassizensis abundant 0-10 cm, Stipa viridula 50, 50, 90, Koeleria macrantha abundant 8-100, Acroopyron [Elymus, "Elytrie""] albicans 75-120, Carex probably pensylvanica heliophila 20); oviposition 11:57 under Carex probably pensylvanica heliophila (C. p. heliophila abundant 0-100, Stipa viridula 3, 10-30, 20-50, 50-55, 90, Koeleria macrantha abundant 4-100, Poa agassizensis 15, 25, 30, 70-80, Acroopyron [Pascopyrum] smithii 100); oviposition 11:58 on Koeleria macrantha (K. macrantha abundant 3-100, Carex probably pensylvanica heliophila abundant 10-100, Stipa viridula 70, Poa agassizensis 20, 20, 30, 40, 50-60 etc.); Green Mtn., Jefferson Co. Colo., June 22, 1989. Oviposition 12:50 on underside of Agrostis gigantea leaf (A. gigantea common 0-100, Poa pratensis abundant 0-100, Poa pratensis Hordem [Critesion] jubatum 70-100); oviposition 10:36 Acroopyron [Elytrie] repens leaf (A. repens 0-100, Poa pratensis 30, 30, 80, 30, 90, Agrostis gigantea 50, Carex stipata 40-50, 60-90, 70-90, Carex praegracilis 45, 70, 80); Wheatridge, Jefferson Co. Colo., July 3, 1989. Oviposition 12:12 Carex lanuginosa leaf underside (10 cm above ground on 3-mm-wide leaf, 30 cm from leaf tip) (C. lanuginosa 0-100, Poa pratensis 0-100, Agrostis gigantea 8, 20, Acroopyron [Elytrie] repens 5-100); Wheatridge, Jefferson Co. Colo., July 14, 1990. Egg found Poa pratensis (P. pratensis 0-100, Danthonia parryi 20, Carex 20); egg found P. pratensis (only grass nearby); Fraser, Grand Co. Colo., July 31, 1990. Eggshell found P. pratensis; egg found P. pratensis (P. pratensis 0-100, Festuca idahoensis 40, 40, 50, Deschampsia caespitosa 70); egg found P. pratensis (0-100, Acroopyron [Elymus] trachycalum 30, 30, 30, long round-leaf rush 40-100); egg found P. pratensis (0-100, Acroopyron [Elymus, "Sitania Vienna"] longifolius 100, Acroopyron [Elymus] trachycalum 0-100, Carex Tareagracilis 5-100); egg found P. pratensis (0-100, Festuca idahoensis 35, 40, 50, etc., tall round-leaf rush 10-100); Fraser, Grand Co. Colo., Aug. 1, 1990. All eggs were found 2-4 cm below leaf tips. Egg found P. pratensis (P. pratensis 0-100, Festuca idahoensis 0-100, Stipa viridula 17, round-cover rush 0-100); egg found Poa pratensis (P. pratensis 0-100, Poa arida or young P. pratensis near egg, Phleum pratense 15, Deschampsia caespitosa 15, Acroopyron [Elymus, "Sitania Vienna"] longifolius 40, 60, Carex Tareagracilis 5-100, round-cover rush 0-100); Fraser, Grand Co. Colo., Aug. 2, 1990. Hollow egg (sucked dry) found on Acroopyron (Elytrie) repens ("15 cm above ground on 4-mm-wide leaf underside") (A. repens 0-100, Poa pratensis 2-100); Wheatridge, Jefferson Co. Colo., Aug. 11, 1990. HOSTPLANTS: 35 eggs or ovipositions were found in nature, scattered among 12 hosts: Poa pratensis 10, Bouteloua gracilis 5, Bromus (Bromopsis) inermis 4, Stipa comata 3, Acroopyron (Elytrie) repens 3, Poa agassizensis 2, Acroopyron (Elymus="Sitania Vienna") longifolius 1, Muhlenbergia filiculmis 1, Stipa robusta 1, Agrostis gigantea 1, Koeleria macrantha 1, Carex probably pensylvanica heliophila 1, Carex praegracilis 1, Carex lanuginosa 1. Lab larvae ate Poa pratensis well, Carex nebraskensis well, Carex nebraskensis well (several larvae grew only on it from half-grown to pupation), Carex pensylvanica heliophila well. These 12 hosts include turf grasses, bunchgrasses, hay grasses, and sedges. Considering that the hosts with the most records were plants that were deliberately searched for eggs (thus artificially increasing the number of records), I conclude that P. carrita chooses a wide
variety of grasses and sedges, short and tall, narrow- and wide-leaved, clumped and nonclumped; clearly it is the most polyphagous monocotyledon-feeding skipper known. \textit{O. garita} is common in thick-grass swales and slopes dominated by \textit{Poa annassizensis}, so this grass may be the most common host in the foothills. NO NEST: Larvae, from young to mature, do not make silk nests, which is very unusual in \textit{Hesperiidae}; this behavior exposes larvae to predation, which may be why larvae have stripes like those of \textit{Genes}, which tend to camouflage the exposed larvae from predators (nearly all nest-building \textit{Hesperiinae} larvae are unstriped, though \textit{Heteropterinae} have a stripe and make nests). The lack of nest building also allows larvae to eat many different kinds of grasses, because the leaf nests of most \textit{Hesperiinae} are adapted to a certain type of grass (such as a rolled-leaf-tube on a broad-leaf grass, or a silk tunnel in the litter & soil at base of a narrow-leaf bunchgrass). HIBERNATION STAGE undoubtedly half-grown larva (no diapause in lab). EARLY STAGES (Beaver Brook): EG6 green, small in size, hemispherical in lateral view with acute angle between lower well and base, an odd asymmetrical oval shape in dorsal view. FIRST-STAGE LARVA when first hatched yellowish-cream, becoming greenish-cream, with a cream band near middorsal, a cream dorsolateral line, a faint cream line above spiracles, a cream line on subspiracular ridge; head ochre-yellow or pale tan with a thick light-brown mark on front shaped like a normal-distribution. First-stage larva after feeding green (darker in middle of body), with 5 white subdorsal to lateral lines (#1, 3, 5 wider than #2, 4), two broad whitish-green sublateral bands, A10 often greenish-tan; head ochre-yellow or greenish-tan with bell-shaped mark on lower front. HALF-GROWN LARVA green covered with black dots, from top to side a middorsal dark-green band (a very narrow whitish line down its center) edged by a white line, 6 whitish lines (narrow, medium, narrow, medium, narrow, wide), a lateral pale-yellow line edged by dark-green, a single wide A10 tail; head green, covered with black dots, eyes cream. MATURE LARVA green, a wide middorsal dark-green band with a very narrow white line down its center, then a medium-width white band, a medium-width greenish-white band edged above by a very narrow green line, a narrow greenish-white band edged above & below by a dark-green line, (only the above bands & lines extend onto A8–10), a medium-width whitish-green band, a greenish-white line edged above & below by a green line, a wide band (light-green above the ochre-tan spiracles, green below them), a wide lateral ridge edged by green, underside of larva green, the A9–10 rear tapered into a duckbill terminated by brown posteriorly-directed hairs; head tan-green. PUPA cloudy (with whitish-green areas)-green, head horn "1.5 mm with pinkish-tan tip, tip of proboscis red-brown, proboscis extends beyond wings".1.5 mm to A5–6 joint, cremaster translucent-whitish with reddish-brown crochets, head and distal half of wings whitish-green, T2–A8 have the same bands and lines as larvae, including 1 very narrow white middorsal line on abdomen, then 1 wide white subdorsal line, 2 medium-width yellow-white lines (the upper more diffuse), 2 narrow yellow-white lines (the upper also more diffuse), 1 broad yellowish-green with spiracles, 1 narrow yellow-white lateral line, the underside cloudy-(whitish)-green.


\textit{Vyr fluctus} (Edw.). Oviposition \textit{Bouteloua (Chondrosum) gracilis}, Central Plains Experiment Station, Weld Co. Colo., June 1, 1976. Egg found on \textit{Bouteloua gracilis} (B. gracilis very common 0–100, \textit{Buchloe dactyloides} 25–100, \textit{Agropyron} [Pascopyrum] smithii 10–100, \textit{Bromus} [Avenacin] dead 5–100, live 45, \textit{Stipa viridula} 90, \textit{Bouteloua curtispetens} 95, 100, 130, \textit{Aristida purpurea} 70); Horsetooth Res., Larimer Co. Colo. May 28, 1990. Egg found on \textit{Bouteloua gracilis} (B. gracilis sward 0–100, \textit{Agropyron} [Pascopyrum] smithii 5–100, \textit{Vulpia octoflora} 15, 50, 100, \textit{Buchloe dactyloides} 5–100); egg found on \textit{Bouteloua gracilis} (B. gracilis dead 40, \textit{Buchloe dactyloides} nearest plants 2 m away); Horsetooth Res., Larimer Co. Colo. May 28, 1990; all 3 eggs at this site were about 2–3 cm above ground, on top of or near the top of tiny little plates in a broad valley bottom. Egg found \textit{Bouteloua gracilis} (common 0–100 cm, \textit{Carex pennsylvanica heliophila} 5–100 cm, \textit{Aristida} 50, 100, 100, \textit{Andropogon scoparius} 100 cm), N-facing slope near swale, Loury Bombing Range, Arapahoe Co. Colo., May 19, 1991. At the Horsetooth Res. locality I first thought that \textit{Buchloe dactyloides} is the hostplant because adults often land on large patches of this plant, which has rhizomes and spreads outward to form pure patches up to 2–5 m wide; this plant resembles \textit{Bouteloua gracilis} in its turflike growth habit and identical hair-comb ligules, but I found that \textit{B. dactyloides} can be easily identified in the field (with a hand lens or sharp eyes against a dark background) by its pilose leaves (glaebrous in \textit{B. gracilis}); careful identification revealed that \textit{B. gracilis} formed about 40% of the short turfgrass area...
at this site, B. dactyloides 66% and all three eggs were found (about 8 hours of searching produced 3 eggs) on B. gracilis even though I searched about four times more B. dactyloides (although B. dactyloides leaves often curl laterally so an egg could be hidden beneath a leaf and thus be hard to see); therefore I think B. gracilis is the main hostplant, although B. dactyloides could be occasionally eaten; as further proof, B. gracilis is associated with the species in S. Colo. (where B. dactyloides is uncommon), and B. gracilis is a better hostplant because it is mostly green from spring to fall (even in Oct.), whereas B. dactyloides is yellow-green even in late May and has half its leaves brown by the end of summer, and all the leaves are typically narrower and are only 1/2 to 2/3 the length of B. gracilis leaves (causing hotter drier conditions for larvae). Larvae no doubt live in silk tubes among the lower leaves and soil, as do Hesperia, because I have never seen an aerial nest on B. gracilis. Mature larvae hibernate. Egg whitish-green (pale green), no color change. FIRST-STAGE LARVA yellowish-cream, turning greenish-yellowish-cream after feeding, heart blue-green, A10 with 2 short 2 long setae, the shiny collar is black on margins but dull-gray in center, between collar and neck light-brown; head black. 2ND-STAGE LARVA greenish-cream; head & collar black. 3RD-STAGE LARVA similar. 4TH-STAGE LARVA similar to mature larva, light-gray-green, heart-band slightly darker on A4-8, intersegmental areas pale yellow-cream, lateral ridge yellow-cream (faintly tan on A6-10), top of A10 has a middorsal brown stripe and a supralateral brown stripe, collar black; head as in mature larva. MATURE LARVA light-gray-(slightly-bluish)-green (some larvae are much redder, being brownish-green, but brownish-red sublaterally and posteriorly [brownish-red on top of last few abd. segm.], heart-band slightly darker on A4-8, intersegmental areas pale-yellow-cream, lateral ridge (below spiracles) yellow-cream from T3-A9 and suffused with reddish-tan in middle of each segment, A8-9 (and A7 somewhat) suffused with tan, neck translucent gray, front of T1 greenish-cream, collar black (but has a short pale-green vertical streak starting from lateral end near rear—this streak faint on 4th stage), a small black oval sclerite anterodorsal to T1 spiracle, spiracles black, top of A10 has a brown middorsal stripe and a brown oblique supralateral stripe, numerous tiny setae with blackish bases, legs black, top of A10 gray with black middorsal stripe and black supralateral stripe; head black, a cream vertical stripe along coronal sulcus, cream adfrontal areas, & a cream crescent in front of eyes 3-5 & a cream spot behind them form the ventral edge of a gray flush covering most of face. PUPA (deformed) thorax pale-green tinged with brown, abdomen pale-creamy-green with cream clouds visible inside body, A4-7 more chitin-tan on rear, heart-band green on abdomen, T1 spiracle dark chitin-brown, cremaster chitin brown.

Stinga morrisoni (Edw.). 2-cm-long larva found in tube of "Stipa scribneri" leaves (15 cm above ground on 30-cm-tall clump); 2-cm-long larva found on S. scribneri in tube of "S. leaves (10 cm above ground on 20-cm-tall plant); 4 empty nests found on S. scribneri (one nest of "S. 4-5 leaves 1/3 up on 30-cm-tall clump"); empty fresh leaf tube of "S. leaves was 20 cm above ground on 30-cm-tall Stipa scribneri clump and a red wasp was in clump below nest, I searched clump and found a "2-cm-long larva in base of clump wedged in among last year's dead culm bases" 8 cm from nest, larva may have been parasitized as 1 of the 3 larvae found at site produced wasps (or possibly heavy hail and rain the night before drove the larva out of the nest); empty nest with "2nd-stage-larval head capsule found, and 3 other empty nests found, all on S. scribneri; the mature larvae died in hibernation, but are Stinga based on larval color pattern, mature larval hibernation, the A7-8 ventral powder glands, and grass host; all were on ridgetop and on N-facing slope just N of hilltop, in sun between Pinyon Pine trees on N-facing slope and NW-sloping ridge, or in partial shade under Pinyons there and on ridgetops; Bear Creek, Chaffee Co. Colo., Aug. 21-22, 1890. Stipa scribneri common but no nests or larvae seen; Cotton Creek, Saguache Co. Colo., Aug. 22, 1900. Silked-leaf nest of Stinga found on S. scribneri; Stove Mtn., "3900", El Paso Co. Colo., June 23, 1900. 2 eggs (1 under green leaf, 1 under dead straw-colored leaf) found on Stipa scribneri clump (10 & 15 cm from Oryzopsis exigua) on hilltop; Stipa scribneri occurred only on ridgetops; Chesman Peak, Jefferson Co. Colo., June 10, 1991. No eggs found on Andropogon gerardi or Andropogon scoparius, W Decker's, Jefferson Co. Colo., June 12, 1991. Mature larvae hibernate. Stipa scribneri grows on ridgetops and just north of ridgetops where there is shade at least part of the day, commonly under the canopy of Pinyon or juniper trees. It is very common in the Arkansas Canyon and hills around the San Luis Valley, where it is the commonest non-riparian "hay" (wide-leaf) grass, and seems to be the main hostplant, and Stinga is also fairly common there. S. scribneri is fairly common in the lower Wet Mts. foothills, where Stinga is scarce. But in the Front Range S. scribneri is very local (floras call it "rare", though it is common on top of the Dakota Sandstone.
hogback at the edge of the plains, fairly common in the South Platte River-canyon (on ridges NE Foxton, Reynolds Park, W Deckers, etc.), and I have also found a few plants at Mt. Vernon Historic Site, ridge S Chimney Gulch, ridge N Ralston Butte); *Stinga* is also rare in the Front Range (but was very common one year in S Platte Can.). I have not found *S. scribneri* on ridges at Tinytown and Crawford Gulch where *Stinga* occurs (is rare), and so far *Stinga* has not been found on the Dakota Hogback where *S. scribneri* is common, so there may be additional hosts in the Front Range, the most likely being *Acropyron* (*Levmus*) ambiguus. *Stinga* larvae hibernate, and refuse to feed further or pupate in lab and eventually die. Early stages (based on larvae found in nature, and reared from eggs laid by females from near Deckers and reared to mature larvae): EGG cream, hemispherical but definitely oval (asymmetrical) in dorsal view and very rounded on the bottom edges (this shape easily distinguishes the egg from other *Colo. Hesperinae*) and somewhat flat on the very top. FIRST-STAGE LARVA cream, a narrow black collar; head black, 0.6 mm wide. OLDER AND MATURE LARVA (reared from eggs and from nature) tan (slightly pinkish-tan on A7-9 and the rear of A6, with wide darker gray-tan internal subdorsal areas, somewhat translucent so that faint grayish subdorsal areas appear and most larvae are somewhat dark-greenish except near head and on rear, heart dark-gray-tan, collar very narrow & black posteriorly, collar translucent tan on anterior 40%, top of A6 brown, a lateral silvery streak of internal tracheae is visible through the translucent exoskeleton; head blackish-brown; the semi-translucent body distinguishes the larva from other *Colo. Hesperinae*.

**Hesperia.** By searching for eggs in nature, I determined hostplant choice well for several *Hesperia*, especially *H. juba*, *H. comma assimiliosa*, and *H. leonardus pawnee* in the foothills, and *H. nevada* in montane grasslands. Table 7 summarizes the hostplants found for *H. juba*, *comma*, *leonardus pawnee*, and *nevada*, and lists the grasses/sedges found at the habitats studied even when no eggs were found on them; the first three were studied at the same localities so the potential hostplants are the same, but *H. nevada* was studied at higher-altitude sites with some different grasses. The fall generation of *H. juba* prefers to oviposit on green *Bouteloua* (*Chondrosyn*) gracilis leaves, dead *Bromus* (*Anisantha*) tectorum inflorescences, and dead *Poa secunda* var. *sandbergii* clumps, whereas the spring generation of *juba* chooses several green grasses (esp. *Poa*). *H. comma assimiliosa* prefers *Carex pensylvanica heliophila*, but sometimes also oviposits on *Bouteloua gracilis* leaves and dead *Bromus* tectorum inflorescences, rarely on other grasses. High-altitude *H. comma* eat several *Carex* of the same shape as *C. p. heliophila*. *H. leonardus pawnee* prefers green *Bouteloua gracilis* and rarely other grasses (one female oviposited on a dead *Bromus* tectorum inflorescence above a *Bouteloua* *gracilis* clump). *H. leonardus montana* eats *Bouteloua* *gracilis*. *H. nevada* on the eastern slope of the continental divide prefers *Festuca saximontana*, sometimes *Koeleria macrantha*, less often *Stipa comata*; at western-slope sites *Festuca idahoensis* is chosen. *H. unces*, *P. pausana*, and *H. viridis* prefer *Bouteloua* *gracilis*; though the latter sometimes chooses *Bouteloua curtipendula*, rarely *Andropogon gerardii*. *H. otis* prefers *Andropogon gerardii*. The popularity of montane grasses is discussed under *H. nevada*. In the foothills, some Sept.-Oct. grasses are favorites of *Hesperia*, including *Bouteloua gracilis* which has wide green tender (but sometimes dry) leaves all season long (it is the favorite grass for low-altitude turfgrass-feeding butterflies and skippers in Colo.). *Carex pensylvanica heliophila* is also green and tender all summer and is preferred by *Hesperia comma*. Surprisingly, *Hesperia juba* and *comma* often oviposit on dead *Bromus* tectorum inflorescences (seed sheaths), and *H. juba* often oviposits on *Poa secunda* var. *sandbergii* clumps that are dead except for tiny green fall-emerging shoots; the explanation is that beneath these dead inflorescences and within the dead clumps are small green shoots that are actually the most tender grasses available in the habitat at the end of summer and early fall. Eggs laid on dead *Bromus* tectorum inflorescences and dead *Poa secunda* var. *sandbergii* clumps hatch, then larvae must crawl to the ground and feed on tiny green shoots that grow in fall and spring; these grasses are called "winter grasses". Most Sept.-Oct. grasses and sedges are shunned by *Hesperia*. *Bouteloua curtipendula* has wider leaves and is a good *Hesperia* host earlier in the summer, but in Sept.-Oct. most leaves are dying or are turning brown. *Stipa comata* is very common and grows in clumps but is almost never chosen apparently because the leaves are extremely tough. *Sporobolus cryptandrus* is common but never chosen apparently because it is turning brown and does not grow in clumps and has a single stalk for the lowest 10 cm of the stem (larvae prefer clumps because they provide more food and permit a silk tube nest to be constructed much easier in the plant base and upper soil—the exception, *Bromus tectorum*, is a single-stem...
grass but it grows in dense patches on disturbed areas such as gopher diggings and rain-washed slopes where the inflorescences form a canopy shading the growing shoots. Aristida purpurea grows in clumps but is almost never chosen perhaps because of biochemical reasons, or perhaps the leaves are too fine (1 mm wide). Andropogon gerardii grows in clumps and is used for oviposition by many Hesperia inae in June-July, but is never chosen in Sept.-Oct. apparently because its leaves are mostly turning brown. Andropogon (Schizachyrium) scoparius grows in clumps but is seldom chosen apparently because it is turning brown by Sept. Agropyron (Elymus="Sitanion") elymoides (="Sitanion hystrix") grows in small clumps but is refused by Hesperia perhaps (?) because the leaves are fairly narrow and tough, although it was not searched much because it is uncommon. Agropyron (Pascopyrum) smithii does not grow in clumps and has very tough leaves; no eggs were found on it. Koeleria macrantha grows in clumps and has fairly tender 3 mm wide leaves but no eggs were found on it in the foothills although it was not searched much because it is uncommon there. Poa also received almost no eggs though it was not searched thoroughly; it generally grows in moister soils than the habitats that female Hesperia prefer.

Table 7. Summary of hostplants of four Hesperia. Numbers are eggs found on or oviposited on each plant. No eggs were found on some plants.

| Hostplant | Hesp. nevada | Hesp. l. pawnee | Hesp. l. assiniboia | Hesp. comu
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</thead>
<tbody>
<tr>
<td>Bromus (Anisantha) tectorum (dead) 28</td>
<td>28</td>
<td>9</td>
<td>-2</td>
<td>28</td>
</tr>
<tr>
<td>Bromus japonicus (dead)</td>
<td>--</td>
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<tr>
<td>Bromus (Bromopsis) inermis</td>
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<tr>
<td>Vulpia octoflora</td>
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<tr>
<td>Festuca saximontana</td>
<td>--</td>
<td>--</td>
<td>97</td>
<td>--</td>
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<tr>
<td>Festuca idahoensis</td>
<td>--</td>
<td>--</td>
<td>8</td>
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<tr>
<td>Festuca arizonica</td>
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<tr>
<td>Poa pratensis</td>
<td>1</td>
<td>1</td>
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<td>1</td>
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<tr>
<td>Poa agassizensis</td>
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<tr>
<td>Poa nemoralis inter</td>
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<tr>
<td>Poa compressa</td>
<td>-2</td>
<td>--</td>
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<tr>
<td>Poa secunda sandbergii (dormant) 11</td>
<td>11</td>
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<tr>
<td>Agropyron (Pascopyrum) smithii</td>
<td>-1</td>
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<tr>
<td>Agropyron (Elymus) elymoides</td>
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<td>Agropyron (Elymus) longifolius</td>
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<tr>
<td>Agropyron (Elymus) trachycaulum</td>
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<tr>
<td>Agropyron (Levmus) ambigus</td>
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<tr>
<td>Ag. (Levmus, &quot;Elytrig.&quot;) albicans</td>
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<tr>
<td>Koeleria macrantha</td>
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<td>Danthonia parryi</td>
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<tr>
<td>Muhlenbergia montana</td>
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<tr>
<td>Sporobolus cryptandrus</td>
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<td>Oryzopsis exigua</td>
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<td>Stipa comata</td>
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<td>15</td>
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<td>Stipa cumbiana</td>
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<tr>
<td>Stipa viridula</td>
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<td>Aristida purpurea</td>
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<tr>
<td>Bouteloua (Chondrosom) gracilis</td>
<td>71</td>
<td>12</td>
<td>30</td>
<td>4</td>
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<tr>
<td>Bouteloua curtipendula</td>
<td>-2</td>
<td>5</td>
<td>3</td>
<td>--</td>
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<tr>
<td>Andropogon gerardii</td>
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<td>Andropogon (Schizach.) scoparius</td>
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<td>Carex pensylvanica heliophila</td>
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<td>31</td>
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<tr>
<td>Carex sp.</td>
<td>--</td>
<td>8</td>
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broad lateral band on abdomen; legs black, collar black, edged anteriorly by white; head black, a cream line along coronal sulcus, a darker-cream streak on adfrontal area. Pupa translucent pale-olive-green on thorax head & wings (changing to greenish-cream on outer part of wings), most of head, eye, and anterior part of T2 mottled with black-gray, exposed tip of hindlegs and proboscis orange-brown, proboscis extends to anterior third of A6, T5-A1 orange-tan, A10 green-gray, rest of abdomen cream-tan, a green-gray sinuous middorsal band on abdomen, some slightly-darker supralateral and lateral and sublateral patches on abdomen, the usual hairy bump near midventral line on A455, cremaster orange-brown, rather long (with straight lateral margins) and fairly wide (H. juba also has a fairly long cremaster, whereas that of H. ottoe and H. viridis is shorter so the lateral margins are convex), the crochets long and unhooked or only slightly hooked; pupa later becomes yellow, abdomen yellow-tan (light yellow-brown on top of abdomen and ventrally on A7-10) with prominent black spiracles, wings thorax orangish-tan, mouthparts light brown, the same dark motting as before (plus middle of T2(now dark brown as well).

Hesperia juba (Scud.). Oviposition Poa pratensis, Fort Collins, Larimer Co., Colo., June 5, 1976. Oviposition (preoviposition?) 12:50 Poa anasaitisensis (W), 5 mi. SE Bailey, Park Co. Colo., May 31, 1977. Preoviposition, bent abdomen to Distichlis spicata var. stricta, Jones Hole, Dinosaur Nat. Mon., Utah, June 11, 1973. Preoviposition or oviposition 12:35 on dead Bromus (Anisantha) tectorum inflorescence and two eggs found on dead B. tectorum inflorescence stalks (in 30 X 50 cm patch of dead B. tectorum; Sporobolus cryptandrus (W) clump 15 cm away, Aristida purpurea (W) tiny clump 15 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 23, 1987. Oviposition (lot #1) 11:08 on dead Bromus tectorum stem (next to 15 cm rock), and 1 egg found on dead B. tectorum inflorescence, both in large B. tectorum sward downslope from Cercocarpus montanus bush (Stipa comata (W) several clumps 15-60 cm away, Bouteloua curtipendula uncommon 30 & 80 cm away, Sporobolus cryptandrus (W) rare 50 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. 3 eggs (lot #2) found on dead Bromus tectorum inflorescences next to and near 20-cm-wide rock in B. tectorum sward in small clearing below Cercocarpus bush (Stipa comata clumps 10-40 cm away, Sporobolus cryptandrus clumps 70 cm away, Bouteloua (Chondrosoma) gracilis 1 m away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. 1 egg (lot #3) found on dead Bromus tectorum inflorescence in B. tectorum sward above 20-cm rock downslope from Cercocarpus bush (Bouteloua curtipendula 6 small clumps were at rock edge and 15-40 cm away, Stipa comata 4 clumps 10-25 cm away, Sporobolus cryptandrus 70 cm & 1 m away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. 1 egg (lot #4) found on dead Bromus tectorum leaf above a 25-cm rock on B. tectorum sward downslope from Cercocarpus shrub (Agropyron [Paspopyrum] smithii var. mollis (W) 30 cm away, Bouteloua gracilis 35 & 50 cm away, Sporobolus cryptandrus 1 m away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. 1 egg (lot #5) found on dead Bromus tectorum inflorescence in B. tectorum sward 5 cm from 30 X 15 cm rock downslope from Cercocarpus bush (Bouteloua curtipendula many clumps 2-40 away, Stipa comata 15 cm away, Sporobolus cryptandrus 40 cm & 1 m away, Andropogon (Schizachyrium) scoparius 60 cm away, Carex probably pensylvanica heliophila 1 m away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. Egg (lot #6) found on dead Bromus tectorum inflorescence 5 cm above a 15 X 10 cm rock in big B. tectorum sward downslope from Cercocarpus bush (Stipa comata 5 clumps 5-50 cm away, Agropyron [Elvynus, "Elfricia"] dasystachyum (possibly trachycaulum) 3 clumps 30 cm away, Sporobolus cryptandrus 2 patches 1 m away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. Egg (lot #8) found on dead Bromus tectorum inflorescence clump 20 X 15 cm rock downslope from Cercocarpus bush in B. tectorum sward (Stipa comata common 5-70 cm away, Sporobolus cryptandrus several 60-70 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. Oviposition (lot #12) 11:17 on dead Bromus tectorum inflorescence in B. tectorum sward 70-100 cm from Cercocarpus bushes (Sporobolus cryptandrus common 15-100 cm away, Agropyron [Elvynus, "Elfricia"] albicans (W) 2 small plants 20 cm away, Stipa comata clump 50 m away), prior to this oviposition the female hovered over dead B. tectorum in several other clearings among Cercocarpus also (if the hovering female runs out of clearing she zooms over the bushes to the next clearing and hovers again), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Egg (lot #14) with larva chewing its way out found on underside of Bouteloua gracilis leaf below 20 cm rock in moderate Bromus tectorum sward downslope from Cercocarpus bush (B. gracilis was all around, Sporobolus cryptandrus 2 clumps 70-80 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Egg (lot #15) found on dead Bromus tectorum inflorescence beside 30 cm rock in thick B. tectorum sward Cercocarpus (H. juba often prefers to oviposit in clearings several meters wide between Cercocarpus bushes) (Stipa
Egg (lot #16) found on dead Bromus tectorum inflorescence in B. tectorum sward above a 40 CM rock in B. tectorum sward downslope from Cercocarpus clearing on a SE-facing point of ridge (Andropogon gerardii) 5 clumps 20-55 cm away, Stipa comata (W) common 25-100 cm away, Sporobolus cryptandrus (W) 5 clumps 25-50 cm away, dead Bromus japonicus Thunberg 2 dead shoots 30-56 cm away), Red Rocks, Jefferson Co. Colo., Sept. 30, 1987. Egg (lot #26) found on underside of Bouteloua gracilis leaf among large clump of it (dead Bromus japonicus dead 3 & 20 cm away, Stipa comata 2 clumps 40 cm away, dead Bromus tectorum 20 & 30 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. 2 eggs (lot #27) found on Bouteloua gracilis leaves in a 25 cm row of it (dead Bromus tectorum rare 5 cm away, dead Bromus japonicus occasional 10-30 cm away, Stipa comata common 20-100 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. 2 eggs (lot #28) found on Bouteloua gracilis (B. gracilis common 20-70 cm away, Bouteloua curtipendula 3 clumps 45-50 cm away, Stipa comata 3 clumps 45-80 cm away, Agropyron [Elymus="Sitanion"] glyoides ["Sitanion hystrix"]W 2 clumps 10-40 cm away, dead Bromus tectorum 30 cm away, Bouteloua curtipendula big clump 50 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #30) found on Bouteloua gracilis (B. gracilis common 20-70 cm away, Bouteloua curtipendula 3 clumps 45-50 cm away, Stipa comata 3 clumps 45-80 cm away, Agropyron [Elymus="Sitanion"] glyoides ["Sitanion hystrix"]W 2 clumps 10-40 cm away, dead Bromus japonicus scattered all over, dead Bromus tectorum rare 20-60 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #31) found on Bouteloua gracilis 25 cm clump (B. gracilis 2 large clumps 20 & 30 cm away, dead Bromus japonicus scattered all over 15 cm onward, Agropyron [Elymus="Sitanion"] glyoides ["Sitanion hystrix"]W 2 clumps 50 cm away, Bouteloua curtipendula clump 59 cm away, Stipa comata 2 clumps 50-65 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #36) found on Bouteloua gracilis (B. gracilis all over, dead Bromus japonicus uncommon 10 cm onward, Stipa comata 5 clumps 50-90 cm away, Bromus tectorum uncommon 2 cm onward), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #37) found on Bouteloua gracilis (B. gracilis common 5-100 cm away, Stipa comata common 25-50 cm onward, dead Bromus japonicus uncommon 10 cm onward, dead Bromus tectorum common 30 cm onward), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #38) with Trichogrammatid exit hole found on Bouteloua gracilis (B. gracilis all over, Stipa comata common 30-70 cm away, dead Bromus japonicus scattered all over 7 cm onward, dead Bromus tectorum scattered all over 7 cm onward, Aristida purpurea clump 90 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. 3 eggs (lot #39) (one with Trichogrammatid exit hole) found 30 cm apart on Bouteloua gracilis (B. gracilis thick, dead Bromus japonicus scattered 10 cm onward, dead Bromus tectorum scattered 10 cm onward, Sporobolus cryptandrus 2 clumps 40-100 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #40) found on Bouteloua gracilis (B. gracilis thick, dead Bromus tectorum scattered 10 cm onward, dead Bromus japonicus scattered 2 cm onward, Sporobolus cryptandrus 3 clumps 30-50 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. 2 eggs (lot #42) found on Bouteloua gracilis (B. gracilis thick, dead Bromus japonicus scattered, dead Bromus tectorum common 20 cm onward, Stipa comata common 15-100 cm away, Sporobolus cryptandrus 3 clumps 70-100 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #50) found on Bouteloua gracilis (B. gracilis common downslope, dead Bromus tectorum thick all over, Stipa comata (W) 4 clumps 50-80 cm away), lookout Mtn., Jefferson Co. Colo., Oct. 3, 1987. Egg (lot #53) found on dead...
In thick *B. tectorum* sward in hollow among boulders and 3 *Carcocarpus* bushes on same ridge point as lot 109 (*B. tectorum* green shoots 30 cm away, *Stipa comata* 2 clumps 45-80 cm away), Cherry Gulch, Jefferson Co. Colo., Oct 7, 1987. Egg (lot #111) found on dead *Bromus tectorum* seed shell in thick *B. tectorum* sward between boulder and 3 *Carcocarpus* bushes on same ridge point as lot 109 (*B. tectorum* shoots under egg, *Stipa comata* clump 70 cm away), Cherry Gulch, Jefferson Co. Colo., Oct 7, 1987. This ridge point (lots 109-111) was the only place to have a thick *B. tectorum* sward and was the only place to have *Hesperia* eggs despite searching elsewhere. Egg (lot #112) found on *Bouteloua gracilis* in large clearing (*B. gracilis* common 0-80 cm away, *Stipa comata* common 30-100 cm away, *Aristida purpurea* clump 1.2 m away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. 4 eggs (lot #113) on tiny 3 cm *Bouteloua gracilis* clump in broad clearing edged by juniper and *Carcocarpus* (*B. gracilis* common 10-100 cm away, *Stipa comata* common 25-100 cm away, *Bouteloua curtipendula* clump 1 m away, *Aristida purpurea* clump 50 cm away, *Agropyron [Pascopyrum] smithii* 80-100 cm away, dead *Bromus tectorum* uncommon 30 cm onward), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #114) found on *Bouteloua gracilis* (*B. gracilis* 70-80 cm away, *Stipa comata* common 25-50 cm away, *Agropyron [Pascopyrum] smithii* common 25-100 cm away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #115) found on *Thlaspi arvense* stem in *Bouteloua gracilis* clump in broad clearing (*B. gracilis* common 0-100 cm away, *Stipa comata* common 15-70 cm away, *Aristida purpurea* clump 50 cm away, dead *Bromus japonicus* clump 45 cm away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #116) found on *Bouteloua gracilis* in broad clearing (*B. gracilis* common 0-90 cm away, *Bouteloua curtipendula* frequent 20-70 cm away, *Stipa comata* common 25 cm onward, *Agropyron [Elymus, 'Elvricia'] albus* common 40-100 cm away, *Andropogon gerardii* clump 1 m away, dead *Bromus tectorum* scattered 40 cm onward), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #117) found on *Bouteloua gracilis* in broad clearing (*B. gracilis* common 0-100 cm away, *Bouteloua curtipendula* 2 clumps 20-80 cm away, *Stipa comata* common 20-80 cm away, dead *Bromus tectorum* scattered 10 cm onward), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Hatched egg (lot #118) found on *Bouteloua gracilis* in broad 4 m clearing (*B. gracilis* common 0-100 cm away, *Stipa comata* common 25-100 cm away, dead *Bromus tectorum* scattered 5 cm onward, *Carex* probably *psyllus* *pensylvanica* *heliophila* 2 clumps 90 cm away, *Bouteloua curtipendula* clump 1.2 m away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #119) found on *Bouteloua gracilis* in broad juniper- *Carcocarpus* clearing (*B. gracilis* common 0-80 cm away, *Stipa comata* common 35-100 cm away, dead *Bromus tectorum* scattered 20 cm away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #120) found on *Bouteloua gracilis* in large *B. gracilis* sward 0-100 cm away (*Carcocarpus* and junipers 1-4 m away) (dead *Bromus tectorum* scattered 20 cm onward, *Stipa comata* common 30-100 cm away, *Bouteloua curtipendula* 2 clumps 1.2 m away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #121) found on *Bouteloua gracilis* in small *Carcocarpus*-juniper clearing (*B. gracilis* 0-50 cm away, *Stipa comata* common 15-100 cm away, *Carex* probably *psyllus* *pensylvanica* *heliophila* 90-100 cm away, *Aristida purpurea* clump 1 m away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #122) found on *Bouteloua gracilis* in open area (*B. gracilis* common 0-100 cm away, *Stipa comata* frequent 15-100 cm away, dead *Bromus japonicus* scattered 0 cm onward, dead *Bromus tectorum* uncommon 20 cm onward, *Carex* probably *psyllus* *pensylvanica* *heliophila* 1 m away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #123) found on *Bouteloua gracilis* in open area (*B. gracilis* common 0-100 cm away, *Stipa comata* 10-100 cm away, dead *Bromus japonicus* scattered 20 cm onward, dead *Bromus tectorum* uncommon 20 cm away, *Carex* probably *psyllus* *pensylvanica* *heliophila* 1 m away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #124) found on *Bouteloua gracilis* in open area (*B. gracilis* common 0-100 cm away, *Stipa comata* common 15 cm onward, dead *Bromus tectorum* rare 10-50 cm away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #125) found on *Bouteloua gracilis* in open area (*B. gracilis* common 0-70 cm away, *Stipa comata* common 10-100 cm away, dead *Bromus tectorum* rare 50-90 cm away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. Egg (lot #126) found on *Bouteloua gracilis* in broad clearing (*B. gracilis* common 0-100 cm away, *Stipa comata* common 20 cm onward, dead *Bromus tectorum* rare 40-90 cm away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. 2 eggs (lot #127) found on *Bouteloua gracilis* in clearing (juniper 3 m away, 2 *Carcocarpus* 1 m away) (*B. gracilis* common 0-50 cm away, *Carex* probably *psyllus* *pensylvanica* *heliophila* 70-120 cm away, *Stipa comata* common 50-100 cm away, *Carex* probably *psyllus* *pensylvanica* *heliophila* 3 clumps 60-100 cm away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987. 2 eggs (lot #128) found on *Bouteloua gracilis* in open area (*B. gracilis* common 0-50 cm away, *Stipa comata* common 50 cm onward, dead *Bromus tectorum* 40-100 cm away, *Carex* probably *psyllus* *pensylvanica* *heliophila* 3 clumps 60-100 cm away), Red Rocks, Jefferson Co. Colo., Oct 8, 1987.
Bouteloua gracilis (B. gracilis common 0-100 cm away, dead Bromus tectorum scattered 15 cm onward), Red Rocks, Jefferson Co. Colo., Oct. 8, 1987. Egg (lot #138) found on Bouteloua gracilis (B. gracilis common 0-100 cm away, dead Bromus tectorum scattered 15 cm onward), Red Rocks, Jefferson Co. Colo., Oct. 9, 1987. Egg (lot #142) found on Bouteloua gracilis on open area below cliff (B. gracilis common 0-70 cm away, Stipa comata 2 clumps 50-55 cm away, dead Bromus tectorum 4 spots 15-70 cm away, Lycurus phileoides [W] 4 clumps 80-120 cm away [a rare grass], Red Rocks, Jefferson Co. Colo., Oct. 9, 1987. Egg (lot #143) found on Bouteloua gracilis clump with many inflorescences and other tall clutter (B. gracilis frequent 0-80 cm away, dead Bromus tectorum very common 5 cm onward, Sporobolus cryptandrus common 20-80 cm away, dead Bromus japonicus scattered 20 cm onward), Red Rocks, Jefferson Co. Colo., Oct. 9, 1987. 3 eggs (lot #144) found on Bouteloua gracilis in nook of cliff boulder in Cercocarpus-juniper clearing (B. gracilis 0-40 cm away, dead Bromus tectorum common 10 cm onward, dead Bromus japonicus scattered 10 cm onward, Stipa comata 2 clumps 90-100 cm away), Red Rocks, Jefferson Co. Colo., Oct. 9, 1987. Egg (lot #146) found on dead Bromus tectorum inflorescence (seed) in thick B. tectorum sward below 50 cm rock on sloping ridgetop (in broad clearing of boulder 1.5 m upslope and 4 Cercocarpus 3.5-4 m away) Bouteloua curtipendula 5 clumps 5-100 cm away, Andropogon gerardii common 45-100 cm away, Sporobolus cryptandrus 3 clumps 90-100 cm away, Stipa comata 3 clumps 60-80 cm away), Indian Gulch 1 mi. W Golden, Jefferson Co. Colo., Oct. 13, 1987. Oviposition 11:25 on dead Bromus tectorum inflorescence (on underside of horizontal peduncle at base of drooping spikelet pedicel) 10 cm above ground, among rocks in large B. tectorum sward on S-facing slope, several bushes and trees 2-3 m away, (B. tectorum 0-10 m, no green B. tectorum seedlings present, Sporobolus cryptandrus 20, 40, 50, 50, 90, 90, 1 m, Stipa comata 80, Bouteloua curtipendula 30, 40-50 common), Apex Gulch, Jefferson Co. Colo., Sept 3, 1988. Oviposition 13:47, she hovered for 1-2 minutes over grassland lacking dead grasses with little Bouteloua gracilis, landed on dormant Poa secunda var. sandbergii (sandbergii is a synonym of secunda in the latest Colo. flora, but is listed as a species in a Great Plains flora and a North American plant checklist, so I will call it a variety here) and laid egg (which later hatched) on horizontal dead leaf 2 cm above ground, and another egg found there (which failed to hatch) on vertical broader dead P. secunda var. sandbergii leaf 2 cm above ground (P. secunda var. sandbergii 8, 8, 15, 15, 20, 20, 30, 30, 50, 50-80 common, all dormant, Stipa comata 15, 20, common 30 cm onward, Sporobolus cryptandrus 15, Carex probably pensylvanica heliophila 80, Aristida purpurea 10, 15, 40, 40, 45, 60, 60, Oryzopsis exigua 20, 30); 1 egg (which failed to hatch) found on vertical green Aristida purpurea leaf and 2 eggs (which later hatched) found on horizontal dead Poa secunda var. sandbergii leaf (all 3 eggs in 7 cm wide clump of dormant P. secunda var. sandbergii, 12-15 cm from oviposition 13:47) (P. secunda var. sandbergii 0-10, 20, 50, 55-85, Stipa comata 15, 15, 15, etc. thick, Sporobolus cryptandrus 25, Oryzopsis exigua 40, 45, Aristida purpurea 7-8, 60, 70); egg (which did not hatch) found on green Stipa comata leaf 12 cm above ground (8-15 cm from last 3 eggs and 15 cm from oviposition 13:47) (S. comata 10, 20, 20, 30, 30 cm onward common, dormant Poa secunda var. sandbergii 8-15, 15, 45-75, Aristida purpurea 15, 20, 65, 70, Oryzopsis exigua 40, 50, Sporobolus cryptandrus 20); egg (which later hatched) found (30 cm from previous Stipa comata egg, 40 cm from oviposition 13:47) on green Aristida purpurea leaf (A. purpurea 0-10, 30, 30, 30-50, 90 common, S. comata 8, 10, 15, 20, 20, 20, 30 etc. common, dormant Poa secunda var. sandbergii 30, 30-50, 40, etc., Oryzopsis exigua 50, 60, Sporobolus cryptandrus 50); all on gentle N-facing grassland on sloping small ridgetop just SE Turkey Creek Can. entrance (S. Cooley gravel quarry), Jefferson Co. Colo., Sept. 16, 1988. Egg (which later hatched) found 8 cm above ground on dead Poa secunda var. sandbergii sheath (dormant P. secunda var. sandbergii plants with new 1-2 cm high green shoots 0-8, 5, 5, 8, 15, 20, 25, etc. onward thick, Aristida purpurea 8-12, Sporobolus cryptandrus 70, Stipa comata 3, 8, 10, 10-15, 15, 15, 19, 20, 20 cm onward thick, Bouteloua gracilis 25-3 m thick on one side of egg); egg (which did not hatch) found on dead Poa secunda var. sandbergii leaf 2 cm above ground (P. secunda var. sandbergii dormant plants with many new shoots 0-20, 10, 12, 15 etc. thick all over, Sporobolus cryptandrus 30, 35, 50, 60, Stipa comata 7-15, 8, 13, 20, 25 etc. thick all over, Aristida purpurea 25, 65, 95, Poa compressa 8-15, 20); the previous two eggs were on gentle N-facing sloping small ridgetop grassland place just SE of the eggs of Sept. 15, 1988; egg (which later hatched) found on dead vertical Poa secunda var. sandbergii blade 2 cm above ground (P. secunda var. sandbergii 0-1 m very thick, tiny green shoots 4, 4, 4 etc., Sporobolus cryptandrus 12, 20-25, Stipa comata 20, 25, 30, 35, 35, 90, Agropyron [Pascopyrum] smithii 10, 10, 15, 15, 20, 25, Aristida purpurea 10, 30, 85, 1 m, dead Bromus japonicus 15, Bouteloua gracilis 35-1 m); egg (which later...
of some floras, but most recent floras treat sandbergii as a synonym of secunda,

Red Rocks, Jefferson Co. Colo., Sept. 50; oviposition 12:37 on probably Agropyron

Koeleria, perhaps Agropyron smithii--and

Carex probably Pennsylvanica heliophila 10, 17, 20, 25, 30, 35, etc., Agropyron

Carex with new shoots 10-15, 20-30, 30); all just SE Turkey Creek Can. entrance

E. palustris 10-100); the last 5

in 3.5 hours of searching for eggs at

in Moister spots) so the sprouting leaves are


in 3.5 hours of searching for eggs at

July (rarely as late as Oct.), and sprout in late summer-fall (sprouting earlier

Bouteloua gracilis leaves (leaves not

Bouteloua gracilis Most eggs are laid on

Carex probably Pennsylvanica heliophila 10, 17, 20, 25, 30, 35, etc., Agropyron

Bouteloua gracilis leaves 3 cm above ground (B. gracilis 0-50,

Carex probably Pennsylvanica heliophila 20, 20-1 m, 30, 30, 40, 40, Poa annua

Carex with new shoots 10-15, 20-30, 30); all just SE Turkey Creek Can. entrance

E. palustris 10-100); the last 5

in 3.5 hours of searching for eggs at

in 3.5 hours of searching for eggs at

in 3.5 hours of searching for eggs at

Carex probably Pennsylvanica heliophila 20, 20-1 m, 30, 30, 40, 40, Poa annua


in 3.5 hours of searching for eggs at

in 3.5 hours of searching for eggs at

in 3.5 hours of searching for eggs at

Bouteloua gracilis Most eggs are laid on

Bouteloua gracilis Most eggs are laid on

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in 3.5 hours of searching for eggs at

in 3.5 hours of searching for eggs at

in 3.5 hours of searching for eggs at
Grasses available in March-Mid May in Colorado, when true overwintering adult butterflies are adults, and that adult overwinterers were the adults caught in June. My research obviously proves that juba overwinters as young larvae (probably about 2nd stage usually, probably 1st and 3rd stage sometimes). H. juba and H. leonardus pawnee eggs always hatch in the lab (whereas H. comma eggs hibernate, though some hatch after a month or two in the lab), and juba larvae grow very fast (the fastest Hesperia) and pupate as early as late Nov.-early Dec. in the lab for an oviposition to adult time of as little as two months, versus three months or more in most Hesperia (Scott 1975c). Thus juba larvae have plenty of time to mature in fall and spring to produce adults in mid May-June. Additional strong proof that juba adults do not hibernate is that adults are not found in March–mid May in Colorado, when true overwintering adult butterflies are common. Thus there are two yearly flights in Colo. Early stages: E86 white, no color change, no basal flange or a very weak one. FIRST-STAGE LARVA yellowish-cream, becoming creamy-tan or greenish-tan, neck and T1 brown with black collar edged anteriorly by white, anterior setae on A10 short (slightly shorter than H. comma); head black. All Hesperia first-stage larvae have four setae in the following pattern on the prothoracic shield: three anterior setae (D1, XD1, and XD2) and one smaller posterior setae (D2) behind XD1 (thus the drawings of C. G. MacNeill (1984) for H. comma etc. need some improvement). MATURE LARVA dark-brown with a slight greenish tinge, four transverse brownish-green ridges on rear of each segment, middorsal 1-mm-wide dark-brown line on abdomen (this a 1-mm-wide green band on one larva), prothoracic shield black, narrowly-edged anteriorly with white, tiny white curves near T1 spiracle, spiracles black; head black, a cream stripe along coronal sulcus. PUPA dark-brown, abdomen ochre with rear of each segment chitin-brown, a middorsal brown line on A2-7 and a weak one on T2-1, abdomen covered with transverse brown dashes, between A6 & A7 are 2 ventral black patches, a brown dot is ventroposteral of each abdomen spiracle, eye has tan motting, two tan patches are on top of head, top of thorax mottled tan (with long brown streaks on T1 and a long anteriorly-convex bowl-shaped brown curve on top of T2 and another on T3), proboscis extends 0.5-1 mm beyond wings; one pupa was dark-green (abdomen greenish-ochre) when young, turning almost-unspotted tan (wings pale-brown); cremaster fairly long with straight lateral margins and hooked crockets. The cremaster varies in shape in Hesperia: H. uncas has a long cremaster also but it has unhooked crochets; H. ottoe and H. viridis have a short narrow-tipped cremaster (with convex lateral margins), and H. comma assiniboia, H. comma colorado, H. pahaska, H. leonardus montana, and H. leonardus pawnee also have a narrow cremaster with hooked crochets (which is evidently short also, Scott 1975c); MacNeill (1984) stated that H. columba and H. lindeyi have a long cremaster with hooked crochets.

Hesperia comma oroplate Scott. Oviposition 11:19 Bouteloua (Chondrosia) gracilis leaf underside (B. gracilis 0-100, Elymus=Sitania) ?gonifolius 20, 25); 2 eggs found on Bouteloua gracilis (B. gracilis 0-100, Stipa comata both "10, "40 cm) Bear Creek, Chaffee Co. Colo., Sept. 5, 1990. Carex occurs at this site only on N-facing slopes, where H. comma also flies.

Hesperia comma assiniboia (Lyman) (=ochracea Lindsey). One egg found on...
Andropogon (Schizachyrium) scoparius (previously misidentified as A. saccharoides [B]), 1 mi. N Cheesman Res., Sept. 3, 1971. 8 eggs found on Carex sp. (B), 3 eggs found on Andropogon (Schizachyrium) scoparius (previously misidentified as A. saccharoides [B]), 3 eggs found on Arenaria pendiculata Gray (G) leaves, all eggs with the characteristic basal flange of comma, and one oviposition on Bouteloua (Chondrogon) gracilis (B), all 1 mi. N Cheesman Res., Jefferson Co. Colo., Sept. 7, 1971. Oviposition 11:45 B. gracilis (B), Nighthawk, Douglas Co. Colo., Sept. 1, 1970. Oviposition 12:01 on dead Bromus (Anisantha) tectorum inflorescence stalk under Berberis repens (a few B. tectorum green shoots were there, Andropogon gerardii clump 20 cm away, Agropyron [Pascopyrum] smithii 20 & 30 cm away, Andropogon (Schizachyrium) scoparius 1 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 23, 1987. Oviposition 12:30 on underside of Stipa comata leaf (Bouteloua gracilis 25 cm away, Poa sp. 25 cm away, Andropogon gerardii 1 m away), Van Bibber Creek, Jefferson Co. Colo., Sept. 23, 1987. Oviposition 10:58 on underside of Poa pratensis (W) leaf, Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. 1 egg (lot #2) found on dead Bromus tectorum inflorescences near 20-cm-wide rock in B. tectorum sward in small clearing downslope from Cercocarpus bush (Stipa comata 5 clumps 10-40 cm away, Sporobolus cryptandrus 5 clumps 70 cm away, Bouteloua gracilis 1 m away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. 1 egg (lot #3) found on Bouteloua curtipendula leaf beside 20 cm rock in Bromus tectorum sward downslope from Cercocarpus bush (B. curtipendula 6 small clumps were at rock edge and 15-40 cm away, Stipa comata 4 clumps 10-25 cm away, Sporobolus cryptandrus 70 cm & 1 m away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. 1 egg (lot #4) found on dead Bromus tectorum inflorescence above a 25-cm rock on B. tectorum sward downslope from Cercocarpus shrub (Agropyron [Pascopyrum] smithii [W] 30 cm away, Bouteloua gracilis 35 & 50 cm away, Stipa comata 40 & 40 cm away, Sporobolus cryptandrus 1 m away), Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. 5 eggs (lot #5) found 1-2 cm above ground on side of Carex pensylvanica heliophila (W) leaves, at lower edge of large boulder, Van Bibber Creek, Jefferson Co. Colo., Sept. 24, 1987. 2 eggs (lot #10) found on underside of Bouteloua gracilis leaves, in a sward of B. gracilis and a little dead Bromus tectorum (Sporobolus cryptandrus two patches 30 cm away, Stipa comata [W] one clump 25 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Egg (lot #11) found on underside of dead Bromus tectorum inflorescence in B. tectorum sward above a 30 X 20 cm rock, 80 cm downslope from Cercocarpus bush (Stipa comata 5 clumps 0-30 cm away, Sporobolus cryptandrus clump 45 cm away, Bouteloua curtipendula 50 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Egg (lot #13a) found on underside of Andropogon (Schizachyrum) scoparius leaf in 30 X 20 cm clump of it (A. [S.] scoparius 2 other clumps 15-30 cm away, Stipa comata 2 clumps 25-30 cm away, Sporobolus cryptandrus 2 clumps 30 & 60 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Egg (lot #13b) found on underside of Andropogon (Schizachyrum) scoparius leaf (A. [S.] scoparius 2 other clumps 25 cm away, Stipa comata clump 15 cm away, Sporobolus cryptandrus 2 clumps 40 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Egg (lot #18) found on dead Bromus tectorum inflorescence stalk next to 15 cm rock in B. tectorum sward in Cercocarpus clearing (Stipa comata common 5-40 cm away, Sporobolus cryptandrus common 15-70 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Egg (lot #19) found on dead Bromus tectorum inflorescence stalk beside 35 cm rock in B. tectorum sward, in Cercocarpus clearing (Sporobolus cryptandrus common 50-60 cm away, Stipa comata 4 clumps 25-50 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Egg (lot #20) on dead Bromus tectorum inflorescence stalk sticking out of a small Stipa comata clump beside 50 cm rock in B. tectorum sward in clearing among Cercocarpus (S. comata several 10-90 cm away, Andropogon gerardii common 30-70 cm away, Bouteloua gracilis clump 40 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Old egg (lot #22) with Trichogrammatid wasp exit hole found on dead Bromus tectorum inflorescence above 1 m wide rock pile in B. tectorum sward, 60 cm from Cercocarpus bush (Sporobolus cryptandrus common 20-100 cm away, Stipa comata 40-100 cm away), Van Bibber Creek, Jefferson Co. Colo., Sept. 25, 1987. Egg (lot #54) found on Carex probably pensylvanica heliophila clump in Stipa comata common 30-100 cm away, dead Bromus japonicus common scattered 5 cm onward, dead Bromus tectorum 2 plants 40-50 cm away, Bouteloua curtipendula clump 30 cm away, Bouteloua gracilis clump 80 cm away), Lookout Mtn., Jefferson Co. Colo., Oct. 3, 1987. Egg (lot #55) found on Carex probably pensylvanica heliophila (C. p. heliophila thick, Stipa comata common 30-100 cm away, dead Bromus japonicus common scattered 5 cm onward, dead Bromus tectorum 2 plants 40-50 cm away, Bouteloua curtipendula 2 clumps 20-40 cm away, dead Bromus japonicus common all over, Bouteloua gracilis clump 40 cm away), Lookout Mtn., Jefferson Co. Colo., Oct. 3, 1987. Egg (lot #56) found on dead inflorescence in Stipa comata (W) clump (S.
Bouteloua curtipendula common 30-100 cm away, Agropyron [s.]{Levys} ambiguous 5-100 cm away, dead Bromus tectorum common 5-100 cm away, Andropogon gerardii 5 clumps 50-70 cm away, Sporobolus cryptandrus 3 clumps 50-70 cm away), Lookout Mtn., Jefferson Co. Colo., Oct. 3, 1987. Egg (lot #75) found on Bouteloua gracilis in B. gracilis sward (dead Bromus tectorum common 5 cm onward, Aristida purpurea clump 80 cm away, dead Bromus japonicus clump 30 cm away, Bouteloua curtipendula 4 clumps 50-90 cm away, Stipa comata common 50-100 cm away), Chimney Gulch, Jefferson Co. Colo., Oct. 5, 1987. Egg (lot #80a) found on Carex probably p. heliophila in sward of it (dead Bromus tectorum common 15 cm away, E face Lookout Mtn., Jefferson Co. Colo., Oct 5, 1987. Egg (lot #80b) found on Carex probably p. heliophila at edge of sward of it (dead Bromus japonicus scattered 10 cm onward, Stipa comata 3 clumps 25-55 cm away, Agropyron [s.]{Levys} ambiguous 1 m away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 5, 1987. Egg (lot #81) found on Carex probably p. heliophila on edge of sward of it (dead Bromus tectorum common 5 cm onward, dead Bromus japonicus common 0 cm onward, Sporobolus cryptandrus 2 clumps 50-90 cm away, Agropyron [s.]{Levys} ambiguous common 35-80 cm away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 5, 1987. Egg (lot #82) found on Carex probably p. heliophila (dead Bromus japonicus scattered 0-100 cm away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 5, 1987. Egg (lot #83) found on Carex probably p. heliophila (dead Bromus tectorum thick 5 cm onward, dead Bromus japonicus common 15 cm onward, Agropyron [s.]{Levys} ambiguous common 50-100 cm away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 5, 1987. Egg (lot #85) found on Carex probably p. heliophila (dead Bromus tectorum thick 5 cm onward, dead Bromus japonicus common 15 cm onward, Andropogon gerardii common 50-100 cm away, Stipa comata common 50-100 cm away, E face Lookout Mtn., Jefferson Co. Colo., Oct. 5, 1987. Egg (lot #86) found on Carex probably p. heliophila (dead Bromus tectorum thick, Stipa comata common 30-100 cm away, E face Lookout Mtn., Jefferson Co. Colo., Oct. 5, 1987. Egg (lot #88) found on Carex probably p. heliophila (dead Bromus tectorum inflorescence above a 30 cm wide rock in a very thick B. tectorum sward in a 2 m wide Carex probably pensylvanica heliophila clearing (B. tectorum green shoots all over, Bouteloua gracilis common 5 cm onward, Stipa comata clump 30 cm away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. 2 eggs (lot #99) on Carex probably p. heliophila (dead Bromus japonicus common 10-45 cm away, Stipa comata common 20-100 cm away, Agropyron [s.]{Levys} ambiguous clump 1 m away, dead Bromus japonicus common 5 cm onward), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. Egg (lot #100) found on Carex probably p. heliophila (dead Bromus japonicus scattered 10 cm onward, Agropyron [s.]{Levys} ambiguous common 3-100 cm away, Andropogon gerardii few 50-100 cm away, Sporobolus cryptandrus clump 60 cm away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. Egg (lot #101) found on Bouteloua gracilis in 40 cm clump of it (Sporobolus cryptandrus 3 clumps 35-70 cm away, Stipa comata 4 clumps 50-100 cm away, dead Bromus japonicus scattered 3 cm onward, dead Bromus tectorum uncommon 15 cm onward), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. Egg (lot #102) found on Bouteloua gracilis in big sward of it (dead Bromus tectorum thick 5 cm onward, Stipa comata 2 clumps 50-100 cm away, dead Bromus japonicus rare 30-50 cm away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. 2 eggs (lot #105) on Carex probably p. heliophila (dead Bromus japonicus common 30-100 cm away, dead Bromus tectorum common 20 cm onward, dead Bromus japonicus very common 20 cm onward, Agropyron [s.]{Levys} ambiguous clump 1 m away, Stipa comata clump 1 m away, Bouteloua curtipendula 40-100 cm away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. Egg (lot #104) found on Bouteloua gracilis in 35 clump of it (B. gracilis common 0-100 cm away, dead Bromus japonicus common 10 cm onward, dead Bromus tectorum uncommon 15 cm onward, Bouteloua curtipendula clump 80 cm away, Agropyron [s.]{Levys} ambiguous 2 clumps 50-100 cm away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. Egg (lot #105) found on Bouteloua curtipendula at lower edge of 1 m B. curtipendula sward (dead Bromus japonicus common 10 cm onward, Bouteloua gracilis 50-80 cm away, dead Bromus tectorum uncommon 40 cm onward), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. Egg (lot #106) found on Carex probably p. heliophila (dead Bromus japonicus common 5 cm onward, Bouteloua curtipendula common 20-100 cm away, Sporobolus cryptandrus clump 1.2 m away), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. Egg (lot #107) found on single tiny stem of Stipa comata 1 mm from Bouteloua curtipendula in B.
**Hesperia curtipennis** (B. curtipennis rather than S. comata must be considered the host here) (S. comata 3 other clumps 35-45 cm away, Koeleria macrantha (Wl) 2 clumps 25-30 cm away, dead Bromus japonicus common 5 cm onward), E face Lookout Mtn., Jefferson Co. Colo., Oct. 6, 1987. Egg (lot #118) found on Carex probably pensylvanica heliophila (C. probably p. heliophila 0-25 cm away, Bouteloua gracilis common 15-60 cm away, Stipa comata 2 clumps 30-80 cm away, Agropyron [Pascopyrum] smithii frequent 25-100 cm away, dead Bromus tectorum scattered 20 cm onward), Red Rocks, Jefferson Co. Colo., Oct. 8, 1987. Egg (lot #125) found on Carex probably pensylvanica heliophila (C. probably p. heliophila common 0-100 cm away, Stipa comata 3 clumps 50-100 cm away, dead Bromus tectorum common 10 cm onward, Bouteloua gracilis several 70-100 cm away), Red Rocks, Jefferson Co. Colo., Oct. 8, 1987. Egg (lot #126) found on Carex probably pensylvanica heliophila (C. probably p. heliophila common 0-100 cm away, Stipa comata 2 clumps 90-100 cm away, dead Bromus tectorum scattered 10 cm onward under juniper, Aristida purpurea 1.2 m away), Red Rocks, Jefferson Co. Colo., Oct. 8, 1987. Egg (lot #135) found on Bouteloua gracilis in 3 m wide "clearing" (B. gracilis common 0-50 cm away, dead Bromus tectorum common 15 cm onward, Stipa comata common 25-100 cm away, dead Bromus japonicus 80 cm away, Carex probably pensylvanica heliophila 1.2 m away), Red Rocks, Jefferson Co. Colo., Oct. 8, 1987. Egg (lot #135) with 2 Trichogrammatid exit holes found on Carex probably pensylvanica heliophila (C. probably p. heliophila common 0-100 cm away, 1/2 m tall grass probably Agropyron [Leymus] ambigus 1 m away, Koeleria macrantha (Wl) 4 clumps 20-80 cm away, Stipa comata common 20-100 cm away, dead Bromus japonicus scattered 50 cm away, Andropogon gerardii thick 25-100 cm away, dead Bromus tectorum scattered 4 cm onward, dead Bromus japonicus uncommon 10 cm onward, Stipa comata clump 50 cm away, Bouteloua gracilis thick 30-100 cm away), Red Rocks, Jefferson Co. Colo., Oct. 8, 1987. 3 eggs (the third 3 cm from the other two) (lot #141) found on Carex probably pensylvanica heliophila (C. probably p. heliophila common 0-80 cm away, dead Bromus tectorum common 50-100 cm away), Red Rocks, Jefferson Co. Colo., Oct. 9, 1987. Egg (lot #139) found on Carex probably pensylvanica heliophila (C. probably p. heliophila 5 clumps 5-100 cm away, Andropogon gerardii thick 25-100 cm away, dead Bromus tectorum scattered 4 cm onward, dead Bromus japonicus uncommon 10 cm onward, Stipa comata clump 50 cm away, Bouteloua gracilis thick 30-100 cm away), Red Rocks, Jefferson Co. Colo., Oct. 8, 1987. Egg (lot #139) found on Carex probably pensylvanica heliophila (C. probably p. heliophila 5 clumps 5-100 cm away, Andropogon gerardii thick 25-100 cm away, dead Bromus tectorum scattered 4 cm onward, dead Bromus japonicus uncommon 10 cm onward, Stipa comata clump 50 cm away, Bouteloua gracilis thick 30-100 cm away), Red Rocks, Jefferson Co. Colo., Oct. 8, 1987. 3 eggs (the third 3 cm from the other two) (lot #141) found on Carex probably pensylvanica heliophila (C. probably p. heliophila common 0-80 cm away, dead Bromus tectorum common 50-100 cm away), Red Rocks, Jefferson Co. Colo., Oct. 8, 1987. 1 egg found on Carex probably pensylvanica heliophila, 2 eggs found on Bouteloua gracilis; Lookout Mtn., Jefferson Co. Colo., Sept. 20, 1990. Larva 2 cm long found in silked-dirt tunnel 3 cm long in soil among Bouteloua curtipennis roots, leaves chewed off around tunnel and frass among stumps, larva was killed during removal from nest, but must have been H. comma or juba because of its large size (H. viridis or pahasca or uncas larvae are much smaller at this time) and the head color pattern matches the pattern of 3rd-stage comma rather than juba; S-facing slope, Apex Gulch, Jefferson Co. Colo., Aug. 24, 1990. Egg found on Carex probably pensylvanica heliophila; NE Faxon, Jefferson Co. Colo., Aug. 25, 1990. Egg found on Bouteloua curtipennis leaf top; Mt. Vernon Historic Site, Jefferson Co. Colo., Sept. 3, 1990. Egg found on Carex pensylvanica heliophila (many inflorescences found); Indian Creek Cbg., Douglas Co. Colo., Sept. 18, 1990. HOSTPLANTS: Females prefer to oviposit on Carex probably pensylvanica heliophila, and also oviposit on Bouteloua gracilis and dead B. tectorum, rarely on other grasses. Larvae will eat many grasses in the lab (Scott 1975c reared seven Hesperia on Poa pratensis and Digeratia sanguinalis). Eggs are usually laid "2-3 cm above ground. Eggs hibernate, in fact, all of the foothills (5400-6500') eggs hibernate even in the lab, whereas eggs of the high altitude (10,300') H. c. colorado hatch fairly frequently in the lab (though in the cold temperatures of nature surely none hatch before spring). EGGS of H. comma have a distinct basal flange (no flange or a very slight one in H. juba, no flange in H. leonardus paeowee, stay whistish in color (paeowee eggs turn pinkish, juba eggs stay whitish), and are smaller than paeowee eggs (juba are also small). FIRST-STAGE LARVAE have the anterior (D1) seta on A10 short (but slightly longer than H. juba; seta very long in paeowee). Hesperia comma assiniboia-colorado. Egg (lot #145) found on Carex brevipes (S; identification based on plants with inflorescences collected at egg site June 26, 1988), hilltop SSE Empire, 9400', Clear Creek Co. Colo., Oct. 12, 1987. Hesperia comma colorado (Scudder). 1 egg (typical comma egg, white with basal flange) found on litter (Carex foemina common 1 cm-2 m away, Agropyron [Elymus] trachycaulus andinus 2, 4, 10, 10, 15, 18, 20, 20, 20, etc. common to 1 m, Poa fendleriana [=longiligulal] big clumps 15, 40, 90, 1 m, Poa nemoralis interior 20, 40, 40, 45, 50, Carex rupestris drummondiana 90, 90, Carex
The egg diapaused, Hoosier Pass, 12000', Park Co. Colo., Aug. 31, 1988. Carex foenea is probably the main host at this locality as it is the commonest suitable sedge. Eggs hibernate. Carex foenea and C. brevipes both resemble the main host of foothills H. comma assimiloba (Carex pennsylvanica heliophila) in appearance (about 10 cm tall with narrow green leaves) and all three grow on slopes etc. In lab, some eggs (by females from Tennessee Pass, Lake Co. Colo.) hibernated, while others hatched and the larvae fed to pupation on Poa pratensis.

H. ottoe Edw. Oviposition 10:12 on side of leaf, oviposition 12:00 on side (top) of leaf, both on Andropogon gerardii Red Rocks, Jefferson Co. Colo., July 11, 1984. 2 eggs (cream like eggs laid by identified females, and first-stage larvae have D1 setae long on A9 as in ottoe) found on leaves of A. gerardii, Red Rocks, July 12, 1984. Oviposition 8:25 on underside of A. gerardii leaf, preoviposition 8:35 on underside of A. gerardii leaf, (another ovip. on A. gerardii seen by William McGuire), Red Rocks, July 4, 1985. Oviposition 5:22 on underside of A. gerardii leaf, Red Rocks, July 2, 1986. 6 eggs (3 produced 1st stage larvae with long D1 on A9 characteristic of ottoe, 3 did not hatch) found on A. gerardii in 1-2 m wide cluster of A. gerardii (Stipa comata common near cluster, Carex probably pennsylvania heliophila on one side of cluster), Mt. Zion, Jefferson Co. Colo., July 11, 1988. Egg (#10, probably ottoe but did not hatch) found on A. gerardii (A. gerardii A. 0-1 m, Andropogon [Pascopyrum] smithii 20, 20, 40, 90, Oryzopsis exigua 70, 70, 90, Carex probably pennsylvania heliophila 25, 30, 40, onward, Stipa comata 50, 1 m), Red Rocks, Jefferson Co. Colo., July 4, 1986. 1 larva 11 mm long found in A. gerardii leaf nest (reared, pupated Oct. 20, male emerged Nov. 10); Mt. Vernon Historic Site, Jefferson Co. Colo., Sept. 3, 1990. Half-grown larva (probably ottoe, larva similar to ottoe with head black with cream adfrontal & coronal stripes, pupa similar to ottoe, pupated Oct. 25, pupa died) found on A. gerardii Horseshoe Res., Larimer Co. Colo., Sept. 14-15, 1990. Larva 8 mm long with chestnut head and cream coronal & adfrontal stripes found in Bouteloua curtipendula aerial leaf nest (reared, pupated Oct. 6, male emerged Oct. 25); S-facing slope, Apex Quich, Jefferson Co. Colo., Aug. 27, 1990. HOSTPLANTS AND NEST: Andropogon gerardii is a popular hostplant in Colo. (although William McGuire observed oviposition on Bouteloua [ChondrosuM] gracilis, and at another site A. gerardii is rare and the only oviposition was seen by McGuire on Carex geerieri). Interestingly, H. ottoe larvae have aerial nests (females oviposit and larvae occur far above ground); all other Colo. Hesperia have soil nests, based on larvae discovered in nature and on their short hosts (on which aerial nests do not occur). H. ottoe, Polites origenes rhene, and Atrytone acrops all prefer A. gerardii, and all are basically Great Plains taxa which carried this preference westward with them to the Colo. foothills (they also make aerial nests, and P. origenes is the only aerial Polites). Half-grown larvae hibernate. HALF-GROWN LARVA tan; head chestnut-brown. MATURE LARVA medium grey-brown, A2-8 with a slight reddish tinge, heart-band darker, collar wide, black; head black with cream stripe beside coronal sulcus, and cream stripe laterally edging adfrontal sulcus. PUPA pale brown on head & thorax (thorax & most of wings olive-green on day of pupation), wings tan, orbit brown, one pupa has abdomen pale pink (esp. dorsally) on day of pupation, turning pinkish-tan (pinkish on front of each segment, pale brown on rear 1/3), intersegmental areas A4-7 orange-brown, another pupa merely ten on abdomen, T1 spiracle pink-tan, black specks are heavy on one pupa, light on another (black specks on T2-3, black splotchy areas on head, black dots on dorsal wing margin), 3 rows of black transverse dashes on A2-7 (very faint on A1), A456 each has a supraventral hairy mound, cremaster & proboscis tip red-brown, cremaster fairly short (lateral margins convex), proboscis barely extends beyond wings & A4, eye then antenna club turns red before hatching. Pupa lasts 19-21 days in lab (2 males).


H. leonardus pawnee Dodge. Oviposition 12:11 on dead leaf tip of Carex probably pennsylvania heliophila in 2 m-wide patch of this sedge, while female was resting on Thlaspi arvense plant (one shoot of Stipa viridula Trin. (W) was 5 cm from egg), Green Mtn., Jefferson Co. Colo., Sept. 5, 1985. Oviposition 12:01 on underside of Sporobolus cryptandrus (W), Green Mtn., Sept. 12, 1985. Oviposition 12:01 on underside of Aster ericoides leaf (only Carex probably
Pennsylvanica heliophile was all around egg, Stipa viridula (W) 10 cm and 15 cm from egg, a Bouteloua (Chondrurus) gracilis plant was 25 cm from egg); oviposition 13:25 on underside of B. gracilis leaf (the nearest other monocot was Stipa sp. 25 cm away); oviposition 13:37 on underside of B. gracilis leaf (the nearest other monocot was a small Stipa comata (W) 30 cm away); oviposition 15:41 on bract of dead Bromus (Anisantha) tectorum (nearby five monocots were B. gracilis beneath and common all around egg, a small Agropyron [Pascopyrum] smithii var. mollis (W) 10 cm from egg, a big Sporobolus cryptandrus (W) at 10 cm from egg); Green Mt., Jefferson Co. Colo., Sept. 14, 1988. Oviposition 10:51 on underside of fruit of dead Thlaspi arvense plant among many B. gracilis (the only other nearby monocots were two small Stipa viridula (W) clumps 20 cm away), Green Mt., Jefferson Co. Colo., Sept. 19, 1988. Oviposition 12:47 on 3 cm-wide Bouteloua gracilis clumps (some dead Bromus japonicus 2 cm away, Agropyron [Pascopyrum] smithii all over B. gracilis beneath and common all around egg, Routeloua curtipendula less common 15 cm away), W Soda Lakes SE Morrison, Jefferson Co. Colo., Sept. 10, 1987. Oviposition 11:39 on underside of Bouteloua gracilis leaf (dead Bromus japonicus plants scattered nearby, an Agropyron [Pascopyrum] smithii clump 25 cm away), Red Rocks, Jefferson Co. Colo., Sept. 21, 1987. Egg (lot #7) found on side (top) of Bouteloua gracilis leaf in middle of 30 X 25 cm B. gracilis patch (dead Bromus tectorum scattered about, Sporobolus cryptandrus frequent 30 cm away), Stipa comata 3 clumps 40-70 cm away, Van Bibber Creek, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #34) found on Bouteloua curtipendula at edge of 20 X 30 cm clump of it (B. curtipendula all over 5-100 cm away in tiny clumps, Aristida purpurea Nutt. (W) 2 clumps 25-100 cm away, dead Bromus japonicus scattered all over 5 cm, Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #33) with Trichogrammatid exit hole found on Bouteloua gracilis (B. gracilis 3 clumps 5-20 cm away, Stipa comata 4 clumps 30-70 cm away, dead Bromus japonicus scattered all over 5 cm away, Routeloua curtipendula 2 clumps 70-100 cm away, Agropyron [Elymus=“Sitanion”] elymoides ("Sitanion hystrix") 3 clumps 30-60 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #35) found on Bouteloua gracilis (B. gracilis all over, Stipa comata 5 clumps 40-100 cm away, dead Bromus japonicus uncommon scattered 5 cm, Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #41) found on Bouteloua gracilis (B. gracilis thick, dead Bromus tectorum common 5 cm away, Stipa comata common 30-100 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #42) found on Bouteloua gracilis (B. gracilis thick, dead Bromus japonicus scattered, dead Bromus tectorum common 20 cm onward, Stipa comata common 15-100 cm away, Sporobolus cryptandrus 3 clumps 70-100 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. 2 eggs (lot #43) found on Bouteloua gracilis in B. gracilis sward (dead Bromus japonicus common, dead Bromus tectorum common 5 cm onward, Stipa comata common 30-100 cm away, Sporobolus cryptandrus clump 70 cm away), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #44) found on Bouteloua gracilis (B. gracilis thick, dead Bromus japonicus common, Stipa comata common 15 cm onward, dead Bromus tectorum common 40 cm onward, dead Bromus japonicus common 40 cm onward), Falcon County Park, Jefferson Co. Colo., Oct. 2, 1987. Egg (lot #51) found on Bouteloua gracilis (B. gracilis thick nearby, dead Bromus tectorum fairly common nearby, Stipa comata 1 tiny clump 5 cm away, Sporobolus heterolepis? 2 clumps 30-40 cm away), Lookout Mt., Jefferson Co. Colo., Oct. 3, 1987. Egg (lot #52) found on Bouteloua gracilis (B. gracilis thick, dead Bromus tectorum fairly common, Aristida purpurea (W) clump 30 cm away, Stipa comata 2 clumps 35-50 cm away), Lookout Mt., Jefferson Co. Colo., Oct. 3, 1987. 3 eggs (one hatched) (lot #78) found on Bouteloua gracilis in B. gracilis sward (dead Bromus tectorum common 5 cm onward, Stipa comata common 30 cm onward), Chimney Gulch, Jefferson Co. Colo., Oct. 5, 1987. Egg (lot #88) found on Bouteloua gracilis in big sward of it (Stipa comata 4 clumps 40-100 cm away, dead Bromus tectorum thick 5 cm onward), E face Lookout Mt., Jefferson Co. Colo., Oct. 5, 1987. Egg (lot #91) found on Bouteloua gracilis in big sward of it (dead Bromus japonicus uncommon 5 cm onward, dead Bromus tectorum common 10 cm onward, Stipa comata 4 clumps 36-100 cm away), E face Lookout Mt., Jefferson Co. Colo., Oct 5, 1987. Egg (lot #100) found on Bouteloua gracilis (B. gracilis common 0-40 cm away, Stipa comata common 15 cm onward, Aristida purpurea common 20-100 cm away, dead Bromus japonicus scattered), Cherry Gulch, Jefferson Co. Colo., Oct. 7, 1987. Egg (lot #120) found on Bouteloua gracilis in broad clearing (B. gracilis common 0-30 cm
Hesperia pahaska Leuss. Ovipositions 9:35, 10:46, 12:05, 13:38, 14:20, 14:27 on underside of leaves (usually near the outer edge of the clump) of Bouteloua (Chondrurus) gracilis, 1 mi. up Bear Creek, Chaffee Co. Colo., June 1968 and June 1970 (Scott 1974a reports movements and behavior at this site). Egg (#75, egg slightly larger than H. nevada egg, 1st stage larva D1 and D2 equally long on A10 like pahaska) found on Bouteloua gracilis large clump (B. gracilis 30-100, Agropyron [Elymus = Sitanion] longifolius SS, 1 m, old Bromus [Anisantha] tectorum 20, 20, few, Vulpa octoflora 1 m, Stipa comata 1 m), egg (#79, 1st stage larva D1 as long as D2) found on Bouteloua gracilis (B. gracilis 20-1 m, old Bromus tectorum 20 fairly common, Stipa comata 40, 40, 40, 80, etc.), N Beaver Brook, Jefferson Co. Colo., June 22, 1988. Egg (#108, 1st stage larva pahaska, perhaps viridis) found on Bouteloua gracilis (B. gracilis 0-1 m, old Bromus japonicus 10 scattered, Stipa comata 70, 90, 90, 90, 1 m, Carex rossii 10), Red Rocks, Jefferson Co. Colo., July 4, 1989. Females prefer to oviposit on Bouteloua gracilis. Half-grown larvae must hibernate. Eggs and first-stage larvae are virtually identical to those of H. viridis.

Hesperia viridis (Edw.). Oviposition Bouteloua (Chondrurus) gracilis, 1 mi. up Bear Creek, Chaffee Co. Colo., June 1969/June 1970. Premoviposition 9:45 she failed to land on Oryzopsis exigua or Andropogon gerardii; preoviposition 10:35 bent abdomen 5 times Bouteloua gracilis; this B. gracilis patch was then searched for eggs; egg (probably viridis but did not hatch) and 1st stage larva (lost) (#102) found on Bouteloua gracilis (B. gracilis 0-1 m, old Bromus japonicus 3 cm scattered, Agropyron [Elymus = Sitanion] longifolius 1 m, Poa compressa 40-55, Stipa comata 60, 60, 70), egg (#103, probably viridis but lost) found on Bouteloua gracilis (B. gracilis 0-1 m), egg (#104, larva viridis) found on Bouteloua gracilis (B. gracilis 0-1 m, Agropyron [Elymus = Sitanion] longifolius 70), egg (#105, larva viridis) found on Bouteloua gracilis (B. gracilis 0-1 m, Oryzopsis exigua 40-50, 90, old Bromus japonicus 10 scattered, Poa compressa 80, Agropyron [Elymus = Sitanion] longifolius 50, 70, 1 m), egg (#106, probably viridis but did not hatch) found on Bouteloua gracilis (B. gracilis 0-1 m, Stipa comata 20, 20, 25, 30 onward, old Bromus japonicus 15 rare, Andropogon gerardii 60, Agropyron [Pasocorus] smithii 35, 50, 70, 80), 2 eggs (#107, probably viridis but did not hatch) found on Bouteloua gracilis (B.
gracilis 0-1 m, old Bromus japonicus 5 scattered, Agropyron [Elymus="Sitanion"] longifolius 30, Stipa comata 35, 50, 90 onward), 2 eggs (#108, 1 larva viridis, other egg did not hatch) found on Bouteloua gracilis (B. gracilis 0-1 m, old Bromus japonicus 10 scattered, Stipa comata 70, 80, 80, 1 m, Carex rossii 10), egg (#109, probably viridis but did not hatch) found on Bouteloua gracilis (B. gracilis 0-1 m, old Bromus japonicus 15 scattered, Agropyron [Pascopyrum] smithii 8, 40, 50, 70, 80, Stipa comata 60, 1 m, Carex probably pensylvanica heliophila 90); Bouteloua gracilis was uncommon here and the patch of short plants was very hot from the sun which perhaps explained the mortality of most of the exposed eggs; some of the eggs that did not hatch could have been H. pahaska; Red Rocks, Jefferson Co. Colo., July 4, 1988. Egg (probably viridis, perhaps pahaska, based on egg and 1st stage larva) found on Bouteloua gracilis (B. gracilis abundant 0-100 cm, Stipa comata 100, Sporobolus cryptandrus 35-55, 50, common 75, green Bromus japonicus scattered 3-100, dead Bromus [Anisantha] tectorum scattered 5-100, Agropyron [Elymus="Sitanion"] longifolius 95), Chimney Gulch, Jefferson Co. Colo., June 27, 1989. Egg found 13:04 on Bouteloua gracilis (B. gracilis 0-40 cm away, Stipa comata 20-25, 50-90, Carex probably pensylvanica heliophila 35-50, 80-110, Bromus tectorum 10); 2 eggs found 13:11 on Bouteloua gracilis 15 cm apart (B. gracilis 0-40, Aristida purpurea 75, Stipa comata 30, abundant 40-100, Carex probably pensylvanica heliophila 55-90); egg found 13:22 on Bouteloua gracilis (B. gracilis 0-40, 80-110, Stipa comata 15, common 30-100, Bouteloua curtipendula 80-120); egg found 13:32 on Bouteloua gracilis (B. gracilis 30-45, 50-120, Stipa comata 20, 30, 45, 60, 80-200); egg (did not hatch, probably viridis) found 13:35 on Bouteloua gracilis (B. gracilis 30-50, 40-80, 70-110, Stipa comata common 20-35, 50, 80, etc., Bromus japonicus 20, Koeleria macrantha 90, Aristida purpurea 90); all eggs were determined to be probably H. viridis, or possibly H. pahaska, based on egg shape, setae of hatched first-stage larva, adult abundance and habitat, except the last egg; Red Rocks, Jefferson Co. Colo., June 25, 1989. 3 eggs (H. viridis or pahaska) found on Bouteloua gracilis (B. gracilis 0-20, Stipa comata 25-45, Aristida purpurea 100); Falcon County Park, Jefferson Co. Colo., July 18, 1990. Oviposition 10:40 Bouteloua curtipendula (W), Chimney Gulch, Jefferson Co. Colo., July 17, 1978. 2 larvae 7 & 12 mm long found on Bouteloua curtipendula, in silk-tube nests (of silked dead leaves and sand grains) in soil just below surface, the leaves chewed nearly to stumps around nest (2 males reared, emerged Oct. 18-19); S-facing slope, Apex Gulch, Jefferson Co. Colo., Aug. 27, 1990. Empty horizontal silk web nest (H. viridis? or comm?) found in litter in Bouteloua curtipendula clump; Apex Gulch, Jefferson Co. Colo., Sept. 19, 1990. Oviposition 10:10 on underside of leaf of Andropogon gerardii, Red Rocks, Jefferson Co. Colo., July 2, 1986. Bouteloua gracilis is the main host. Bouteloua curtipendula is sometimes chosen, Andropogon gerardii rarely. Half-grown larvae may hibernate. MATURE LARVA dark brown; head & collar black (no cream stripes, unlike H. attalus). PUPA resembles H. attalus, pale brown, abdomen pink-tan (as in some ottoe), intersegmental areas chitin-brown, orbit brown, Ti spiracle pink, head & thorax & dorsal edge of wing with blackish-brown fine motting (light on one pupa, dark on other), A2-7 (very faint A1) have 3 transverse rows of short blackish-brown dashes, A455 each have a supraventral hairy mound, proboscis tip orange and extends just beyond A4 or extends to A5, cremaster red-brown, fairly short (lateral margins convex), antenna becomes red prior to emergence, then adult wings become visible etc.

Hesperia atalbus atalbus (Edw.). Adults associated with Bouteloua curtipendula, S of Hopeton, Woods Co. Okla., Sept. 3, 1986. Hesperia nevada ssp. (ventral hindwing slightly More ochre-brown than green). Oviposition 11:03 Poa pratensis then probably Agropyron (Pascopyrum) smithii, egg found (#1) on underside of Koeleria macrantha leaf in a clump which had 1/4 of clump consisting of Festuca saximontana 1 cm from egg (K. macrantha common 10, 20, 20, 30-80 cm etc., F. saximontana 5 scattered clumps common, Danthonia parryi 60, 60, 90-100 cm, Agropyron [Elymus="Sitanion"] longifolius 70 cm, Orzyopsis exile common 10-100); all Guy Hill, Jefferson Co. Colo., June 15, 1988. Oviposition 10:30 Poa pratensis; oviposition (egg #2) 10:59 beneath Koeleria macrantha leaf (K. macrantha common 15, 25, 30, 30, 40, 40 cm etc., Festuca saximontana 2, 10, 20, 40 cm onward, Orzyopsis exile 10-20, 25-30 cm etc., Danthonia parryi 20-25, 50, 80 cm etc., Poa pratensis 10, 15, 25, thick 40-100, Carex probably pensylvanica heliophila 20-100 cm); egg (#3) found on underside of Poa pratensis leaf (P. pratensis common all around, Agropyron [Pascopyrum] smithii 15, 20, 30, 45, 60 cm etc., old Bromus [Anisantha] tectorum scattered 10 cm onward, Festuca saximontana 20, common 40 cm onward, Agropyron [Elymus="Sitanion"] longifolius 30, 45, 50, 70 cm, Carex probably pensylvanica heliophila 1 m, Bouteloua [Chondrostylis] gracilis 80-90); egg (#4) found Festuca saximontana (F. saximontana common all around, Koeleria macrantha;
red-and-black ants were on edge of Danthonia parryi grass blade (D. parryi 0-30, 50 cm, 1 m), Bromus [Bromopsis] inernis 60 cm, Stipa comata 70, 80, 1 m, Poa pratensis very thick 15-100 cm, Carex probably pennsylvanica heliophila 3, 8, 20, 40 cm etc., Koeleria macrantha 30, 35, 80, Festuca saximontana 20, 40); 2 eggs (#5) found on Festuca saximontana leaves (F. saximontana common 10 cm onward, Koeleria macrantha 30 cm onward, Oryzopsis exigua thick 40, 70, 80, 1 m, Danthonia parryi 30 cm, Carex probably pennsylvanica heliophila 50, Agropyron [Pascopyrum] smithii 1 m, Bouteloua gracilis 80 cm, Poa annaesizensis 50 cm, old Bromus tectorum scattered 15 cm onward); 2 eggs (#7) found on Festuca saximontana (F. saximontana thick 5, 25, 30 cm onward, Carex probably pennsylvanica heliophila 10-25, 25, 35, 40 cm, Oryzopsis exigua 1 m, Koeleria macrantha common 3, 10, 10, 20 cm etc. onward, Poa nemoralis interior 80-90, old Bromus tectorum 30 cm); egg found (#8) on underside of Koeleria macrantha leaf (K. macrantha common 5 cm onward, Festuca saximontana common 20 cm onward, Oryzopsis exigua thick 50-90, Agropyron [Pascopyrum] smithii 30, 50, 60, old Bromus tectorum 30-60, 1 m); egg found (#9) on underside of Koeleria macrantha leaf (K. macrantha 10, 15, 20, 30, 50, 50 cm onward, Agropyron [Pascopyrum] smithii 6, 30, 50, 60, Festuca saximontana 2, 15, 18, 20 cm etc. onward, Oryzopsis exigua 30-70, 80, old Bromus tectorum 25, 40-100); egg found (#11) Festuca saximontana (F. saximontana thick 5, 10, 25 cm etc. onward, Agropyron [Pascopyrum] smithii 30-100, Carex probably pennsylvanica heliophila 20, 30-100, Bouteloua gracilis 5-25, 20-30, 30-40 cm onward, Oryzopsis exigua 0-100, old Bromus tectorum 15-100, Koeleria macrantha 40, Stipa comata 40, 70, 1 m, Agropyron [Elymus="Sitonion"] longifolius 20-25); egg found (#12) Festuca saximontana (F. saximontana thick 0-100 cm, Koeleria macrantha 3, 15, 18, 20 cm etc. onward, Oryzopsis exigua 75-90, Bouteloua gracilis 50-100); egg found (#13) on Stipa comata tiny clump (possibly Koeleria macrantha as no other Stipa nearby) (Koeleria macrantha scattered common 10 cm onward, Festuca saximontana 1, 10, 15, 20 cm etc. onward, Oryzopsis exigua 60, 60-90, Agropyron [Pascopyrum] smithii 10, 20-40, etc., Danthonia parryi 80-100); egg found (#14) Festuca saximontana (F. saximontana thick 0-100, Koeleria macrantha common 2, 5, 5 cm onward, Bouteloua gracilis 2 blades 2 cm from egg and 35-50, Stipa comata 10, 25, 40, Agropyron [Pascopyrum] smithii 50, 60, 80, Poa pratensis 60-80, Oryzopsis exigua 90-100); oviposition (egg #15) Stipa comata (S. comata 40, 45, 80 cm, Koeleria macrantha common 5, 10, 15, 20, 40-50 etc., old Bromus tectorum 30-100, Festuca saximontana 2, 5, 15, etc., Bouteloua gracilis thick 5-100, Poa pratensis 70-90, Agropyron [Pascopyrum] smithii 80); egg found (#16) Stipa comata (S. comata 20, 30, 40, Bouteloua gracilis thick 0-100, Festuca saximontana common 10 cm onward, Agropyron [Pascopyrum] smithii 5-100, old Bromus tectorum 35-100, Poa pratensis 110, Koeleria macrantha 40, 50-60, 60, 1 m); egg found (#17) on Festuca saximontana (F. saximontana thick 100 cm, common 25 cm onward, Agropyron [Pascopyrum] smithii 30, 40, 30-100, Bouteloua gracilis 0-100, old Bromus tectorum 20-100, Stipa comata 10, 20, 30 cm onward, Poa pratensis 1 m); egg found (#18) Festuca saximontana (F. saximontana 15, 25, 30 cm etc. common, Bouteloua gracilis thick 5-1 m, Poa pratensis 10, 30-100 scattered, Koeleria macrantha 20, 40, 50, 70, 90-100, Agropyron [Pascopyrum] smithii 70, 80, old Bromus tectorum 20, 60-100, Bouteloua gracilis 1-5, 9, 10, 20, etc. common, Stipa comata 5, 10, 12, 15, 25 etc. common); 1 egg found (#21) on underside of Festuca saximontana leaf (F. saximontana 10, 15, 15 cm onward, Poa pratensis scattered 50 cm onward, Koeleria macrantha 20-30, 40, 50, Agropyron [Pascopyrum] smithii 10, 30, 30, 30, 55, etc., Bouteloua gracilis 25-1 m, Stipa comata 40, 50, uncommon, old Bromus tectorum 50, 80-100); red-and-black ants were common near most eggs on this day; all Guy Hill, Jefferson Co. Colo., June 17, 1988. 1 egg found (#20) on Koeleria macrantha (K. macrantha 0-15, 15, 20, 20, 35, 40, 50 etc. common, Festuca saximontana 5, 10, 15, 20, etc. common, Poa pratensis 80, Agropyron [Pascopyrum] smithii 70, 80, old Bromus tectorum 20, 60-100, Bouteloua gracilis 1-5, 9, 10, 20, etc. common, Stipa comata 5, 10, 12, 15, 25 etc. common); 1 egg found (#21) on underside of Festuca saximontana leaf (F. saximontana 20, 25, 30, 30, 60, 70 cm etc. not common, Koeleria macrantha thick 3, 5, 10, 15, 20-30 onward, Oryzopsis exigua 6, 15-25, 30, 50-100, Danthonia parryi 5-7, 9-120, Stipa comata 20, 25, 35, 90, Carex probably pennsylvanica heliophila 10, 10, 20, 20 cm onward); egg found (#24) on Stipa comata (S. comata 2, 15, 20, 25, 50, 60, Bouteloua gracilis 1, 5, 7, 15-1 m, Koeleria macrantha 5, 8, 30, 30, 35, 30-40 etc., Festuca saximontana 20, 25, 30, 35, 40, 40, 40-100, Agropyron [Pascopyrum] smithii 25, 50, Poa pratensis 1 m); egg found (#25) Festuca saximontana (F. saximontana 8, 20, 25, 30 cm onward, Koeleria macrantha 20, 25, 60, 70 cm common, Bouteloua gracilis 1-5, 8, Stipa comata 25, Danthonia parryi 15, 20, 25-50, 1 m, Carex probably pennsylvanica heliophila 8 cm common all over, Poa nemoralis interior 25, 40, Agropyron [Elymus="Sitonion"]
longifolius dead 40, Oryzopsis exicua 40, 50, Agropyron [Pascopyrum] smithii 40); egg found (#26) Festuca saximontana (F. saximontana 25, 30, 35, 80-100, Oryzopsis exicua 20-40, 40-90, Poa pratensis 90-110, Danthonia parryi common 3-100, Carex probably pensylvanica helioohila 5, 15-20, 40-100, Koeleria macrantha 30, 50, 50, 60, 100, old Bromus tectorum 50, Bouteloua gracilis 50); egg found (#27) Festuca saximontana (F. saximontana 5, 10, 15, 25 cm onward, Oryzopsis exicua 10-25, 20-80, 50-100, Koeleria macrantha 30, 30-40, 50, 60, 70, Poa compressa 15-20, 20, 30-40, 50, 70, Danthonia parryi 10, 50-60 onward, Carex probably pensylvanica helioohila 70, Stipa comata 1 m, Agropyron [Elvymus="Sitanion"] longifolius 50); egg found on (#28) Festuca saximontana (F. saximontana 5, 10, 15, 25 cm, 20 thick onward, Stipa comata 20, 25, 25, 30, 30, 45 cm onward, Oryzopsis exicua 21, 30, Koeleria macrantha 15, 30, Bouteloua gracilis 35-40, 40, Agropyron [Pascopyrum] smithii 40, old Bromus tectorum 50-100); egg found on (#29) Oryzopsis exicua (O. exiqua 1-30, 25-40, 30-40 etc. common, Poa pratensis 15, 30, 40-100, Festuca arizonica 70-75, Danthonia parryi 25-35, 30, 40-100, Koeleria macrantha 70-80, Carex probably pensylvanica helioohila 15, 40, 50, 50, Koeleria macrantha 80-80, Festuca saximontana 12, 20, 1 m, Agropyron [Pascopyrum] smithii 30); egg found on (#30) Festuca saximontana (F. saximontana 30, 30, 1 m, Stipa comata 10, 12, 15, 20 cm onward common, Oryzopsis exicua 80, Bromus [Bromopsis] inermis 40-50, Danthonia parryi 20, 50-90, old Bromus tectorum scattered 4 cm onward, Agropyron [Pascopyrum] smithii 15-25, 60, Agropyron [Elvymus="Sitanion"] longifolius 60); all BuY Hill, Jefferson Co. Colo., June 18, 1988. Preoviposition 12:10 she did not land in Poa pratensis meadow, she hovered under shrubs and crawled under one shrub; egg (#31) found on Festuca saximontana (F. saximontana 15, 25, 40, 40, 70 etc. common, Agropyron [Elvymus="Sitanion"] longifolius 70, Carex probably pensylvanica helioohila 10, 25, 30, 30, 50 etc., Stipa comata 5, 10, 20, 25, 40, 50, Bouteloua gracilis 5-10, 15, old Bromus tectorum 5, scattered, 60-100, Koeleria macrantha 20, Danthonia parryi 90-120); egg found on (#32) Festuca saximontana (F. saximontana 20, 50, 50-80, etc., Agropyron [Elvymus="Sitanion"] longifolius 20, Koeleria macrantha 15-25, 25, thick, Carex probably pensylvanica helioohila 60 onward, Poa pratensis 50-100, old Bromus tectorum 15 scattered, Stina comata 10, 15, 20, 25, 25 cm onward common, Bouteloua gracilis 10, 15, 35-40, 50-80, Agropyron [Elvymus="Sitanion"] longifolius 80, 80, Bromus [Bromopsis] inermis 1 m); egg found on (#33) Festuca saximontana (F. saximontana 10, 15, 15, 20, 25, Bouteloua gracilis 3-15, 10, Stipa comata 15, 20, 20, 25, 30, etc. common, old Bromus tectorum 4 all over, Poa pratensis 40-100, Vulpia octoflora 3-100, Bromus [Bromopsis] inermis 1 m); egg (#34) found on Festuca saximontana (F. saximontana 2, 10, 15, 25, 30 etc. common, Stipa comata 5, 5, 8, etc. common, Agropyron [Elvymus="Sitanion"] longifolius 5, old Bromus tectorum 5 scattered, Poa pratensis 50-100, Bouteloua gracilis 10, 20-30, 50, Vulpia octoflora 10 scattered, Agropyron [Pascopyrum] smithii 15, 80, 1 m); 2 eggs (#35) found on Stipa comata (S. comata 35, 50, Poa pratensis 15, 15, 20, common 30 cm onward, Agropyron [Pascopyrum] smithii 60-80, Bouteloua gracilis 30); egg (#36) found on Stipa comata (S. comata 10, 20, 25, 35-100, Festuca saximontana 10, 45, Bouteloua gracilis 15-100, Poa pratensis 70 onward, Vulpia octoflora 30 etc., old Bromus tectorum 30 onward); 2 eggs (#37) found on Festuca saximontana (F. saximontana 10, 15, 20, 25, 30, 50, 80, 80, Bouteloua gracilis 10-40, 30, 30, 70-100, Poa pratensis 80 onward, old Bromus tectorum 1 m, Vulpia octoflora 1 m); egg (#38) found on Stipa comata (S. comata 5-40, 10, 15, 15-25 etc. common, old Bromus tectorum thick 0.5-100); preoviposition 10:10 Festuca saximontana, egg (#39) found on Festuca saximontana (F. saximontana 12, 15, 20, 25, 25, 30-40, 45 etc. common, Agropyron [Elvymus="Sitanion"] longifolius 8, 15, 20, 40-50, 60, Stipa comata 5, 15, common 25, 30, 30, Poa compressa 50-100); 3 eggs (#40) found (1 egg on dead leaf perhaps of Carex in Koeleria macrantha clump, 2 eggs piled on top of each other on Koeleria macrantha leaf) (K. macrantha 50 cm and perhaps closer, 1 m, Agropyron [Pascopyrum] smithii 15, Festuca saximontana 15, 25, 30, 40-100, Bouteloua gracilis 10, 15, 40-50, Stipa comata 15, 40, 50 onward, Carex probably pensylvanica helioohila 25, 40, 40, 40, 45 onward, old Bromus tectorum 10, 20, 40, 80-50, Agropyron [Elvymus="Sitanion"] longifolius 25); egg (#41) found on Festuca saximontana (F. saximontana 10, 20, 30 cm etc. common, Koeleria macrantha 30, 40, 45, 50, 50-100, Bouteloua gracilis 2-30 common, Stipa comata 25, 30, Poa pratensis 15, Agropyron [Elvymus="Sitanion"] longifolius 20, 40); egg (#42) found on Koeleria macrantha (K. macrantha 5, 15, 25, to 1 m, Festuca saximontana 3, 10, 15, etc. common, Bouteloua gracilis 12-50, 60-100, Stina comata 12, 30 uncommon, Agropyron [Elvymus="Sitanion"] longifolius 20, 40, 60, Poa pratensis 60-100); egg (#43) found on Festuca saximontana (F. saximontana 15, 20, 30, 40 onward, Koeleria macrantha 8, 10, 15, 20, 25, 30-100 common, Bouteloua gracilis 10, 15, 30, 30, common onward, Poa pratensis 50-100, Carex probably pensylvanica helioohila 60, 75, Stipa comata 3 clump, 20, Danthonia
5-10, 15, 50, 50, 65, 20-100, probably *Helianthus* *pensylvanica heliophila* 60, *Stipa* scattered 50-80, 1 M; egg (#55) found on *Festuca saximontana* (F. saximontana common, *Bouteloua gracilis* common, *Carex* probably *pensylvanica heliophila* scattered, *Danthonia parryi* 20 or 50, *Poa pratensis* 20 onward, *Agropyron* *Elvms*="Sitanion" longifolius 80, 1 m, *Dwarf Hair Grass* *Dactylis* 20 CM, *Carex* probably *pensylvanica heliophila* 60, 10 rare, old *Bromus tectorum* 10 scattered, *Agropyron* *Pascopyrum* *smithii* 80, *Stipa comata* 15, 15, 30, 30); egg (#56) found on *Stipa comata* and egg (#51) found on *Festuca saximontana* within 10 cm of egg #50, (S. comata 15-30, 20 common, F. saximontana 25, 30, 30, 35, 30, etc. common, *Danthonia parryi* 20-100, *Koeleria macrantha* 15, 35, 50, 70, *Bouteloua gracilis* 60, *Agropyron* *Elvms*="Sitanion" 1 longifolius 70, *Carex* probably *pensylvanica heliophila* 90, *Bromus* *Bromopsis* *inermis* 45-45, *Poa pratensis* 70 one clump, 90, old *Bromus tectorum* 50-100; egg (#52) found on *Koeleria macrantha* (K. macrantha 35, 80, *Stipa comata* 5, 7, 10 very common, *Bouteloua gracilis* 12, 20-45, *Festuca saximontana* 7, 30, 50, 50, *Agropyron* *Elvms*="Sitanion" longifolius 40, 60, 80-100, old *Bromus tectorum* 10 scattered, *Carex* probably *pensylvanica heliophila* 40-70, *Poa pratensis* 40, *Bromus* *Bromopsis* *inermis* 20-40); egg (#53) found on *Festuca saximontana* (F. saximontana 3, 10, 20, 45, 25-30, 80, *Bouteloua gracilis* 7, 20, 20, 40, etc., *Stipa comata* 5, 10, etc. very common, *Carex* probably *pensylvanica heliophila* 45-90, *Danthonia parryi* 80 onward, *Agropyron* *Elvms*="Sitanion" longifolius 1 m, *Dwarf Hair Grass* *Dactylis* 80); egg (#54) found on *Koeleria macrantha* (K. macrantha 15, 20, 20, 50, *Stipa comata* 15, 25, 25, 35 etc. common, *Festuca saximontana* 10, 15, 15, 25, 25, *Bouteloua gracilis* 13, 40-50, *Carex* probably *pensylvanica heliophila* 8, 25, 25, 50-1 m, *Danthonia parryi* 50-80, 1 m); egg (#55) found on non-monocot (found 18 cm from egg #54 so not detailed separately, but nearest monocots were *Bouteloua gracilis* 8 etc., *Carex* probably *pensylvanica heliophila* 10 etc., *Festuca saximontana* 10 etc.); egg (#56) found on *Koeleria macrantha* (K. macrantha fairly common 10 cm onward, *Stipa comata* 8, 20, 20, 30, 50, *Festuca saximontana* 20 common, *Bouteloua gracilis* 8, 15, 20-100, *Carex* probably *pensylvanica heliophila* 55, 60, 60, 60, etc., old *Bromus tectorum* 70 etc., *Agropyron* *Pascopyrum* *smithii* 15); 3 eggs (#57) found on *Festuca saximontana* (very near egg #56 so not detailed separately, but nearest grasses *Koeleria macrantha* 15-25, *Agropyron* *Pascopyrum* *smithii* 15-20, *Festuca saximontana* 3); egg (#58) found on *Stipa comata* (S. comata 5, 10, 15, 20-1 m, *Festuca saximontana* 5, 15, 25, 25, 50, 50, etc., *Danthonia parryi* 15, 20, 25-40, 50, *Koeleria macrantha* 15, 50, 90, *Carex* probably *pensylvanica heliophila* 60, 60, old *Bromus tectorum* 10, 1 m scattered); egg (#59) found on *Stipa comata* (S. comata common, *Festuca saximontana* 2, 20, 50, 50, old *Bromus tectorum* 10 scattered, *Carex* probably *pensylvanica heliophila* 40, 40, 40, etc., *Danthonia parryi* 50, 50 onward, *Koeleria macrantha* 40, 50, 50, 65, 70, *Bouteloua gracilis* 50); egg (#60) found on *Koeleria macrantha* (K. macrantha 10, 20, 1 m, *Poa nemoralis interior* 1 m, *Stipa comata* 3, 10, 15, 15, 20-100, *Bouteloua gracilis* 10-100, *Carex* probably *pensylvanica heliophila* 15, 15, 50-100, *Danthonia parryi* 25-35, *Festuca saximontana* 30, 40, 45, 90, etc., *Agropyron* *Elvms*="Sitanion" 1 longifolius 15, 35); egg (#61) found on *Stipa comata* (S. comata 20, 20, 20, 30, 35, etc. common, *Agropyron* *Elvms*="Sitanion" 1 longifolius 5, 20, 60, *Bouteloua gracilis* 15, 20-40, 40, etc., *Danthonia parryi* 30-40, 40-55, *Carex* probably *pensylvanica heliophila* 35, old *Bromus tectorum* 5 scattered common 20-1 m, *Festuca saximontana* 90); egg (#62) found on *Festuca saximontana* (F. saximontana 5, 5, 20, 20, 20, 20, common, *Koeleria macrantha* 5-10, 15, 30, 35, 55, 80, 1 m, *Danthonia parryi* 20-100, *Stipa comata* 12, 15, 20
common, Carex probably pensylvanica heliophila 20, old Bromus tectorum 25, Agropyron [Pascopyrum] smithii 40, Bouteloua gracilis 15, 50-70, 70; egg (#83) found on Festuca saximontana (F. saximontana 10, 30, 30, 40, 70, Koeleria macrantha 20, 25, 25, 45, 50-100, Stipa comata 10-30, 35, common, Danthonia parryi 10-1 m, Oryzopsis exigua 25-50, Agropyron [Pascopyrum] smithii 45, Carex probably pennysylvanica helio phi 10, 15, 20, 40, 60 etc., old Bromus tectorum 1 m, Bouteloua gracilis 60-1 m); all Guy Hill, Jefferson Co. Colo., June 20, 1988. Egg (#85) found on Festuca saximontana (F. saximontana 8, 20, 30, etc. thick, Danthonia parryi 18, 20-100 thick, Oryzopsis exigua 12-25, 50-80, Bouteloua gracilis 10-100 thick, Carex probably pensylvanica heliophila 25, 30, 40 etc., Koeleria macrantha 80, 1 m; egg (#86) found on Festuca saximontana (F. saximontana 15, 20, 20, 25, etc., Stipa comata 10, 20, 20, etc., Bouteloua gracilis 8, 5-1 m, Carex probably pensylvanica heliophila 12, 15, 15, 25, 30, Danthonia parryi 40-70, Koeleria macrantha 60, Poa nemoralis interior? 1 m; egg (#87) found on Festuca saximontana the second on Stipa comata leaf of tiny plant touching the F. saximontana (F. saximontana 40, 50, 1 m, S. comata 1, 4, 12, 15, 20, etc. common, Carex probably pensylvanica heliophila 28, Koeleria macrantha 40, Bouteloua gracilis 6-100, Vulpia octoflora 60, Danthonia parryi 30, Agropyron [Elymus="Sitanion"] longifolius 70, Oryzopsis exigua 40-55, 60-70); egg (#88) found on Festuca saximontana (F. saximontana 15, 25, 25, 40, etc., Koeleria macrantha 40, 40, Stipa comata 5, 15, 20, 20, 20, etc. Oryzopsis exigua 15, 25, 25-35, etc.); egg (#79) found on Koeleria macrantha (K. macrantha 80, 1 m, Stipa comata 25, 70, 80, 80, Agropyron (Elymus="Sitanion") longifolius 18, 20, 30, 40, 70, 70, 80, 1 m, Carex probably pensylvanica heliophila 10-100, Festuca saximontana 70, Bouteloua gracilis 15-20, 30, 40-100, old Bromus tectorum thick sward 8-100, Danthonia parryi 80, 80-100); egg (#73) found on Festuca saximontana (F. saximontana 5, 10, 13, 20, 20 onward, Stipa comata 30, 70, Poa compressa 60, Danthonia parryi 18-100, Poa pratensis 50 onward, Koeleria macrantha 15, 30, 40, 1 m, Carex probably pensylvanica heliophila 40, 60, etc., Bouteloua gracilis 20-40, Agropyron [Pascopyrum] smithii 30, 30, 50-100); all Guy Hill, Jefferson Co. Colo., June 21, 1988. Egg (#74, first stage larva D1/3 length of D2 on A10 as in nevada) found on Festuca saximontana (F. saximontana uncommon at this locality, 25, 30, 50, 55, 60, 1 m, 1 m, Oryzopsis exigua 10-30, 30, 40, 50-1 m, Carex probably pensylvanica heliophila 80, 90); egg (#76, 1st stage resembles nevada) found on Bouteloua gracilis (B. gracilis common 8 cm onward, Oryzopsis exigua 30, 30, 50, 70, Carex probably pensylvanica heliophila 25, 30, 30 onward common, Agropyron [Elymus="Sitanion"] longifolius 80); both N Beaver Brook, Jefferson Co. Colo., June 22, 1988. At this locality I searched 150 Bouteloua gracilis, 50 Festuca saximontana, 25 Festuca arizonica, 40 Oryzopsis exigua (the most common grass), 40 Carex probably pensylvanica heliophila, 25 Koeleria macrantha, "20 Stipa comata, 4 Agropyron [Elymus="Sitanion"] longifolius. Oviposition (#37) 15:30 on underside of Aster ericoides? leaf near stem (Poa pratensis 8, 20-1 m, 35-1 m common [egg at upper end of big swale of this], Stipa comata 5, 10, 15, 15, 15-1 m, 20, common, Koeleria macrantha 15, 13-30, 25, 30, 45 onward, Agropyron [Elymus="Sitanion"] longifolius 25, 25, 70); egg (#38) found (15 cm from egg #37) on 2-cm Solidago seedling leaf underside under Koeleria macrantha (K. macrantha 15 etc., Stipa comata 8-1 m, Poa pratensis 25 etc.) both Guy Hill, Jefferson Co. Colo., June 27, 1988. Egg found 9:57 on Bouteloua gracilis (B. gracilis 0-20, abundant to 1 m, Bromus tectorum common 2-100 cm, Stipa comata common 15-70 cm etc., Agropyron [Elymus="Sitanion"] longifolius 30, 50 cm, Danthonia parryi 40-60 cm, Vulpia octoflora 5, 10, 15, Carex probably pensylvanica heliophila 1 m); egg found 10:53 on Festuca saximontana (F. saximontana common 6-80 cm, Stipa comata 5, 20-40 cm etc. common, Carex probably pensylvanica heliophila 16-15, 50-1 m, Danthonia parryi 80-80, Oryzopsis exigua 60-30, Bouteloua gracilis 3-40, common 40-100 cm, Poa pratensis 25, 45, 70); egg found 11:05 on Festuca saximontana (F. saximontana common 5-90 cm, Poa compressa scattered 5-50 cm, Agropyron [Elymus="Sitanion"] longifolius 5, 10, common 15-80 cm, Stipa comata 7, 20-50 common, Bouteloua gracilis 5-100 cm common, Bromus tectorum 10-100 cm, Poa pratensis 90 cm onward, Vulpia octoflora 20 cm, Carex probably pensylvanica heliophila 50 cm, Bromus [Bromopsis] inermis 50-70 cm, Danthonia parryi 60-80 cm); 2 eggs found 11:17 on Festuca saximontana (F. saximontana 3, 10, 35, 60-90, Danthonia parryi 15-60, Poa nemoralis interior common 15-100, Poa pratensis 80-100, Bouteloua gracilis 40-60, Agropyron [Elymus="Sitanion"] longifolius 45, 80, Stipa comata 20, 35); egg found 11:50 on Festuca saximontana (F. saximontana 5-20, Agropyron [Elymus="Sitanion"] longifolius 5-50 common, Danthonia parryi 50-70, Bromus tectorum 20-100,
Festuca arizonica

exigua

Macrantha (K. Macrantha 35, nemoralis interior 80, Koeleria Macrantha 20, Bouteloua gracilis 5-10, 20, 50-80, Stipa comata 5, 15-30 etc., Agropyron [Elymus "Sitania"] longifolius 6 cm onward common, Bromus tectorum 10, 20-100, Bouteloua gracilis 5-40); egg found 12:12 on Festuca saximontana (F. saximontana 7-30, 70, 70, Koeleria macrantha 20, Bouteloua gracilis 5-10, 20, 50-80, Stipa comata 5, 15-30 etc., Agropyron

[Elymus "Sitania"] longifolius 15-50 etc., Oryzopsis exigua 80); 2 eggs found 12:28 on Festuca saximontana (F. saximontana 5-40, 50-80, Koeleria macrantha 60, Agropyron [Pascopyrum] smithii 10, very common 15-100, Agropyron

[Elymus "Sitania"] longifolius 10, 20-30 etc. common, Stipa comata 20, 45, Bouteloua gracilis 5-40, Oryzopsis exigua 35-90); egg found 12:38 on Festuca saximontana (0-40, Poa pratensis 15, common 20-100, Oryzopsis exigua 40-80, Agropyron [Elymus "Sitania"] longifolius 60, Agropyron [P.] smithii 10-20, 30-100 common, Stipa comata 20 etc.); egg found 12:48 on Festuca saximontana (F. saximontana 20-55, 80 etc., Koeleria macrantha 40, 100, Agropyron

[Elymus "Sitania"] longifolius 3, common 20-100, Agropyron [P.] smithii 60, 80, Stipa comata 30); egg found 13:06 on Festuca saximontana (F. saximontana 5, 15, 30-50, Oryzopsis exigua 40-50, Danthonia parryi 20, 65-80, Koeleria macrantha 30, Carex probably pensylvanica heliophila 10, 10-20, 60-70, Agropyron

[Elymus "Sitania"] longifolius 40-50, 100, Stipa comata 20, 20, 30, Bromus tectorum 5, Bouteloua gracilis 20-60); 2 eggs found 13:18 on Festuca saximontana (F. saximontana 20-35, 50, 80, Agropyron [P.] smithii 20-100, Danthonia parryi 100, Oryzopsis exigua 30-60, Poa pratensis 100, Stipa comata 70); egg found 13:35 on Festuca saximontana (F. saximontana 17, 90, Carex probably pensylvanica heliophila 10, Koeleria macrantha 7-30, 50, Agropyron [P.] smithii scattered 10-100, Stipa comata 45, 60, Oryzopsis exigua 25-30, 40-100, Bouteloua gracilis 5, 30-100, Danthonia parryi 30-50, Poa sp. 70-100); egg (did not hatch) found 13:43 on Koeleria macrantha (K. macrantha 40-60, Festuca saximontana 20, 30, Stipa comata 20, 25, common 35-100, Bouteloua gracilis 15-100, Carex probably pensylvanica heliophila 8-15, 40-100, Oryzopsis exigua 20-100, Bromus tectorum 90, Poa perhaps nemoralis interior 40, Agropyron [P.] smithii few); 2 eggs found 13:57 on 2 Bouteloua gracilis leaves 3 mm apart, next to Festuca saximontana (B. gracilis 7, 15, 15-100, F. saximontana 1-4, 10, 15, 20, 50, 30, Danthonia parryi 65-90, Festuca arizonica 60, 60-70, 100, Agropyron [Elymus "Sitania"] longifolius 45, 45, Carex probably pensylvanica heliophila 40, 40-100, Stipa comata 25, Oryzopsis exigua 25, 25-40, 40-60, Poa pratensis 20-60, Bromus tectorum 3, scattered 15 onward, Koeleria macrantha 90); egg found 14:10 on Festuca saximontana (F. saximontana 20-30 onward, Agropyron [P.] smithii 8, 15, 20-100, Bromus tectorum scattered abundant 8 cm onward, Stipa comata 10, Danthonia parryi 5, 50-60, Koeleria macrantha 75, Bouteloua gracilis 40-50 etc., Poa pratensis 90); first egg found 14:15 on Festuca saximontana (F. saximontana 18, 15, 25-40, 60, etc.), second egg found 14:15 on Koeleria macrantha (13 cm from last egg) (for both eggs Poa pratensis 25, Bromus tectorum scattered 10-100, Danthonia parryi "40-50, Oryzopsis exigua "30, Poa compressa "40, Bouteloua gracilis "30-100, Stipe comata "15, 25, 80, etc.); egg found 14:24 on Festuca saximontana (F. saximontana frequent 7-50, Bromus tectorum 15-100, Stipa comata 5, 45-50, Bouteloua gracilis 7, Poa pratensis 15, 40-100, Oryzopsis exigua 50-80, Koeleria macrantha 40-50, 100, Agropyron [P.] smithii 30, 40); egg found 14:34 on Festuca saximontana (F. saximontana 20, 20, 40-45, 70-90, Stipa comata 5, 10, 15, 40, 50, etc., Agropyron [Elymus "Sitania"] longifolius 16, 30, 30, Danthonia parryi 20-100, Poa pratensis 30-100, Koeleria macrantha 25, 50-80); egg found 14:52 on Festuca saximontana (F. saximontana 5, 15, 20, 20-100, Bouteloua gracilis 25-100, Koeleria macrantha 5, Agropyron [P.] smithii scattered 35-100, Bromus tectorum scattered common 15-100, Agropyron

[Elymus "Sitania"] longifolius 20, common 40-100, Stipa comata 90); Guy Hill, Jefferson Co. Colo., June 19, 1983. Egg found 9:04 on Festuca saximontana (F. saximontana 5, 7, 12, 25-30, 50, 80-90, Bouteloua gracilis 50-90, Agropyron [Pascopyrum] smithii common 15-100, Stipa comata 6, Oryzopsis exigua 50-100, Bromus tectorum 30-100); 2 eggs found 9:15 on Festuca saximontana (F. saximontana 10-20, 30, 70-80, Poa nemoralis interior 22-100, Agropyron

[Elymus "Sitania"] longifolius 15, 25, Stipa comata 20, 40-55, Oryzopsis exigua 30-60, Carex probably pensylvanica heliophila 50-90); egg found 9:23 on Festuca saximontana (F. saximontana 5, 7, 10, common 20-100, Agropyron

[Elymus "Sitania"] longifolius 20, 25, 50, 60, Oryzopsis exigua 50-90, Koeleria macrantha 50, 80, Carex probably pensylvanica heliophila 1 m, Poa nemoralis interior 80-100, Danthonia parryi 60-80); egg found 9:33 on Koeleria macrantha (K. macrantha 10, 30, 40-60, 100, Bouteloua gracilis 15, Oryzopsis exigua 30-40, 15-50, Stipa comata 30-40, 65, Festuca saximontana 25, 40, 60, 70, Festuca arizonica 70-80, Carex probably pensylvanica heliophila 50-80, Bromus tectorum 35, 50-100); egg found 9:52 on Festuca saximontana (F. saximontana 10,
found 13:24 on Festuca saximontana (= F. saximontana 8, 25, 35, 50, Agropyron [P.] smithii 20, 25, 50, Bromus tectorum scattered 10 cm onward, Poa pratensis interior 8, 10, common 20-100, Koeleria macrantha 45, Stipa comata 45, Bouteloua gracilis 20-30, 50-100); egg found 13:34 on Koeleria macrantha (K. macrantha none near, Festuca saximontana 30, 35, 35, 40, 60, Stipa comata 20, 35, 50, 70, 70, Bouteloua gracilis 10-100, 20-100, Agropyron [Elvymus = "Sitaniaon"] longifolius 20, 20, Bromus tectorum 10-100, Poa pratensis 90-150, Carex probably pensylvanica heliophila 4, 15, 25, 40, 30-100); egg found 13:56 on Festuca saximontana (= F. saximontana 20, Agropyron [P.] smithii 15, 25, 35, abundant 35-100, Koeleria macrantha 10-20, abundant 20-100, Poa pratensis interior 40, Oryzopsis exigua 60-70, Stipa comata 15); egg found 14:00 on Koeleria macrantha (K. macrantha 0-20, 50, 70, abundant 30-100, Oryzopsis exigua 10-20, 30-100, Stipa comata 30, 35, 50-70, etc., Agropyron [P.] smithii 60, 70-100, Festuca saximontana 5, 10, 15, 15, common 20 cm onward, Bromus tectorum scattered 30 cm onward); egg found 14:33 on Festuca saximontana (= F. saximontana 8-10, common 30 cm onward, Oryzopsis exigua 80-100, Agropyron [P.] smithii 20, 30, 40, 50-100, Bromus [Bromopsis] inermis 40, 40, 40, Koeleria macrantha 70-90, Bromus tectorum scattered 35 cm onward, Stipa comata 15 Agropyron [Elvymus = "Sitaniaon"] longifolius 40, 45, 70); egg found 14:46 on Festuca saximontana (= F. saximontana 10, 20, 25, 40, 40, 40, Koeleria macrantha 20, 45, Bromus tectorum abundant 10-100, Stipa comata 65, Agropyron [Elvymus = "Sitaniaon"] longifolius 40-50, 60-65, etc.); egg found 15:04 on Festuca saximontana (= F. saximontana 10-20, 30, Bouteloua gracilis 30, Danthonia parryi 40-80, Carex probably pensylvanica heliophila 40-100, Oryzopsis exigua 100, Agropyron [Elvymus = "Sitaniaon"] longifolius 35, 65-100, Bromus tectorum 15, Koeleria macrantha 90); egg found 15:22 on Festuca saximontana (= F. saximontana 7, 15, 20, 25, 30, etc., Carex probably pensylvanica heliophila 20-25, 30-100, Koeleria macrantha 50, Agropyron [Elvymus = "Sitaniaon"] longifolius 30, 30-35, 40, Oryzopsis exigua 40-100); Guy Hill, Jefferson Co. Colo., June 20, 1989. HOSTPLANTS: 148 eggs or ovipositions were found. Guy Hill is a low montane grassland hillside where H. nevada is common, H. comma is common but flies much later than H. nevada, H. pahaska is less common but flies mostly later than H. nevada, and H. unca and H. iuba are rare. Ovipositing females hover slowly as usual, but if they encounter a tree or shrub or shade or a patch of unsuitable habitat or a disturbance they shift into high speed; as a result they can be followed to oviposition less than 50% of the time, so only 4 ovipositions were seen. Females obviously prefer to oviposit in areas with some bare ground, on the outside (underside) of leaves about 2 cm above ground, on or near the outside of 2-3 cm wide tender young grass clumps (mostly of Festuca saximontana, sometimes Koeleria macrantha or Stipa comata); very few eggs were laid on dicotyledons. Eggs were common around several pine trees at Guy Hill, but not around others so this was apparently coincidence. Koeleria macrantha was searched somewhat more often than its grassland would have warranted if searching had been random in 1988, but was searched much less than random search would require in 1989, so its popularity for oviposition is probably a bit more than the egg count in Table 7 would suggest. The grassland here has millions of grass individuals, so the observer might think that it would be very difficult to find H. nevada eggs; however, after discovering their preferred hosts, I found that it takes only a few minutes to find an egg by searching the favorites Festuca saximontana and Koeleria macrantha. Festuca saximontana is the favorite (97 eggs), Koeleria macrantha is second (20 eggs including 1 on Solidago under it), and Stipa comata is third (16 eggs, plus 1 egg that could be on misidentified Koeleria macrantha, plus 1 egg on Aster ericoides near S. comata and Poa pratensis); females rarely lay on other grasses (Bouteloua gracilis 4 eggs, Poa pratensis 1 egg, Danthonia parryi 1 egg, Oryzopsis exigua 1 egg, non-monoocot 1 egg). Stipa comata is very common but has few eggs; its leaves are narrow and usually so tough that I prefer to believe that it is a poor host for all butterflies. Bouteloua gracilis, Oryzopsis exigua, Agropyron (Pascopyrum) smithii, Danthonia parryi, Poa pratensis, and Carex probably pensylvanica heliophila have few or no eggs despite extensive search. The following discusses the various grasses at this site and their appeal for H. nevada (the grasses are listed from most succulent in appearance to least succulent): Poa pratensis is lush, but is rarely chosen; Danthonia parryi is also a lush green wide-leaf grass growing in large clumps, but various unknown reason is shunned by all butterflies. Carex probably pensylvanica heliophila is common and green and grows in clumps, but is shunned. Koeleria macrantha leaves are dark green and very succulent when touched, so it would appear to be a great host, but it is only second choice by the skippers (the taxonomy of this plant is unresolved, and most people who see it in nature including myself think that there must be several species involved, the plants are so variable). Oryzopsis exigua looks like a terrific hostplant because the
grayish-green leaves are somewhat tender and it grows in a large clump 10-20 cm wide; however it is nearly universally shunned by all butterflies. *Bouteloua gracilis* grows in nice clumps and stays somewhat green even in a drought, but is mostly ignored. *Festuca saximontana* is a small grass, only "4 cm tall and "3 cm wide, with blue-gray leaves, but is the favorite host. *Festuca arizonicus* grows in a very large inviting clump 20 cm wide, but has hairlike grayish leaves and is also universally nearly shunned. *Stipa comata* grows in clumps and is very common but has very tough narrow gray leaves and is mostly ignored by all or most butterflies. *Agropyrum (Pascopyrum) smithii* and *Agropyrum* (*Elymus*="Sitanion") *longifolius* also have tough leaves, the former bluish-gray, and are ignored. *Bromus tectorum* is an annual grass, dead and brown this time of year, so is shunned. *Vulpia octoflora* is a tiny green annual grass, which looks somewhat tough and is shunned. The essential conclusion of this discussion is that *H. nevada* does not choose its hosts according to my succulence rating, or according to the size of the grass clumps, it evidently chooses its favorite hosts according to some biochemical odor. When the results from Guy Hill and South Park (see below) are combined, the favorite hosts (*Festuca saximontana* and *Festuca idahoensis*) differ greatly (a very small clump with 1 mm x 4 cm leaves versus a large clump with <1 mm x 20 cm hairlike leaves), which allows to confirm the conclusion that biochemical factors guide host choice. EARLY STAGES: Mature or nearly mature larvae must hibernate usually lab larvae did not diapause and continued feeding, and consumed *Poa pratensis*, though disease eventually killed all but one larva, which pupated. EGG cream, versus green in *Polites draco*; hemispherical, larger than *P. draco* eggs. FIRST-STAGE LARVA yellowish-cream (slightly greenish internally after feeding), seta D1 on A10 fairly long, nearly as long as the longest seta, which is D2 (D1 is longer than shown by MacNeill 1964 Fig. 5)(H. pahaska & H. uncus have D1 on A10 very long, longer than *nevada*) all 1988 and most 1989 eggs were allowed to hatch and the resulting larvae examined with a microscope for these traits); collar dark brown; head chitin-brown. HALF-GROWN LARVA medium-brown. MATURE LARVA dark brown, collar black with a satellite sclerite just above spiracle; head black, with a long medium-brown stripe along coronal sulcus and a shorter medium-brown stripe along upper part of adfrontal sulcus. PUPA head, thorax, & wings dark blackish-brown, wings dark blackish-gray, abdomen light brown with dark-brown transverse dashes (several strong dashes above and just in front of spiracle axis, weaker ones posteriorly and below and behind spiracle axis), A5 dark-brown, medial part of eye & orbit ochre & hairy, posterior base of eye ochre (appearing to be a separate sclerite), some tufts of long ochre setae on head (each tuft is on an ochre area), T1 spiracle ochre, an ochre streak on each side of T1: a tuft of setae & a lenticle cluster lateral to proboscis on A5 & A6, abdomen has many short ochre setae; hind legs extend 1.7 mm beyond wings; proboscis extends 5 mm beyond wings; cremaster sharp, with lateral hairs and terminal crochets; pupated upside-down attached by cremaster (no silk girdle) in nest of silked-together leaves, the silk had lots of "lumpy" areas in it.

*Hesperia nevada nevada* (Scud.). (Adults have greenish-ochre-brown ventral hindwing, as in most of the species’ range.) Ovipositing *Koeleria macrantha* (W.), 2 mi. NE Rosita, Custer Co., Colo., June 30, 1969. Egg (#80) found on *Festuca idahoensis* large clump (F. idahoensis 10, 20, 20, 40, etc.), *Koeleria macrantha* 5-40, *Bouteloua (ChondrosuM) gracilis* 15-1 m, *Muhlenbergia torreyi* 10-1 m); egg (#81) found on *Festuca idahoensis* large clump (F. idahoensis 15, 15-40, 40-1 m, *Koeleria macrantha* 15, *Muhlenbergia torreyi* 3, 3-1 m, *Bouteloua gracilis* 15-1 m); egg (#82) found on *Festuca idahoensis* large clump (F. idahoensis 20, 20, 25, etc. to 1 m, *Koeleria macrantha* 3-10, 60, *Stipa comata* 5-20, *Muhlenbergia torreyi* 15-1 m, *Carex oreocharis* 40-1 m); egg (#83) found on *Festuca idahoensis* large clump (no F. idahoensis nearby, *Bouteloua gracilis* 5-25, *Carex oreocharis* 3-1 m common, *Muhlenbergia torreyi* 40-1 m, *Agropyrum Elvms*="Sitanion") *longifolius* 50); egg (#84) found on *Festuca idahoensis* large clump (F. idahoensis 6-30, 40, 50, 1 m, *Muhlenbergia torreyi* 10-1 m, *Koeleria macrantha* 25, 45); egg (#85) found on *Festuca idahoensis* large clump (F. idahoensis 10, 15, 20, 40, 1 m, *Koeleria macrantha* 25 etc. onward, *Carex oreocharis* 10 onward, *Muhlenbergia torreyi* 10 common); egg (#86) found on *Koeleria macrantha* (K. macrantha 15, *Bouteloua gracilis* 1 cm-1 m, *Muhlenbergia torreyi* 20-1 m, *Carex oreocharis* 35, 50); egg (#91) found on *Festuca idahoensis* large clump (F. idahoensis 10, 1 m, *Koeleria macrantha* 5-15, 50, 60, *Muhlenbergia torreyi* 7-1 m, *Carex oreocharis* 6-1 m, *Bouteloua gracilis* 30, 30-90); all South Park SW Jefferson, Park Co. Colo., June 23, 1988. Egg found on *Stipa comata* (S. comata none nearby, *Festuca idahoensis* 20-40 cm, 30-100, 50-70, *Festuca saximontana* 90, *Carex obtusata* 90), NW Tabernash, Grand Co. Colo., June 24, 1988. Egg found on *Festuca idahoensis* (F. idahoensis none nearby, *Agropyrum*
S. sabuleti and P. peckius may occupy the middle of a probable phylogenetic network of most species, but extend only 2-2.5 mm beyond wings in S. sabuleti & P. peckius. Mystic & Senora are closely related and evolved from *origenes* in the apparent ancestral type in *S. sabuleti*. Pupae are mostly orange, as in Jefferson County, except a different *Festuca* is chosen. Curiously, *F. idahoensis* resembles *F. arizonica* in Jefferson Co. (same hairlike leaves and large clumps) but *P. arizonica* is shunned in Jefferson Co. where the preferred *F. saximontana* is a tiny clump with larger grey leaves. This again seems to show that olfactory biochemical cues rather than visual appearance are used by ovipositing females to select hostplants.

**Atalopedes ceneaesrias** (BGV.). Adults associated with *Poa pratensis* (the only grass in lawn), Morse Park, Lakewood, Jefferson Co. Colo., Aug. 12, 31, Oct. 5, 1987. Adults associated with *P. pratensis* (the only grass in lawn), Kendrick Lake, Lakewood, Jefferson Co. Colo., Sept. 9, 1987. Larvae eat *P. pratensis* in lab. *Early Stages* (eggs, larvae, pupae from eggs laid by *W. Nebr. Femaile*). Egg white, circular in dorsal view, lower edge slightly rounded, without flange. 1ST-Stage Larva: cream, collar & head black. Young Larva (1/3 grown) dark-green (more tan beneath), middorsal band darker; collar & head black. Half-Grown Larva: light-brown (older larvae become darker and darker). Mature Larva: dark brown (under microscope, actually cream with thousands of red-brown spots, one under each seta), ochre-brown laterally, middorsal line blackish-brown on A2-A10, ventral gland present, T1 spiracle black, collar and circular scute below it black (collar edged by white anteriorly); head black with a weak to strong gray streak along coronal sulcus, pale-brown adfrontal areas (absent sometimes), and an orangish spot in front of eyes (absent on some larvae). Pupa when first formed tan-cream on abdomen (orange-tan on top of abdomen, light-brown on top of thorax, tan on wings) with blackish motting on head T1 and front of T2 and T3, heart-line brown on abdomen, numerous small brown dashes very similar to the spots of *Poanes* and *Hesperia* pupae; abdomen then becomes pinkish-tan and head thorax wings become dark grey-brown, finally abdomen becomes orange-brown and head thorax wings nearly black and the abdominal dots brown-black, head has a large ochre circular spot next to middorsal line and a similar spot on anterior medial front of head with a tiny ochre spot beside it, orbit and vicinity is ochre, crenaster brown, T1 spiracle pale brown, proboscis extends 1-1.5 mm beyond wings. Perhaps *Atalopedes* is a subgenus of *Hesperia*.

**Polites.** I have reared all 7 Colo. *Polites*, and the early stages of all other species (*baracoa, vibex, mardon*) are known (except for the *baracoa* pupa), so comparisons between species can be made. *P. peckius, mystic, and sonora* lay eggs without glue which fall to the litter; *draco* and *themistocles* often lay eggs on dicotyledons rather than hosts. Only *origenes* makes aerial larval nests. Some eggs are cream, others are pale greenish, and in some species the eggs turn orangish or pinkish. First-stage larvae are similar in all species; the body turns greener after feeding. Mature larvae are usually brown (but *sabuleti* is slightly greenish and *P. vibex* is pale green); all have the heartline darker. The top of A10 of older larvae is unmarked brown in mystic & *sonora & origenes*, whereas in *sabuleti & peckius* its rear rim is brown but a blackish U-shaped mark occurs on A10, while in *draco* & *themistocles & mardon* (and perhaps *baracoa* and *vibex?*) the A10 rear rim is blackish and a subdorsal and middorsal blackish band is on A10. The mature larval head is solid black (except "dull yellow" in *baracoa*) without pattern in *draco* & mystic & *sonora & origenes*, but in the apparent ancestral type in *sabuleti & mardon & peckius & themistocles* & *baracoa & vibex* the head has paler stripes (generally beside coronal sulcus, in adfrontal area, & a spot in front of eyes). Pupae are mostly dark brown, though mystic & *sonora* pupae are more black, and *sabuleti & themistocles* are greenish. The pupal proboscis extends 4-7 mm beyond wings to crenaster in most species, but extends only 2-2.5 mm beyond wings in *sabuleti & themistocles* (as *baracoa & mardon* proboscis unknown). I have not yet examined first-stage larval setae, but now *draco* seems to be an offshoot of *sabuleti* as may be *mardon, mystic*, and *sonora* are closely related and evolved from the precursor of *peckius*, while *origenes* and the closely-related *themistocles*/*baracoa* form a branch that evolved from the precursor of *sabuleti*; *sabuleti* and *peckius* may occupy the middle of a probable phylogenetic network.
Polites draco. Female preovipositions 10:03, 10:25, 10:30, Poa pratensis (common nearby); oviposition 10:20 on underside of leaf of 4 cm Potentilla? beside Poa pratensis (P. pratensis common nearby, Stipa comata 3 cm away and common also, Danthonia parryi rare 20 cm away, Koeleria macrantha rare 30 cm away, Bromus [Bromopsis] inermis rare 70 cm); oviposition 12:14 on underside of Poa pratensis leaf next to Ageropseris aurantica (P. pratensis common nearby, Stipa comata 10 cm uncommon, Bromus (Anisantha) tectorum 1 old stalk 20 cm and common 40-70 cm, Koeleria macrantha rare 90 cm, Bromus [Bromopsis] inermis uncommon 20, 1 m); preoviposition 12:10 bent abdomen in litter under Astragalus sp. (Poa agassizensis common all around); all Guy Hill, Jefferson Co. Colo., June 13, 1988. Oviposition 9:57 on top of Antennaria parvifolia leaf (Poa nemoralis interior common 10, 15, 20, 30, 50 cm onward, Stipa comata common 8-20 cm, 30, 40, 60, 100 cm away, Bouteloua (Hordonomus) gracilis 40 cm away, Danthonia parryi 70 cm, dead Festuca saximontana 70 cm away, old Bromus tectorum 20, 40 cm, common 70 cm); preoviposition 10:27 on underside of Taraxacum officinale leaf (Carex probably pennisylvanica heliophila, Bouteloua gracilis, Stipa comata within 10 cm, Poa pratensis 25-100 cm); preoviposition 10:55 bent abdomen on underside of Solidago leaf (Poa pratensis all over, Bouteloua gracilis 10-100 cm); oviposition 11:01 on underside of Poa pratensis leaf (P. pratensis common all over, Danthonia parryi clump 8-30 cm, Bouteloua gracilis rare 10 cm); all Guy Hill, Jefferson Co. Colo., June 14, 1988. Oviposition 13:40 on underside of Antennaria parvifolia leaf (Poa pratensis thick all over and near egg, Stipa comata 2, 20, 40, 70, 50 cm away, Agropyron [Pascopyrum] smithii 20, 30, 30 cm away, Koeleria macrantha 1 m away), Guy Hill, Jefferson Co. Colo., June 15, 1988. Egg found on underside of Oxytropis pascopyrum Pursh seeding leaf beside Koeleria macrantha (K. macrantha common 1-100 cm away, Poa pratensis 3, 15 cm away common and thick all around, old Bromus tectorum scattered 20-100 cm, Agropyron [Pascopyrum] smithii 10, 10-20, 50, 80, 90 cm, Agropyron (Elvynus='Sitanion') longifolius dead inflorescence 50 cm, Bouteloua gracilis 40-80, 90-120 cm, Carex probably pennisylvanica heliophila m, Danthonia parryi 40-50 cm), Guy Hill, Jefferson Co. Colo., June 16, 1988. Oviposition 10:22 Koeleria macrantha stem (K. macrantha 12, 15, 20, 30, 40, 40, 50 cm, Poa pratensis also in small oviposition clump and thick 0.5 cm onward, Stipa comata 5, 20, 20, 40-50 cm etc.); egg found (#10) Festuca saximontana (F. saximontana 5, 15-20, 20-40 cm onward, Koeleria macrantha 2, 20, 20, 1 m, Orezyopsis exigua 15-40, 90-1 m, Agropyron [Pascopyrum] smithii common 20-100 cm, Bouteloua gracilis 30, 50 cm); both Guy Hill, Jefferson Co. Colo., June 17, 1988. 1 egg found (#22) on underside of Koeleria macrantha leaf (K. macrantha 1-5, 15, 20, 25, 25, 50, 40 cm, etc., Festuca saximontana 4, 20, 25-25, 25, 30, 60 cm, etc., Oryzopsis exigua 40-50, Bouteloua gracilis 5-10, 10, 20, 50, 60 cm, Stipa comata 5, 8, 10, 15, 15, 20 cm onward, Danthonia parryi 50-65 onward); 1 egg found (#23) on Festuca arizonica clump (no other clumps of Festuca arizonica, Carex probably pennisylvanica heliophila 5, 8, common 20 onward, Koeleria macrantha 10, 10-15, 25, 30, 30 cm, etc. common, Bouteloua gracilis 15 cm uncommon, Danthonia parryi 40, 60, 60, 70, 70 cm, Festuca saximontana 12, 40, 60, 70 cm, Stipa comata 20 cm, Orezyopsis exigua 70 etc.); both Guy Hill, Jefferson Co. Colo., June 19, 1988. Preevgiposition 11:35 bent abdomen toward Festuca saximontana twice, Stipa comata once, Koeleria macrantha once, she did not land on Poa pratensis; egg found on (#64) Koeleria macrantha (K. macrantha 12, 20, 50-60 cm, Bouteloua gracilis 5-100 cm, Poa compressa 25-60 cm, old Bromus tectorum 5 cm common, Stipa comata 10, 15-30 cm common, Danthonia parryi 30, 40 cm, Agropyron [Pascopyrum] smithii 50 cm); both Guy Hill, Jefferson Co. Colo., June 20, 1988. Egg (#71) found on Festuca arizonica giant clump (F. arizonica another small clump 15 cm, Danthonia parryi 12-100 cm, Festuca saximontana 20, 100 cm, Poa pratensis 40-100 cm, Stipa comata 40, 40, 45, 70, 70, 70 cm, Agropyron [Elvynus='Sitanion'] longifolius 25, 30, 90 cm, Koeleria macrantha 1 m), Guy Hill, Jefferson Co. Colo., June 21, 1988. Oviposition (#92) 10:43 Agropyron (Elvynus='Sitanion') longifolius young leaf (A. E.) longifolius 40, 90 cm, 1 m, Poa pratensis 20, 40-1 m, 40-1 m (commonest grass over a several meter area), Old Bromus japonicus 20-10 cm, Stipa comata 10, 18, 20, 20, 20, 25, 30 cm onward, old Bromus japonicus 3, 15, 40, 45 cm, old Bromus tectorum 10-1 m common); egg (#100) found on Koeleria macrantha (K. macrantha 20-30, 30, 50, 80 cm, Agropyron [Elvynus='Sitanion'] longifolius 20, 80, 80 cm, Stipa comata 15, 15, 20, 20 cm etc. common, Poa pratensis 20, 35, 50-1 m, Carex probably pennisylvanica heliophila 7, 10, 10-1 m); both Guy Hill, Jefferson Co. Colo., June 27, 1988. Preevgiposition 9:20-9:23, female bent abdomen 3 times on Poa
Distichlis spicata var. stricta (C) and Sporobolus airoides, 1 mi. W
Sept. association COMMonest trial so it is not a host (and I know of no butterfly that eats Juncaceae). In but 1st-stage larvae would not eat this (not even one bite) in a two-day lab trial so it is not a host (and I know of no butterfly that eats Juncaceae). In the lab, larvae (from eggs laid by females from Barr Lake, Adams Co., Colo.,
eggs laid on it would be chopped off by lawn mowers if they did). Half-grown larvae must hibernate. EARLY AUG. 12, 1987, and park in Lakewood, Jefferson Co. Colo., Aug. 20, 1990. Female 13:00 landed on vertical Bromus (Bromopsis) inermis leaf and bent abdomen to leaf then flew rapidly away, no egg seen or found; adults were common in this B. inermis/Poa pratensis meadow, so presumably one of them is probably a host, but considerable time spent watching adults produced no ovipositions, and no eggs were found on these blades (evidently because females let eggs drop from the abdomen as do Polites sonora and P. mysticus). Wheateidge, Jefferson Co. Colo., Aug. 4-23, 1930, Aug. 17-Sept. 7, 1931. Hostplants: D. s. var. stricta, P. pratensis, and probably B. inermis are evidently hosts; Leersia oryzoides (a N.Y. host reported by A. Shapiro) cannot be more than an occasional host because it generally grows in/beside water and females lay eggs without glue so most eggs laid on it would float away. Larvae must make silk tunnels in litter/soil, because adults are found on Poa pratensis lawns where no aerial nests occur (and would be chopped off by lawn mowers if they did). Half-grown larvae must hibernate. EARLY STAGES (from eggs laid by female from Wheateidge, Jefferson Co. Colo.) were reared to pupa on Poa pratensis. Females all oviposited in spots (typically 0.5 m wide) where cows have grazed the grass/sedge/rush plants down to only 4 cm heights; they never oviposited or even landed on the 10-20 cm tall mature clumps. The explanation is that females seek the younger more tender plants that are exposed in grazed spots (and grazing may stimulate the growth of young grass shoots). This explains why P. sabuleti is common on lawns in Calif. and W-C Colo.; perhaps it has not invaded the Poa pratensis lawns in Denver because it prefers drier grasses, such as Cynodon dactylon, the Calif. urban host. Barr Lake has three meadows where P. sabuleti occurs, all three with moist-meadow centers (too moist for sabuleti) where Distichlis spicata var. stricta & Hordeum jubatum are on the drier edge of the meadows; P. sabuleti is uncommon in a small meadow without cows, more common in a small meadow with cows, and commonest in a large meadow with cows. So grazing may improve the habitat for sabuleti, and certainly does not hurt it. There are two flights in Adams Co. Colo. (June and Aug.—Sep.) and apparently in W Colo.—N New Mex.—U—C Nev. Larvae must hibernate about half grown. Early stages (Barr Lake): EGG pale greenish-cream (perhaps slightly bluish-greenish-cream), does not develop spots (turns creamy when about to hatch); in contrast, P. themistocles eggs develop spots. FIRST STAGE LARVA cream collar & head black. MATURE LARVA greenish-light-brown in most larvae, brownish-green in others, numerous dark hairs, a middorsal brown band (this band on A10 blackish and consisting of several spots, and a subdorsal blackish band also occurs on A10), a very slight subdorsal dark dashlike spot on front of each abdomen segment, each abdomen segment has a lateral ridge the same color as body, a middorsally-divided black collar, A10 top has dark brown just in front of rear (some larvae have a subdorsal and an interrupted middorsal black bands on top of A10 while in others these bands are broken into small anterior and posterior blackish spots, and in other larvae these spots are small so that there is little trace of the subdorsal and middorsal band on A10), Ti spiracle black; head black with a vertical cream stripe near midline above an adfrontal cream stripe, a cream curve in front of eyes. PUPA head-thorax-wings brownish-green, abdomen greenish-yellow tinged with brown and covered with 1-mm red-brown hair (the front of each abdomen segment cream, the rear greenish-cream, posterior rim red-brown), a few clusters of red-brown hair on head, a middorsal band of brown spots (each spot narrowed on front of each segment) on abdomen, weak lateral and subventral brown areas on abdomen, Ti spiracle dark-red, cremaster light-red-brown, proboscis red-brown where it extends 2 mm beyond wings.

Polites sabuleti ministigma Scott. 11 eggs found on Sporobolus airoides (previously misidentified as Eragrostis trichodes [B]), 1 egg found on Equisetum sp., 1 egg found on unknown dicotyledon, all near S. airoides, NE of Hayden Creek Cgd., Fremont Co. Colo., July 10, 1971. Adults also associated with S. airoides in the San Luis Valley, Saguache Co., Colo. S. airoides is a tough dry grass whose leaves closely resemble those of Distichlis spicata and Hordeum (Critesion) jubatum (all three grasses "crunch" when stepped on), so clearly P. sabuleti is adapted to tough dry turflike crunchgrass. Only one flight in the San Luis Valley and Arkansas River Canyon. Half-grown larvae must hibernate.

Polites sabuleti chusca (Edw.). Adults associated with Distichlis spicata var. stricta, Mesquite, Clark Co. Nev., Aug. 8, 1974. Sep. chusca must have 2-3 flights/year.

Polites peckius (Kirby). Ovipositions 11:30, 11:35 abdomen bent to underside of Distichlis spicata (W) var. stricta leaves, the eggs dropped from abdomen into litter (other grasses within 1/3 m of eggs were Agrostis gigantea [W] common, Hordeum (Critesion) jubatum [W] fairly common, Muhlenbergia spiciglottis [W] rare), Barr Lake, Adams Co. Colo., Aug. 19, 1986. Adults associated with Poa pratensis (only grass present in lawn) Moraie Park, Jefferson Co. Colo., Aug. 12, Oct 5, 1987, and park in Lakewood, Jefferson Co. Colo., Aug. 28, 1988. Female 13:00 landed on vertical Bromus (Bromopsis) inermis leaf and bent abdomen to leaf then flew rapidly away, no egg seen or found; adults were common in this B. inermis/Poa pratensis meadow, so presumably one of them is probably a host, but considerable time spent watching adults produced no ovipositions, and no eggs were found on these grasses (evidently because females let eggs drop from the abdomen as do Polites sonora and P. mysticus). Wheateidge, Jefferson Co. Colo., Aug. 4-23, 1930, Aug. 17-Sept. 7, 1931. Hostplants: D. s. var. stricta, P. pratensis, and probably B. inermis are evidently hosts; Leersia oryzoides (a N.Y. host reported by A. Shapiro) cannot be more than an occasional host because it generally grows in/beside water and females lay eggs without glue so most eggs laid on it would float away. Larvae must make silk tunnels in litter/soil, because adults are found on Poa pratensis lawns where no aerial nests occur (and would be chopped off by lawn mowers if they did). Half-grown larvae must hibernate. EARLY STAGES (from eggs laid by female from Wheateidge, Jefferson Co. Colo.) were reared to pupa on Poa pratensis. Females all oviposited in spots (typically 0.5 m wide) where cows have grazed the grass/sedge/rush plants down to only 4 cm heights; they never oviposited or even landed on the 10-20 cm tall mature clumps. The explanation is that females seek the younger more tender plants that are exposed in grazed spots (and grazing may stimulate the growth of young grass shoots). This explains why P. sabuleti is common on lawns in Calif. and W-C Colo.; perhaps it has not invaded the Poa pratensis lawns in Denver because it prefers drier grasses, such as Cynodon dactylon, the Calif. urban host. Barr Lake has three meadows where P. sabuleti occurs, all three with moist-meadow centers (too moist for sabuleti) where Distichlis spicata var. stricta & Hordeum jubatum are on the drier edge of the meadows; P. sabuleti is uncommon in a small meadow without cows, more common in a small meadow with cows, and commonest in a large meadow with cows. So grazing may improve the habitat for sabuleti, and certainly does not hurt it. There are two flights in Adams Co. Colo. (June and Aug.—Sep.) and apparently in W Colo.—N New Mex.—U—C Nev. Larvae must hibernate about half grown. Early stages (Barr Lake): EGG pale greenish-cream (perhaps slightly bluish-greenish-cream), does not develop spots (turns creamy when about to hatch); in contrast, P. themistocles eggs develop spots. FIRST STAGE LARVA cream collar & head black. MATURE LARVA greenish-light-brown in most larvae, brownish-green in others, numerous dark hairs, a middorsal brown band (this band on A10 blackish and consisting of several spots, and a subdorsal blackish band also occurs on A10), a very slight subdorsal dark dashlike spot on front of each abdomen segment, each abdomen segment has a lateral ridge the same color as body, a middorsally-divided black collar, A10 top has dark brown just in front of rear (some larvae have a subdorsal and an interrupted middorsal black bands on top of A10 while in others these bands are broken into small anterior and posterior blackish spots, and in other larvae these spots are small so that there is little trace of the subdorsal and middorsal band on A10), Ti spiracle black; head black with a vertical cream stripe near midline above an adfrontal cream stripe, a cream curve in front of eyes. PUPA head-thorax-wings brownish-green, abdomen greenish-yellow tinged with brown and covered with 1-mm red-brown hair (the front of each abdomen segment cream, the rear greenish-cream, posterior rim red-brown), a few clusters of red-brown hair on head, a middorsal band of brown spots (each spot narrowed on front of each segment) on abdomen, weak lateral and subventral brown areas on abdomen, Ti spiracle dark-red, cremaster light-red-brown, proboscis red-brown where it extends 2 mm beyond wings.

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other Meadow grasses; Fraser, Grand Co. Colo., July 31, Aug. 1-2, MATURE LARVA of Scudder's Scirpus ater abundant adults May prefer long-grass for oviposition. Larvae eat P. crescent in front of eyes. antennae tan, groove at edge of wing tan.

[to be continued]
lack glue and fall to the litter when laid, and larvae probably tunnel into soil (explaining the absence of aerial nests); a female from Fraser Aug. 1 laid "29 eggs in lab, NONE of which was glued to anything, thus all fell to bottom of container; larvae ate Poa pratensis in lab. Half-grown larvae no doubt hibernate in nature. In lab, oviposition to adults takes 9-11 weeks. EGG not glued on, pale green when laid, developing an orangeish flush later. 1ST-NDFSTAGE LARVA yellow-cream, neck light orange-brown; head & collar dark-brown. HALF-GROWN-MATURE LARVA light-reddish-brown on Al-front of Ab, tan-gray on Tl-3, A9, top of A1, and rear of A8, and side of A10, heart-line dark brown (strong on abdomen, weak on T3, absent on T1-2), a tan cleavage line on T1-3 of mature larva, A10 top unmarked light brown, legs black; head & collar black. PUPA very similar to P. mystic, black, wings bluish-black, A2-3spiracles orangish, A4-7spiracles yellow-tan, intersegmental membranes A4-7 (and to a lesser extent A7-8) yellow-tan, cremaster tip chitin-red-brown, abdomen yellow-tan beneath proboscis on A4-8, proboscis blackish-brown & extending 4-5 mm beyond wings to end of A7 or to end of cremaster (usually to middle of cremaster).

Polites themistocles (Latr.). Adults associated with Poa pratensis, Morse Park, Jefferson Co. Colo., Aug. 12, Aug. 31, 1987. Prespoviposition 12:26 near various grasses, prespviposition 11:28 Poa pratensis, prespviposition 11:29 P. pratensis, Guy Hill, Jefferson Co. Colo., June 14, 1989. Oviposition 12:50 (#95) on underside of Astragalus adsurgens var. robustior leaf (Poa pratensis thick 0-1 m, Agropyron (Elvmsus"Sitaxan") longifolius 5, 15, 50, 50, 50, 50, 500, Stipa comata 20, 30, 30, 40-70 etc. onward, old Bromus (Anisantha) tectorum 50, Bouteloua (Chondrosum) gracilis 25-40; oviposition (#95) 12:54 on underside of Astragalus adsurgens var. robustior leaf (Poa pratensis thick 0-100, Stipa comata 10, 30, 10-1 m etc., Bouteloua gracilis 0-1 m, Agropyron (Elvmsus"Sitaxan") longifolius 25, 50, 80); prespviposition 13:15 bent abdomen twice on underside of GnaphaliuM leaf in Poa pratensis sward (P. pratensis 0-1 m, Stipa comata 10-1 m); prespviposition 13:55 bent abdomen twice on underside of Heterotheca villosa leaves in Poa pratensis sward; prespviposition 12:40 bent abdomen on underside of Astragalus adsurgens var. robustior leaf in Poa pratensis sward; egg (#99) found on Koeleria macrantha (K. macrantha 15-35, 25, 45, 50, 50-60 onward, Stipa comata 15, 15, 20, 20, 25-1 m common, Agropyron (Elvmsus"Sitaxan") longifolius 20, 35, 35, 30, Poa pratensis 5-1 m); all Guy Hill, Jefferson Co. Colo., June 27, 1988. Female 13:58 hovered over Bromus (Bromopsis) inermis; flew, hovered over it again and bent abdomen to a leaf of it, no egg seen or found; adults common in B. inermis/Poa pratensis meadow Aug. 5-23, 1990, so presumably one of them is probably a host, but considerable time spent watching adults produced no ovipositions, and no eggs were found on these grasses (however females may occasionally let eggs drop from the abdomen? as do Polites senora and P. mystic often); Wheatridge, Jefferson Co. Colo., Aug. 18, 1990. HOSTPLANTS: Poa pratensis is probably the major host, explaining why P. themistocles is common on Denver P. pratensis lawns; Koeleria macrantha is an occasional host. A. Shapiro (Butterflies of the Delaware Valley) stated (without documentation) that the smaller Panicum species are preferred; Panicum is scarce or absent where themistocles flies in Colo. Most eggs are laid on underside of dicotyledon leaves near host grasses (in comparison, 44% are laid there in P. draco, and this quirk was not noted in other Polites). Larvae must make silk tunnels in litter/soil (in contrast to the aerial nests of Polites origines), because adults are common on Poa pratensis lawns where no aerial nests occur (and would be chopped off by lawn mowers if they did). Half-grown larvae must hibernate. EARLY STAGES (from egg laid by female from Wheatridge, Jefferson Co. Colo., Sept. 7, 1981, pupated Oct. 28): EGG cream, becoming dirty cream with numerous small red spots (each spot formed of "50 red microdots) so overall appearance of egg becomes mottled pale-pinkish hemispherical in dorsal view, lower edge rounded very little, without flange. 1ST-STAGE LARVA tan, collar & head black. YOUNG LARVA yellow-brown (more greenish anteriorly), collar & head black. HALF-GROWN LARVA brown; heart-band dark-brown, A10 top has black mark on top resembling two U's fused together (the open end anterior); head black with brown stripe along coronal sulcus. MATURE LARVA brown (ochre-brown on abdomen, thorax more gray-brown perhaps with a slight greenish tint), heart-band dark brown, A10 top is tan with black markings consisting of black U-shaped rim around top and a blackish subdorsal band and a blackish middorsal band (both bands extending from front of segment to black rim), collar black and edged with whitish anteriorly; head black, a brown stripe along coronal sulcus, adfrontal area brown, a tiny brown spot on lower frontoclypeus (one left, one right), a brown spot medial to eyes and a smaller one near first (solitary) eye. EGG on 1st & 2nd days head-T2 grass green except wings greenish-tan where they cover abd., heart blackish-green on T2 and brownish on abd. (darkest on A5-8),
abdomen tan with many brown patches, green intersegmental areas between A4-8, with many long tan hairs except on wings, proboscis extends 2.5 mm beyond wings, cremaster red-brown; pupa 4th day olive-green, head a bit darker (with brown areas including a brown spot on top near middorsal axis, a smaller brown spot on front, light-brown above labrum, brown ventral to orbit, antenna base brown on each side), proboscis a bit darker, T1 has row of tiny brown dots on front and brown transverse line near rear, T1 spiracle red-brown, distal half of wings greenish-cream, rear of T2 brownish-green, abd. orangish-greenish-tan on A1-4, mottled slightly-greenish cream on A5-9 (due to cream mottled fat body inside), A2-7 spiracles orange-brown, A1-8 has middorsal-dark green (browner on the brouner segments) band, lenticles present on abdomen (near-middorsal on A2-5, subdorsal on A1-8, about 2-4 on a mound beside proboscis on A4-S), rear part of probosics and hindlegs orange-brown on A4-S, movable areas of A4-7 smooth, rest of abdomen rough, with tan hairs all over pupa except wings, cremaster red-brown.

*Polites origenes rheno* (Edw.). Oviposition 10:45 on underside of *Andropogon gerardii* leaf, Red Rocks, Jefferson Co. Colo., July 11, 1984. 5 eggs (pale green like eggs laid by identified females) found on *A. gerardii* leaves, Red Rocks, Jefferson Co. Colo., July 12, 1984. Oviposition 8:54 on underside of *A. gerardii* leaf, Red Rocks, July 4, 1985. Oviposition 9:38 on underside of *A. gerardii* leaf, Red Rocks, Jefferson Co. Colo., July 4, 1989. 5 larvae 1-1.5 (most 1.5) cm long with blackish-brown heads (4th stage?) found in *A. gerardii* leaf tube nests, 1 male 3 females reared to adults; Apex Gulch, Jefferson Co. Colo., Aug. 24, 1990. Black-head (resembled *origenes*, died) larva found in *A. gerardii* leaf tube nest; Apex Gulch, Jefferson Co. Colo., Aug. 27, 1990. Black-head larva 7 mm long found in *A. gerardii* leaf tube nest "20 cm above ground (female reared to adult); Green Mtn., Jefferson Co. Colo., Aug. 27, 1990. Larva (prob. *origenes*, parasitized) 9 mm long with black head found in *A. gerardii* leaf tube; Mother Cabrini Shrine, Jefferson Co. Colo., Aug. 30, 1990. 2 larvae 15 8 11 mm long with black heads in rolled-leaf tubes (heads upward) on *A. gerardii* (2 females reared to adults); Green Mtn., Jefferson Co. Colo., Sept. 1, 1999. Larva 15 mm long found in *A. gerardii* leaf tube (1 male reared to adult); Van Biber Creek, Jefferson Co. Colo., Sept. 10, 1990. "22 half-grown larvae found in *A. gerardii* leaf nests (nests of "8-cm-long tubes of 2-3 leaves silked together, the tips eaten off, no stilts,"10-15 cm above ground) (8 males & females reared to adults emgd. Nov. 3-22); 5 half-grown larvae found in leaf nests of several *Panicum* (now *Dichanthelium*) *oligosanthes* var. *scribnerianum* leaves silked together ("10 cm above ground on 15-20 cm tall plants) (1 parasitized, 2 died as pupae, 2 males reared to adults emgd. Nov. 7-9); *Panicum virgatum* common but no larvae were found on it so it is definitely rejected by females; Horseshoe Res., Larimer Co. Colo., Sept. 14-15, 1980. 2 larvae 8 mm long with chestnut-brown heads (3rd stage?) found on *Bouteloua curtipendula* leaf nests (1 male 1 female reared to adults), larvae evidently grew more slowly on this plant because larvae were younger than those found on *Andropogon gerardii* at this site the next day; Apex Gulch, Jefferson Co. Colo., Aug. 23, 1990. HOSTPLANTS: Obviously *A. gerardii* is the main hostplant in this area (the *A. scoparius* host in Scott 1988b was a misidentification of *A. gerardii*), and *B. curtipendula* and *P. oligosanthes* are occasional hosts; all are wide-leaved comparatively short grasses growing on open S-, E-, or W-facing slopes. *P. origenes* is evidently the only *Polites* that makes aerial nests, and its hostplants (mostly *Andropogon gerardii*) have wider leaves than hosts of other *Polites*; it is convergent to *Hesperia ottoe* in all these traits. Half-grown larvae must hibernate. EGG greenish-cream. "3RD-STAGE LARVA ochre-tan, insides mostly green on T2-A5 and A5-7, heart very-slightly darker, neck brown behind head but white in front of collar, collar black; head chestnut-brown with a dark-brown vertical stripe near coronal sulcus. "4TH-STAGE LARVA same as mature larva, but medium- or somewhat dark-brown, some larvae with a slight pinkish tinge on sides and rear and on T1. MATURE LARVAE brown (microscopically dotted with brown patches), but many larvae of both sexes pinkish-reddish brown (most mature larvae are at least slightly reddish, but some of both sexes are browner), several larvae definitely brown-pink in color, A10 top blacker brown (no black bands or rim), heart-band dark brown, neck brown just behind head but cream in front of the black collar; head black. PUPA head & thorax brown or blackish-brown (sometimes light brown, sometimes slightly-olive brown), top of abdomen light brown to brown or (when larva was reddish) reddish-brown, with middorsal darker-brown patches (occasionally a long brown heart-band), underside of abdomen paler (tan-brown or tan), rear 40% of A4-S tan (sometimes slightly-greenish tan on first day), wings tan (slightly- or definitely-greenish tan on first day), male wings have 2 brown stigma patches, top half of abdomen has several transverse rows of small blackish dashes & dots, below abdomen spiracle
are several tiny dots in front of a larger dot, sometimes there are 2 small
brown supraventral dots and a 3rd dot near midventral plane, a supraventral
hairy hill with "7 oval lenticles on A.5,6, T1 spiracle & cremaster orange-
brown, appendages tan or light brown (sometimes brown), proboscis base usually
brown, proboscis tip orange-brown where it extends 5-7 mm beyond wings (usually
to cremaster base, sometimes to rear of A8 or to middle of cremaster). Pupa
lasts "18 days in lab (mean 18.0 males 17.5 females, s.d. 1.5 males 1.7 females,
range 16-21 males 14-20 females, N=10 males 8 females).

Atrytone aragons (Bdv. & LeC.). Oviposition 11:10 on underside of leaf of
associated with A. gerardii at Red Rocks, 1973-1988. Two eggs found with a wide
lower red ring and a narrow upper red ring, one egg found with only one wide red
ring, hatched into cream larvae with orangish heads)(NOTE: this record I
formerly misidentified as Anatrytone logan; they are obviously aragons because
the resulting 1st-stage larvae have orangish heads (logan has black heads)
Adults associated with A. gerardii, Chimney Gulch, Jefferson Co. Colo., July 2,
Colo., July 1, 1986. 3 larvae 20, 25, 30 mm long in rolled-leaf nests of 2-3
leaves in center of big A. gerardii clumps, they eat leaf tips and chew notches
out of leaves just above and below the nest; Apex Gulch, Jefferson Co. Colo.,
June 4, 1990. 3 large larvae found in rolled leaf nests on A. gerardii; Apex
Gulch, Jefferson Co. Colo., June 5, 1990. Larva 12 mm long (parasitized) and 8
pupae (1 hatched shell, 2 about to emerge but dead, 3 dead, 2 yellow due to
1 head capsule in one nest & 5 live pupa (female emerged July 21) found in other
nest, both in A. gerardii leaf-tube nests; ridgetop, Green Mtn., Jefferson Co.
Colo., July 12, 1990. Empty pupal shell and head capsule found in leaf nest of
3 leaves of A. gerardii; Falcon County Park, Jefferson Co. Colo., July 18,
1990. No silk girdle, and cremaster not attached. Larva 1.5 cm long, 3 larvae
1 cm long, 8 pupal shells with head capsules, all found in A. gerardii leaf
tubes; Apex Gulch, Jefferson Co. Colo., Aug. 24, 1990. 2 larvae (6 & 7 mm
long), and 4 pupal shells with cast head capsules, all found in A. gerardii leaf
and 3 pupal shells found in A. gerardii leaf tubes; Mother Cabrini Shrine,
Jefferson Co. Colo., Aug. 30, 1990. 4 pupae, 1 pupal nest with head capsule and
pupal shell blown away, 5 larvae (10, 12, 13, 15, 20 mm long), all found in
1 larva 7.5 mm long, 1 dead putrifying larva 17 mm long, 1 pupal shell, all
found in A. gerardii leaf nests; Mt. Vernon Historic Site, Jefferson Co. Colo.,
Sept. 3, 1990. 5 larvae 11-15 mm long found in A. gerardii rolled-leaf nests
(some of 2 leaves); Van Bibber Creek, Jefferson Co. Colo., Sept. 10, 1990. "50
larvae (incredibly abundant, only 1-2 min. were needed to find each larva) 13-17
mm long, and 2 live pupae (2 females emerged Sept. 25, 27), found in leaf nests
on A. gerardii, usually "10-20 cm above ground, the typical larval nest rests on
2 "stilts", and consists of two vertical leaf bases, then a 2-3 cm area where
both leaves are chewed almost down to the midrib (the stilts), then a rolled
leaf tube 2-3 cm long, the upper distal end closed by a silk screen, this may be
a hibernation nest because it was not noted previously earlier in the summer;
Panicum virgatum was common and Panicum (now Dichanthelium) oligosanthes
var. scriberianum was fairly common, but no larvae were found on them so they are
1990. Larva 19 mm long found A. gerardii leaf nest between stem and leaf; Apex
tube (leaves eaten beside it so it was larval nest also), Apex Gulch, Jefferson
found with only mature larval head capsule, both on A. gerardii; larva 10 mm
long found in Bouteloua curtipendula leaf tube nest; Apex Gulch, Jefferson Co.
Colo., Aug. 27, 1990. 1 pupal shell with cast head found on B. curtipendula
leaf nest 3 cm long; Apex Gulch, Jefferson Co. Colo., Aug. 23, 1990. Adults
Adults associated with A. gerardii, 3 mi. NE Holland, Pipestone Co., Minn., July
11, 1986. Adults associated with A. gerardii, 2 mi. E. Renville County Park,
(Schizachyrium) scoparius, 5-10 mi W Medicine Lodge, Barber Co. Kan., Sept. 2,
1986. HOSTPLANTS: Obviously Andropogon gerardii is by far the favorite host;
Bouteloua curtipendula is a rare host; Andropogon scoparius may be a popular
host in E U.S. and S. Texas, but it is shunned in Colo. There is only one
generation in Colo. (mostly July), but a rare partial 2nd generation was proven
Anatrytone logan logan (Edw.). Nearly-mature larva (reared to adult) found in rolled-leaf nest of 4 leaves of Bromus (Bromopsis) inermis 35-cm-tall plant in roadside ditch (B. inermis 0-100 common, Phleum pratense 15, 20, 40, 50, 90 etc., Phalaris arundinacea 35, 35, 35, 50, Poa pratensis 20, 20, 35, 70 etc.); NE Conger, Freeborn Co., Minn., June 12, 1980. Careful study of larvae, pupae, adults, hosts, and behavior clearly prove that logan does not belong in the same genus with Atrytone arogos (Table 8); so I place it in its own genus Anatrytone until a better place can be found. (In contrast, Hesperia and Polites are identical in nearly every respect, Stinga resembles Ochlodes, etc., so some of these genera may have to be lumped.) Half-grown larvae must hibernate. MATURE LARVA light-bluish-green, heart darker-blue-green, collar black (wide esp. laterally), suranal plate has 2 anterior transverse black streaks that resemble eyebrows, T1 spiracle black, A0 spiracle almost as large but brown; head black with 3 cream vertical stripes (a medial stripe running parallel to coronal sulcus from top of head almost to adfrontal sulcus, then continuing straight down through lateral 2/3 of adfrontal area, a cream stripe starting from in front of [and touching] eyes #3-5 and extending vertically to near top of head, a short cream lateral dash encloses eye #1 and teapers upward to a point just below level of top of frontoclypeus), labrum cream. The pattern on head (vertical stripes not parallel sulci) and suranal plate are unique. PUPA black, with a narrow greenish-cream streak running above last half of forewing, which very narrowly extends along wing to greenish-cream ventral 40% of A4, the posterior 40% of A4, A5, and A6 have a greenish-cream margin (dorsally narrowed because margin is anteriorly gray), a small greenish-cream spot around spiracles on A4-7, a black supraventral dot is on A4 lateral to proboscis (the same dots on A5 & 6 are hills lost in edge of anterior black area, all 3 dots have hair and lenticles), proboscis extends 7 mm beyond wings to base of cremaster, cremaster narrow, 1 mm long, with many long unhooked setae (unhooked crochets), but one anteriorly-directed black spine extends from cremaster tip that hooks into nest wall; no silk girdle; duration 12-13 days in lab.
based on the first-stage larva.) No larvae found on Sorghastrum nutans, Panicum virgatum, Panicum ( Dichanthelium) oligosanthes var. scribneriana, Agropyron, and a few Dactylis glomerata under bushes, Agrostis gigantea, Bromus ( Bromopsis) inermis, Agropyron elonatum, Marshall, Boulder Co. Colo., Aug. 29, 1991 (adults occur here every year). EGG yellowish-cream when laid, becoming pale-yellow and developing a red lower ring around egg and a small red ring on top (rings lost just before hatching); shape slightly oval in dorsal view, lower edge slightly rounded (not sharp as in A. aroos). 1ST-STAGE LARVA yellow-cream (after feeding has greenish inards), heart-line weakly blue-green, narrow black collar (collar a bit longer than that of A. aroos; head black. 2RD-STAGE LARVA cream-tan, A10 top (suranal plate) tan with a black crescent-shaped posterior rim and a black crescent across top of A10, collar black; head ochre (possibly cream when live) with dark-red-brown pattern (a wide band along coronal sulcus, a narrow vertical streak down middle of frontoclypeus, a narrow streak down side of frontoclypeus, a dark-red-brown line along adfrontal sulcus [these 3 all join coronal band], a wide vertical band lateral to adfrontal sulcus extending to top of head and joining next band, a wide band extending from anterior eyes 3-5 dorsally then curving medially to coronal sulcus on top of head, rear rim of head brown [this brown rim very narrow dorsally]), labrum pale, brown beside labrum.

Table 8. Differences between Atrytone and Anatrytone.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Atrytone aroos</th>
<th>Anatrytone loeann</th>
</tr>
</thead>
<tbody>
<tr>
<td>tibia of adult</td>
<td>smooth</td>
<td>some short spines</td>
</tr>
<tr>
<td>middle leg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>male genitalia</td>
<td>aedeagus broader, uncus narrower</td>
<td>saccus longer, valva with terminal flap</td>
</tr>
<tr>
<td>mating time</td>
<td>late afternoon (13:20-17:45) under clouds</td>
<td>all day in sun</td>
</tr>
<tr>
<td>mating location</td>
<td>males perch near host on hillsides</td>
<td>males perch in gulch bottoms</td>
</tr>
<tr>
<td>larval hosts</td>
<td>wide-leaf bunch-grass (Andropogon gerardii)</td>
<td>hay-grass ( Bromus inermis etc.)</td>
</tr>
<tr>
<td>egg</td>
<td>pinkish-red rings, much broader &amp; more diffuse, egg more cream, nearly round in dorsal view, lower edge angled outward</td>
<td>red rings, narrow &amp; sharp, egg much yellower, sl. oval in dorsal view, lower edge sl. rounded</td>
</tr>
<tr>
<td>1st-stage larva head</td>
<td>brownish-orange</td>
<td>black</td>
</tr>
<tr>
<td>older larva head</td>
<td>mostly tan with red-brown bands, the median bands are narrow and parallel sulci</td>
<td>black with 3 vertical white stripes that do not parallel sulci</td>
</tr>
<tr>
<td>older larva collar</td>
<td>light green</td>
<td>black</td>
</tr>
<tr>
<td>older larva body color</td>
<td>greenish-cream</td>
<td>light-bluish-green</td>
</tr>
<tr>
<td>older larva suranal plate</td>
<td>no dark marks</td>
<td>2 transverse &quot;eyebrow&quot;-shaped marks</td>
</tr>
<tr>
<td>pupa</td>
<td>yellow-cream on males and some females blackish-gray on head, thorax, &amp; front of abd. segments (abdomen has black only dorsally)</td>
<td>black, with greenish-cream above last half of wing and on movable interseg. areas of A4-7 (abdomen has black rings around segments A4-7)</td>
</tr>
<tr>
<td>pupal hair</td>
<td>small hairs</td>
<td>very hairy</td>
</tr>
</tbody>
</table>
Note: While on the subject of generic limits of Atrytone, it should be noted that based on adult morphology "Atrytone" potoisensis Freem. obviously belongs to genus Hyllena potoisensis new combination.

*Ochlodes yuma yuma* (Edw.). Oviposition on Phragmites australis basal leaf, NE Jct. Hwy. 180 and Hatch Wash, San Juan Co. Utah, Aug. 23, 1974. Adults are associated with this plant at all sites throughout its range, apparently one of very few Hesperianae skippers that are restricted to one hostplant species (Scott et al. 1977).


*Ochlodes sylvanoides sylvanoides* (Bdv.) (=*napa* [Edw.]). 1 pupal shell & shed larval skin (head /2.9 mm wide, with typical *O. sylvanoides* bicoloured color pattern) found in silk nest (the leaf top was silked over an area 37 x 18 mm on which the pupa rested, the leaf folded upward into a U-shape) on *Arropyron* (Elytricia) repens, Wheatridge, Jefferson Co. Colo., Aug. 22, 1988.

Preoviposition 10:50 bent abdomen on underside of dead dried *Dactylis glomerata* leaf 2/3 m above ground, Chimney Gulch, Jefferson Co. Colo., Aug. 30, 1988. A 1.5-mm-wide head capsule found in 7-cm-long leaf nest on *Leucoptera kingii*, a parasitized larva including head (body filled with 7-mm-long elliptical fly? pupa) found in 6-cm-long leaf nest on *L. kingii*, a dead pupa and cast larval skin & head capsule found in 5-cm-long leaf nest on *L. kingii*, 1 dead pupa (hole in head as if parasites emerged or ?ants attacked) with cast larval skin & head found in 5-cm-long leaf nest on *L. kingii*, a molted larval skin (no head) found in 4-cm-long larval nest on *L. kingii*, 4 empty leaf nests 7, 7, 8, 8 cm long found on *L. kingii*, 1 dead larva & head with empty parasitoid fly pupa inside found in leaf nest on *Arropyron* (Levynus) ambiguus, 1 empty 7-cm-long larval nest found on *A. (L.) ambiguus*, 1 empty larval nest (probably *O. sylvanoides* because *sylvanoides* is common here and site is far from the gulch/creek habitat of *Poinas zabulon taxiles*) found on Bromus (Bromopsis) pumellianus, Ralston Butte, Jefferson Co. Colo., Aug. 14, 1988. 4 nests with larval remains found (6-cm-long nest of 3 leaves with a half-grown head capsule, 6 cm nest of 2 leaves and a half-grown dead parasitized larva, 4 cm nest of 3 leaves & head capsule, 5 cm nest of 3 leaves and a half-grown head capsule), 9 empty larval nests found (7-cm-long nest of 4 leaves, 7 cm of 2 leaves, 6 of 2, 6 of 4, 6 of 7, 7 of 4, 8 of 2, 4 of 2, 4 cm of 3 cm nest of leaf tip bent into litter of clump base), 6 pupal nests found (7-cm-long nest of 3 leaves and cast head & skin of larva & part of pupal shell, 6 cm nest of 4 leaves and 3 fly pupal shells, 5 cm nest of several leaves with pupal shell, 7 cm nest of 4 leaves & pupal shell, 5 cm nest of 3 leaves with a long fly pupa, 6 cm nest of 4 leaves with dead pupa and on same plant a 6 cm nest of 4 leaves & half-grown head capsule), all on *Leucoptera kingii*, 2 empty larval nests found on Bromus (Bromopsis) jermynis (6-cm-long nest of 3 leaves, 4 cm nest of 2 leaves); an empty 5-cm-long nest of 3 leaves found on *Arropyron* (Levynus) ambiguus; pupal nests generally show no nearby feeding damage, which proves that larvae usually or often make a new leaf nest before pupating; all Ralston Butte, Jefferson Co. Colo., Aug. 15, 1989. Mature larva found in nest of 2 *Phleum pratense* leaves silked together (larva eats leaf distal to nest); a nest of 2 *Phleum pratense* leaves contained a shrivelled 1-cm-long larva (identified by head color pattern) and a parasitoid cocoon and pupae; 2 empty nests of 2 & 3 leaves found on *P. pratense* and 1 empty nest of 3 leaves found on *Agrostis gigantea* are probably *O. sylvanoides*, but could be *Poinas zabulon taxiles*; Tucker Gulch, Jefferson Co. Colo., July 13, 1989. 4-cm-long silked-leaf nest of 3 leaves with a 1.5-mm-wide head capsule inside, found on *Arropyron* (Elytricia) repens, 2 other empty nests of 3 leaves found on *A. repens*, Tucker Gulch, Jefferson Co. Colo., July 27, 1989. Preoviposition 11:40 she bent abdomen under dead Bromus (Bromopsis) pumellianus leaf (4 mm wide) 15 cm up on 50 cm tall plant and bent abdomen under a nearby more vertical dead leaf of *B. pumellianus*; 2 empty larval nests (probably *sylvanoides*, perhaps *Poinas zabulon taxiles*) of 3 and 4 leaves on *Calamagrostis purpurascens*, N
Egg found on underside of 5-MM-wide dead lower leaf of Agropyron (Elymus) canadensis, eggshell base found on underside of 4.5-MM-wide dead lower leaf of Agropyron (Elymus) canadensis, Indian Peak, Jefferson Co. Colo., Aug. 21, 1989. Preoviposition 9:30 on dead lower leaves of Phalaris (Phalaroides) arundinacea; preoviposition 12:32 on Bromus (Bromopsis) inermis dead leaf "40 cm above ground; oviposition 13:32, she landed on a green Bromus (Bromopsis) inermis leaf then on a nearby 40%-dead Atriplex patula leaf (40 cm above ground) and bent abdomen under it, then landed on a Bromus (Bromopsis) inermis leaf and bent abdomen under it, then flew to same A. patula leaf and laid egg under green part of leaf next to dead part, this was in a Bromus (Bromopsis) inermis patch; 6 eggs found on dead Bromus (Bromopsis) inermis leaf underside "40 cm above ground on "30-100-cm-tall plants, the leaves 3-7 mm wide; 4 eggs found on dead (one green) Dactylis glomerata leaf underside "10, 20, 45, 45 cm above ground, the leaves 4-6 mm wide; all these eggs were in areas shaded most of the day; the oviposition and all eggs were found near Arctium minus flowers that many adults fed on, so the flowers evidently attracted the females who then oviposited nearby; Wheatridge, Jefferson Co. Colo., Aug. 22, 1989. A 2-cm-long leaf nest found on Agropyron (Levymus) ambiguus had an empty wasp pupa and an A10 segment of cast larval skin showing the dorsal lenticle of O. sylvanoides, a 2.5-cm-long empty silk nest (probably O. sylvanoides) found in A. (L.) ambiguus, Lookout Mtn., Jefferson Co. Colo., Sept. 2, 1989. I dead half-grown larva with 6-mm-long fly pupa inside found on Agropyron (Levymus) ambiguus leaf nest, 1 empty 6-cm-long silked-leaf nest found on A. (L.) ambiguus, 1 egg found on underside of dead 6-mm-wide leaf 45 cm above ground on "70-cm-tall Agropyron (Elymus) canadensis plant, 1 egg found on Muhlenbergia racemosa under green leaf 50 cm up on 80 cm plant, 1 hatched egg (probably O. sylvanoides) found on Agropyon (Elymus) trachycaulum on 5-mm-wide dead leaf underside, 1 empty larval nest (probably O. sylvanoides) found on Bromus (Bromopsis) lanatines, Apex Gulch, Jefferson Co. Colo., Aug. 24, 1989. 1 egg found on Agrostis gigantea on underside of dead part of leaf (basal 7 cm of the 19-cm-long leaf was green) 27 cm up on 60 cm plant, 3 eggs found on Bromus (Bromopsis) inermis leaf underside (one leaf dead, one mostly dead, one green) "30 cm up on "60 cm plants, Van Biber Creek, Jefferson Co. Colo., Aug. 29, 1989. 4 eggs found on Phalaris (Phalaroides) arundinacea (1 hatched egg under 8-mm-wide dead leaf, 2 cream eggs under 8-mm-wide dead leaves, 1 cream egg under 8-mm-wide leaf that was mostly-green with 1.5-mm-wide dead brown edge), the eggs 40, 50, 50, 70 cm above ground on the N edge of a patch of "120 cm tall plants, Wheatridge, Jefferson Co. Colo., Aug. 30, 1989. 3 eggs found on underside of dead lower leaves of Bromus (Bromopsis) lanatines (one egg had a Trichogrammatidae wasp crawling on it), an empty 3-cm-long silked-tube-nest (probably O. sylvanoides) found on Agropyron (Levymus) ambiguus, an empty 6-cm-long silk-leaf-nest (leaves chewed off distally) (probably O. sylvanoides) found on Calamagrostis purpurascens, Indian Peak, Jefferson Co. Colo., Sept. 2, 1989. Preoviposition 11:05 she bent abdomen 4X on underside of Agropyron (Levymus) ambiguus lower leaves; 2 eggs found on underside of dead 5-mm-wide lower leaf of A. (L.) ambiguus; egg found on underside of 5-mm-wide dead lower leaf of Agropyron (Elytrigia) repens; 6 eggs found on underside of dead lower leaves (leaves 3, 4, 4, 4, 4.5 mm wide) of Agropyron (Elymus) trachycaulum; 1 egg with Trichogrammatid exit hole found on underside of Bromus (Bromopsis) lanatines lower leaf; Red Rocks, Jefferson Co. Colo., Sept. 4, 1989. I silked-leaf nest of "4 leaves found on Agropyron (Levymus) ambiguus contained a 3 X 3 mm piece of O. sylvanoides pupal shell, a 3 X 1.5 mm piece of O. sylvanoides wing (with orange, dark-brown, and fringe scales present), and a ladybird beetle "6 mm long, evidently the beetle entered the nest and ate part of the pupal; 2 eggs found on underside of dead lower leaves (leaves 4, 4, 4, 4.5, 5.5, 5.5, 5.5, 7 mm wide) of Agropyron (Elymus) trachycaulum; 9 Calamagrostis purpurascens plants had empty silked-leaf nests (probably O. sylvanoides) of 3, 3, 3, 3, 4, 5, 5, 6, 7, 7, and 8 leaves; Lookout Mtn., Jefferson Co. Colo., Sept 4, 1989. 3 eggs found on underside of dead leaves (6, 7, 9 mm wide) 1/3 way up from base of Bromus (Bromopsis) inermis plants, Lookout Mtn., Jefferson Co. Colo., Sept. 6, 1989. 2 eggs found on underside of dead lower leaves (one 5 mm wide) of Agropyron (Elymus) trachycaulum; 1 egg found on underside of dead 5-mm-wide lower leaf of Agropyron (Levymus) ambiguus, Indian Peak, Jefferson Co. Colo., Sept. 14, 1989. Egg found on underside of 5-mm-wide dead lower leaf of Agropyron (Elymus) canadensis, eggshell base found on underside of 4.5-mm-wide dead lower leaf of
ovipositions was and that therefore will have enough time to mature the larvae. Probably infrequent because no preoviposition was on them. Adults are usually

Sept. 6, 1990. Sept. 4, 1990. 5 MM from gulch bottom in full sun; Red Rocks, Jefferson Co. Colo., Sept. 4, 1990. 20-MM-long larva found on Aoropyron (Elytrigia) repens silked-leaf tube; larva 18 MM long found on Dactylis glomerata leaf tube nest; gulch bottom, Tinytown, Jefferson Co. Colo., June 26, 1990. Dead larva 15 MM long found Agropyron (Elymus) trachycaulum leaf nest on W-facing gulch bank; larva 18 MM long found Agropyron (Elymus) canadensis leaf tube on S-facing sunny road bank; Tinytown, Jefferson Co. Colo., June 29, 1990. 3 larvae "15 MM long found on Agropyron (Levymus) ambiguus (50 cm above ground in nest of 3 leaves, 25 in 4, 30 in several) on N-facing slope, 1 under NE side of tree in roadside ditch on SE-facing slope); Red Rocks, Jefferson Co. Colo., June 30, 1990. Larva 26 MM long found in Bromus (Bromopsis) inermis leaf tube nest, W-facing slope near gulch; Tinytown, Jefferson Co. Colo., June 25, 1990. 20-MM-long larva found on Agropyron (Elytrigia) repens silked-leaf tube; larva 18 MM long found on Dactylis glomerata leaf tube nest; gulch bottom, Tinytown, Jefferson Co. Colo., June 26, 1990. Dead larva 15 MM long found Agropyron (Elymus) trachycaulum leaf nest on W-facing gulch bank; larva 18 MM long found Agropyron (Elymus) canadensis leaf tube on S-facing sunny road bank; Tinytown, Jefferson Co. Colo., June 29, 1990. 3 larvae "15 MM long found on Agropyron (Levymus) ambiguus (50 cm above ground in nest of 3 leaves, 25 in 4, 30 in several) on N-facing slope, 1 under NE side of tree in roadside ditch on SE-facing slope); Red Rocks, Jefferson Co. Colo., June 30, 1990. Larva 26 MM long found in Bromus (Bromopsis) inermis leaf tube; dead half-grown larva with 2 fly pupae found in Agropyron (Elymus) trachycaulum rolled-leaf nest; W-facing bank, Tinytown, Jefferson Co. Colo., July 2, 1990. 3 pupae found in Agropyron (Levymus) ambiguus silk nests; N-facing slope of hilltop, Mt. Zion, Jefferson Co. Colo., Aug. 14, 1990. Oviposition 11:30 Agropyron (Elymus) trachycaulum, she hovered near Festuca arundinacea and bent abdomen under Monarda leaves 2X, bent abdomen under 4 dead A. (E.) trachycaulum leaves, laid egg on horizontal green 2-MM-wide A. (E.) trachycaulum leaf underside 4 cm above ground; N-facing slope 5 mm from gulch bottom in full sun; Red Rocks, Jefferson Co. Colo., Sept. 4, 1990. Pupal shell & head capsule found in silked-leaf Agropyron (Levymus) ambiguus tubetes; N-facing slope just N high ridge, Mt. Lindo, Jefferson Co. Colo., Sept. 6, 1990. Pupa found in nest of 9 leaves (second empty larval nest of 3 leaves nearby) of Agropyron (Levymus) ambiguus, N fork Clear Creek, Gilpin Co. Colo., July 18, 1991. Oviposition 11:02 she hovered then landed on green leaf 4 MM wide 15 cm from leaf tip 15 cm above ground of young Agropyron (Elymus) canadensis (A. canadensis 0-100, Bromus [Bromopsis] lanatipes 40, 50, 100, Carex sp. 10-100, Dactylis glomerata 50), partially shaded gulch Tinytown, Jefferson Co. Colo., Sept. 4, 1991. HOSTPLANTS. All 14 grasses are hostplants (except perhaps Calamagrostis); Leucopoda kingii (28 records), Agropyron (Elymus) trachycaulum (28), Agropyron (Elymus) ambiguus (21), Bromus (Bromopsis) inermis (19), Calamagrostis purpurascens (14 records, none have definite proof but the large size of some larval nests indicate O. sylvanoides), Agropyron (Elytigia) repens (18), Dactylis glomerata (8), Bromus (Bromopsis) lanatipes (6), Phalaris arundinacea (5), Phleum pratense (4), Agropyron (Elymus) canadensis (4), Agrostis gigantea (2), Bromus (Bromopsis) pumpellianus (2 records, the most poorly-documented host because based only on 1 nest & 1 preoviposition), Muhlenbergia racemosa (1). All are "hay" grasses (wide-leaf tall grasses), the largest being P. arundinacea which is 1.5-2 m tall, the smallest A. gigantea and M. racemosa which are only 30-60 cm tall; the hostplants are nearly identical to those eaten by the other hay-feeding skippers Piruna pirus, Poanes zabulon taxile, and Amblyscirtes vialis. L. kingii is obviously a favorite host, but it is very localized perhaps because it is dioecious; I have seen it only at two localities (only common at one), though it ranges to Calif. OVIPOSITION. Eggs are laid preferentially in partial shade (on N-facing nearly-always-wooded slopes or in shady areas near creeks) on the underside of dead leaves 20-40 cm above ground on wide-leafed usually-tall "hay"-grasses 20-40 cm above ground, in patches of the host grasses (not on a single isolated small clump). Eggs are laid within patches of green grass, but are placed on dead leaves evidently because first-stage unfed larvae hibernate (therefore do not feed until spring) so there is no necessity to lay on green leaves, and perhaps the egg is safer on a dead leaf from being eaten by a herbivore or predator, and safer from mechanical distortion caused by the shrinkage of a senescing leaf. By laying on a dead leaf, the female may be more certain that the plant grows in a suitable site that will have enough time to sprout, grow leaves, and have them senesce, and that therefore will have enough time to mature the larvae. One of three ovipositions was seen on a dicotyledon, but oviposition on dicotyledons is probably infrequent because no preoviposition was on them. Adults are usually
found near flowers, and it seemed that immatures and nests were more common near flowers too, evidently because females are drawn there. NEST. Young larvae make a silked-leaf nest by curving the leaf up around them, while older larvae make a nest by silking several leaves together; the nests are the same as those of Poanes. Silked-leaf skipper nests incorporating more than 1 grass leaf take a characteristic form due to the growth of the leaves: the larva starts the nest by silking together leaves that angle upward near the stem, but the upper leaves, being smaller, grow more than the lower leaves, and the stem lengthens, so gradually the nest is aimed downward a little more and the leaf bases (basal to the nest) of the upper leaves curve upward from the stem than downward to the nest. Larvae evidently usually or often make a new leaf nest before pupating, the proof being the lack of feeding damage on leaves near pupal nests. Unfed first-stage larvae hibernate. EARLY STAGES from Jefferson Co.: EGG cream, roughly hemispherical without ribs, the top with a slight indentation "1/10th the egg diameter", with a slight hill in middle of indentation that appears to move (an optical illusion) as the egg is tilted from side to side, duration 12 days. FIRST-STAGE LARVA cream, becoming tan-cream, a long black or dark-brown collar; head black or dark-brown. Unfed first-stage larva hibernates in a silked-leaf nest, the leaf edges tied together by "7 multistrand cords, but in the lab most larvae eventually start to feed, and a larva grew to mature size in 8 weeks eating Poa pratensis. 3RD-STAGE LARVA green, heart-line dark-green, 2 darker green subdorsal bands, a paler green lateral line, collar narrow, black; head black. 4TH-STAGE LARVA dull grayish-cream, heart-band dark-gray, a narrower over a wider gray subdorsal band, body slightly grayed in a wide band above creamy-gray lateral ridge, collar black; head tan, with rear of head black, and a black "kachina doll" on front (complete with feet, pantaloons, hands, tail shoulder pads, the head formed of a black band over coronal sulcus). MATURE LARVA dull yellow-tan, greenish-yellow-tan in middle half or front 2/3 of body due to food, with numerous tiny dark-green dots all over, with intersegmental interrupted tan rings around body, a sharply-edged middorsal dark green heart-line, two dorsolateral dark bands (due to coalescence of many of the dark-green dots, the lower band darker)(the upper band covers an internal pulsating yellow line) edge a creamy-tan dorsolateral band, a lateral cream band is edged above by a pale gray-tan band, below the lateral cream band the body is green-tan (little darker than ground color), collar black on rear edge and on lateral edge, front of collar white, collar gray between the white front and black rear; head dark red-brown or nearly black on side and rear and top and on a broad band along coronal sulcus, gena and vertex and frontoclypeus-ecdysial area red-brown or tan-brown, vertex and gena to level of top of eyes covered with pits and looks pale red-brown (fewer pits next to coronal dark band producing a slightly paler vertical stripe edging dark coronal band), a broad vertical dash in upper part of frontoclypeus, lower corners of frontoclypeus red-brown, a red-brown line along adfrontal sulcus and lower part of coronal sulcus, a dark-red-brown band along adfrontal cleavage line. PUPA pale yellow-tan with a slight grayish bloom (a few pupae have a slight pinkish tinge), wings & head usually darker (light brown) than abdomen, T1-2 spiracle red-brown, rear of T2 blackish-brown, with many tiny blackish-brown dots on abdomen & top of thorax, proboscis light orangish-brown where it extends "4-5 mm beyond wings to between base of A8 or base of cremaster, a black dorsal edge to front of A8 and front of A10 and ventral front of A9, A4-6 have a subventral cluster of hairs, eye dark-brown, orbit light-brown and hairless, head has dark-brown internal markings, long hairs over most of body except wings legs proboscis antennal pupates in a silked-leaf nest of silk-mesh like a screen, the ventral side of pupa upward, hanging attached to top of nest by a silk girdle around body just behind T2 and by cremaster attached to mesh.

Ochlodes snowi (Edw.). Ovipositions 10:25 and 10:35 on underside of leaves of edge of Blapharoneuron tricholepis (B, Scott) clumps (Muhlenbergia montana was within a few cm also and may have been substrate for one egg), Rosita, Custer Co. Colo., July 26, 1970. I searched for eggs at Coal Creek, Jefferson Co. Colo., July 9, 10, 15, 16, 17, 1991, and N fork Clear Creek, Gilpin Co. Colo., July 11, 18, 29, 1991, but no eggs found. B. tricholepis is common in montane S Colo., so is likely to be an important host there. Dryocopus exiguus is the commonest grass at the Jefferson Co. sites, and it is tempting to assume that it is a hostplant, but there is no data except one previposition on D. exiguus at Tinytown, Jefferson Co. Colo., and this grass is shunned by all other butterflies. Before ovipositing the females hover over the grass, flying back and forth about 20 cm above the grass before landing and ovipositing (Scott 1974a reports movements and behavior). EGG cream, developing a red ring. FIRST-STAGE LARVA cream; head blackish-brown.

Poanes zabulon taxiles (Edw.). Oviposition Glycera striata (previously
1. Empty larval nest found on *Phalaris* (Phalaroides) arundinacea, the nest 2 leaves silked together and both leaves eaten to midrib above nest (the size of the nest and construction seems to indicate that the nest was probably *taxiles*, possibly *Ochlodes sylvanoides*, and not *Piruna pirus*), Wheatridge, Jefferson Co. Colo., Oct. 11, 1988. 1 empty larval nest (1 green and 2 dead leaves silked into tube)(probably *taxiles*, possibly *O. sylvanoides*) on *Agropyron* (Elymus) repens, Red Rocks, Jefferson Co. Colo., Oct. 18, 1989. 2 eggs found on *A. gigantea* leaf underside, 3 eggs found on *Phleum pratense* leaf underside, 1 egg found on *Bromus* (Bromopsis) lanitipes leaf underside, Tucker Gulch, Jefferson Co. Colo., July 13, 1989. 12 eggs found on *Muhlenbergia racemosa*, 2 eggs found on *A. gigantea* (Elymus) repens, 3 eggs found on *A. gigantea*, (2 empty nests of 3 A. gigantea leaves tied together could have been *taxiles* or *Ochlodes sylvanoides*), all on leaf undersides, Apex Gulch, Jefferson Co. Colo., July 15, 1988. 2 eggs found on *Deutelis glomerata*, 5 eggs found on *A. gigantea*, 1 egg found on *A. intermedium*, 1 egg found on *Glyceria striata*, Chimney Gulch, Jefferson Co. Colo., July 15, 1989. 1 3rd-stage larva found in 4-MM-long rolled-leaf nest on *Echinochloa crus-galli* var. *mitis*, 1 empty larval nest (probably *taxiles*) on *Glyceria striata*, S Cooley Gravel Quarry, Jefferson Co. Colo., Aug. 10, 1989. 1 3rd-stage larva, and 1 dead egg on leaf underside, found on *A. gigantea* (Elymus) canadensis, Green Mtn., Jefferson Co. Colo., Aug. 10, 1989. A 1-cm-long larva found in *A. gigantea* leaf nest, a 6-MM-long larva found in *A. gigantea* (Elymus) trachycaulum leaf nest (nest 8 cm long, the leaf chewed down to midrib beyond and basal to the 1-cm-long tube containing larva, head facing leaf base—this nest resembles *Piruna pirus* nest, but larva was reared and proved to be *taxiles*, having larva died when mature due to fly pupa inside), Apex Gulch, Jefferson Co. Colo., Aug. 24, 1999. 10-MM-long larva (head 1.7 MM wide) found in *Glyceria grandis* leaf nest (leaf eaten beyond tube, and chewed to midrib for 15 MM basad of tube, larval head facing leaf base), 7-MM-long larva (reared to pupa) found in 4-cm-long rolled-leaf nest on *Calamagrostis canadensis*, Wheatridge, Jefferson Co. Colo., Aug. 30, 1989. A 12-MM-long larva (head 2.6 MM wide) found in *Bromus* (Bromopsis) porteri leaf nest, SE Phillipsburg, Jefferson Co. Colo., Aug. 31, 1989. 1 larva 15-MM-long (head 1.7 MM wide) found in silk-leaf nest of *A. repens*, Wheatridge, Jefferson Co. Colo., Sept. 18, 1988. Larva 15-MM-long (head 2.4 MM wide) found in *Echinochloa crus-galli* var. *mitis* rolled-leaf nest, S Cooley Gravel Quarry, Jefferson Co. Colo., Sept. 20, 1999. Larva 15-MM-long (head 2.4 MM wide)(with 4-MM-long parasitoid inside) found in silked-leaf nest (two tubes on one leaf with leaf chewed to midrib basal to each tube, another leaf rolled into tube also) on *A. repens* (Elymus) canadensis, Falcon County Park, Jefferson Co. Colo., Sept. 20, 1988. Egg found on *A. repens* (Elymus) trachycaulum (larva 70 MM above ground on 8-MM-wide leaf, 10 MM from leaf tip); empty egg on A. (E.) trachycaulum (50 MM, 7 MM, 9 MM); egg on A. (E.) trachycaulum (50, 5, 14); egg found *A. (E.) trachycaulum* (50, 6, 13); egg found *A. repens* (Elymus) canadensis (40, 9, 7); egg found *A. repens* (Elymus) ambiguus (30, 4, 12); egg found A. (L.) ambiguus (35, 6, 20); all on leaf undersides in gulch or N-facing slope, some in shade and some in mostly sunny spots; Red Rocks, Jefferson Co. Colo., June 30, 1999. Egg found on *A. gigantea* leaf underside (30 MM above ground on 3-MM-wide leaf, 7 MM from tip); Tucker Gulch, Jefferson Co. Colo., July 1, 1990. 2 eggs found on *Bromus* (Bromopsis) inermis leaf undersides, shade under spruce tree; preoviposition 15:49; Lakewood, Jefferson Co. Colo., June 6, 1990. 2 eggs found on underside of *A. repens* (Elymus) canadensis leaves 7 & 8 MM wide in partial shade; Falcon County Park, Jefferson Co. Colo., July 10, 1990. Egg found on *Leersia oryzoides* (30-40 MM above ground on 4-MM-wide leaf, 9 MM from leaf tip), in tree shade next to water; Wheatridge, Jefferson Co. Colo., July 14, 1999. Oviposition 11:28 on small *A. gigantea* (10 MM above ground on 4-MM-wide leaf underside, 4 MM from leaf tip)(sunny 2-3 hr. per day); Wheatridge,
Jefferson Co. Colo., July 25, 1990. Larva 7 mm long found in *Muhlenbergia racemosa* leaf tube beside creek, Apex Gulch, Jefferson Co. Colo., Aug. 29, 1990. 2 larvae 10, 12 mm long found in *Agropyron* (Elvnum) *canadensis* leaf tube nests; partly shaded gulches; Tinytown, Jefferson Co. Colo., Aug. 28, 1990. Larva 12 mm long found in *Bromus* (Bromopsis) *inermis* leaf tube nest; Tinytown, Jefferson Co. Colo., Aug. 30, 1990. 1 larva 5 mm long, 9 larvae 12-15 mm, found on *Agropyron* (Elvnum) *trachycaulum*; 2 larvae "15 mm long found on *Agropyron* (Levnum) *ambiguus*; all in fairly sunny gulch, Red Rocks, Jefferson Co. Colo., Sept. 4, 1990. 15-mm-long parasitized larva found in *Bromus* (Bromopsis) *lanatipes* leaf tube; 2 empty nests found B. *lanatipes*; 15-mm-long parasitized larva found in *Stipa scribneri* nest of several leaves silked together (10 cm above ground) (larvae had been eating this plant), but *Agropyron* (Elvnum) *canadensis* grew in this clump also and 5 cm from larva was an empty nest 3 cm above ground on *A. canadensis*; 3 empty nests found on *A. canadensis*; N Oak Creek Cdg., Fremont Co. Colo., Sept. 11, 1990. Larva 14 mm long found in *Dactylis glomerata* silked-leaf nest of "3 leaves; Jarre Can., Douglas Co. Colo., Sept. 18, 1990. 2 larvae and 1 head capsule found in leaf tubes on *Sorostratum nutans* ("avenaceum") plants; larva 1 found in nest of 2 *S. nutans* leaves and 1 *Agrostis gigantea* leaf; 2 larvae and 2 head capsules found in silked-leaf nests on 4 *A. gigantea*; 1 larva found in *Bromus* (Bromopsis) *inermis* leaf nest; 3 larvae found in silked-leaf tubes on *Carex nebraskensis* 40-cm-long leaves (the leaves were heavily eaten proving that larvae ate this plant), but "4 tiny empty larval tubes were found on adjacent *Agrostis gigantea*, so I think the mother must have laid eggs on *A. gigantea*, and later the larvae sought a larger nest and crawled onto the *C. nebraskensis*, thus *Carex* is only a secondary host; no nests seen on *Panice virgatum*, so females evidently reject it! Marshall, Boulder Co. Colo., Sept. 25, 1990. Oviposition 13:15 *Bromus* (Bromopsis) *lanatipes* leaf underside, W-facing slope among trees, N fork Clear Creek, Gilpin Co. Colo., July 11, 1991. Larva "12 mm long found in *Bromus* (Bromopsis) *inermis* leaf nest; *lanatipes* leaf nest, shaded gulch, Tinytown, Jefferson Co. Colo., Sept. 4, 1991. Preovipositing female landed on *Andropogon scoparius* twice 10:26 but did not oviposit, Coal Creek, Jefferson Co. Colo., July 10, 1991. HOSTPLANTS. I accept all 23 grasses as hostplants, and am not sure that any of them is favored: *Agrostis gigantea* (39 records), *Glyceria striata* (37), *Muhlenbergia racemosa* (15), *Agropyron* (Elvnum) *canadensis* (14), *Bromus* (Bromopsis) *inermis* (13), *Agropyron* (Elvtricia) *repens* (12), *Phalaris* (Phalaroides) *aruindacea* (9), *Agropyron* (Elvnum) *trachycaulum* (7), *Dactylis glomerata* (5), *Agropyron* (Levnum) *ambiguus* (6), *Bromus* (Bromopsis) *lanatipes* (4), *Phleum pratense* (4), *Sorostratum nutans* (4), *Calamagrostis canadensis* (3), *Echinochloa crusgalli* var. *mitis* (2), *Agropyron cristatum desertorum* (2), *Glyceria grandis* (1), *Leersia oryzoides* (1), *Bromus* (Bromopsis) *porteri* (1), *Stipa scribneri* (1), *Agropyron* (Pascopyrum) *smithii* var. *mollis* (1), *Agropyron* (Elvtricia) *intermedium* (1), *Festuca arundinacea* (1), the most poorly-documented host, based on only 1 empty nest). In addition, *Carex nebraskensis* had 3 records but was probably a secondary host of older larvae. *Glyceria striata*, *Muhlenbgria racemosa*, and *Phalaris arundinacea* have more records than their popularity would indicate because they are not common and I searched them heavily to find immatures of all hay-feeding skippers. *Agrostis gigantea*, *Agropyron* (Elvnum) *canadensis*, *Bromus* (Bromopsis) *inermis*, *Agropyron* (Elvtricia) *repens*, *Agropyron* (Elvnum) *trachycaulum*, *Dactylis glomerata*, *Agropyron* (Levnum) *ambiguus*, and *Bromus* (Bromopsis) *lanatipes* are no doubt popular hosts in nature because they are common plants and grow in valley bottoms, while *Phleum pratense* is less common so is a less common host. The other hostplants are only occasionally chosen because they are uncommon plants or because they usually do not grow in valley bottoms. *Festuca arundinacea* has very tough straplike leaves and is no doubt rarely chosen. Evidently any moist-habitat (streamsie, gulch bottom, etc.) preferably-shaded tall grass with leaves about 3 mm or wider, either growing in a single stalk (or few stalks) or a clump, is suitable for this species. The hosts are very similar to those of *Piruna pirus*, *Ochlodes sylvanoides*, and *Amblyscirtes vialis*. (Hay-feeding skippers differ somewhat in their distribution: *P. zabulon taxiles* females are almost entirely restricted to valley bottoms in semi-shaded or shaded places, whereas *Piruna pirus* females mostly stay in valley bottoms but occur on N-facing slopes to some extent, *Amblyscirtes vialis* occur in valley bottoms in partly sunny areas near lush vegetation, and *Ochlodes sylvanoides* females occur on N-facing slopes including valley bottoms.) In the lab, larvae fed to pupation on *Poa pratense*. NESTS: Young larvae roll a leaf upward into a tube; older larvae roll single leaves into a tube if the leaf is very wide, but usually silk several leaves together into a tube. Larvae do not intentionally chew the leaf down to the midrib basal to the larval tube as *P. pirus* does, although in the course of feeding the leaf is chewed to the midrib sometimes. Most larval nests...
were found on the upper part of grasses, but this is in part due to greater difficulty of finding nests near the ground. HIBERNATION STAGE: 14 larvae found in late Aug.-Oct. have head widths of 1.5-2.6 mm (one larva 1.2, one 1.5, seven 1.7-1.8, one 2.0, one 2.1, two 2.4, one 2.6); for comparison, 4 pupating larvae had 2.7-3.3 mm head width; thus, if there are 5 stages total, these larvae apparently represent mostly 4th-stage larvae with a few 3rd- and one 5th-stages, so evidently 4th stage larvae hibernate most often, evidently in the silked-leaf-tube larval nest. Head widths of larval stages evidently are: 1st 0.5 mm, 2nd 0.8-0.85, 3rd 1.2-1.5, 4th 1.6-2.4, 5th 2.7-3.3. EARLY STAGES from Colo.: EGG cream-white, hemispherical but with tapered sides, smooth & unribbed.

FIRST-STAGE LARVA cream, after feeding insides greenish; collar and head black or red-brown. MATURE LARVA orangish-tan (sometimes greenish-ochre-tan) dorsally (microscopically, cream with brownish motting), tan on the sides, underside pale-tan, with a brown middorsal band, a small subdorsal brown dot on front of each segment near middorsal band, a weak narrow dorsolateral brown band, a weak but slightly darker supra spiracular brown band, a wide very weak fairly-light brown lateral band containing spiracles (the upper part of this band above spiracles is the darkest), brown dots occur along spiracle line, a light-brown band below lateral bulge, underside uniform pale-tan, prothorax cream with narrow black collar; head brownish-red or orange-brown, with weak pattern (a brown stripe edging coronal sulcus has a faint orangish band beside it, a light orange-brown band runs from just in front of eyes to top of head and contrasts with a brown streak extending up from eyes), head & body covered with short white hair. PUPA head, T1-2; wings & appendages dark-brown with a bluish-gray glaucous suffusion, orangish-tan on top of T3 and abdomen, pale-tan on underside of abdomen, a brown dot below each of the numerous tan body hairs, a blackish lenslike mark across front of head is constructed then flared laterally next to orbit, orbit red-brown, eye blackish, two blackish subdorsal crescents on top of head, 2 subdorsal transverse blackish dashes on rear of T2, the abdomen with many black transverse dashes and dots (the dashes fewer & longer in middle of each segment, more and small in a line near the rear), an odd orange patch of oval bumps (lenticles?—each has a seta) near each side of the proboscis on A4-6, proboscis orange-brown where it extends 5-mm beyond wings, cremaster red-brown; inside the larval leaf nest, attached only by the cremaster.

Euphres bicaule (G. & R.) ("illinois" (Dodge), a weak sp. distinguished only by larger size). Larvae (raised in lab from eggs laid by a female from Republican River, Yuma Co. Colo., July 1, 1973) ate various sedges, a larva hibernated and died during 5th-stage (head width 2.2 mm). Adults common in sedge meadow where Carex nebraskensis and Carex simulata are common, Scirpus americanus ("Schoenoplectus pungens") less common, Eleocharis palustris few, Juncus arcticus var. vallicola common, Juncus longistyliis few, Juncus alpinio-articulatus uncommon, near Fort Collins, Larimer Co. Colo., July 12, 1988; Carex is the most likely host. Preoviposition 11:15, she landed on Carex nebraskensis and backed down leaf; oviposition 11:20 Carex nebraskensis (C. nebraskensis and C. simulata common nearby); oviposition 11:22 Carex simulata (C. simulata and C. nebraskensis common nearby, Juncus arcticus var. common nearby); oviposition 11:25 on Carex nebraskensis (C. nebraskensis and C. simulata common nearby); oviposition 11:29 Carex simulata (C. simulata abundant nearby, Carex nebraskensis abundant nearby, Juncus arcticus var. common nearby). MATURE LARVA 3-100, Typha latifolia 30-100; oviposition 11:32 Carex simulata (C. simulata abundant nearby, Carex nebraskensis abundant 5-100, Typha latifolia 3-100); oviposition 11:35 Carex simulata (C. simulata abundant nearby, Carex nebraskensis abundant nearby, Scirpus americanus 5, 15, 35-45, 60, Juncus longistyliis 80-100); oviposition 11:40 on Carex nebraskensis (C. nebraskensis abundant nearby, Agrostis gigantea 25, 50, Juncus longistyliis common, 50, Poa pratensis 30); oviposition 13:37 Carex nebraskensis (C. nebraskensis common nearby, Agrostis gigantea common 10-100, Juncus arcticus var. common 5-100, Scirpus americanus uncommon 15-100); sedge meadow near Fort Collins, Larimer Co. Colo., July 5, 1989. Preoviposition 12:10 on Carex nebraskensis; preoviposition 12:12 Carex nebraskensis; preoviposition 12:20 Carex simulata; oviposition 12:40 on Carex nebraskensis (Carex nebraskensis common on one side 0-100, 0-40 on other side, Juncus arcticus var. very abundant 2-100, Hordeum (Critisens) jubatum 60, 80, Poa pratensis 60, Sphenopholis obtusa 25, S. obtusa and/or Agrostis gigantea [confused identification] common 5-100, Typha latifolia 60); oviposition 12:42 (the same female) Carex nebraskensis (C. nebraskensis abundant 0-100, Scirpus americanus common 10-100, Carex praecocellata common 3-100, Agrostis gigantea common 8-100, Juncus arcticus var. common 20-100, Juncus longistyliis 60); oviposition 13:20 Carex nebraskensis (C. nebraskensis abundant 0-100, Poa pratensis common 5-100, Agrostis gigantea common 5-100, Eleocharis palustris common nearby, Juncus arcticus var. common nearby, Juncus alpinio-articulatus one nearby, Carex
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other side at coronal sulcus. There are probably 6 larval stages, though 4th- and 5th-stage larvae have rather variable head widths.

~stris, anterior brown of head (just in front of rear rim) that tapers upward to join along coronal sulcus, a slight brown streak extends upward from adfrontal sulcus creaM with red-brown vertical bands and a black forehead oval, the oval formed gap, the collar wider ventrally where it incorporates the black polygonal sclerite of previous larval stage.

Most individuals, but blackish-brown in mouthparts, ventrally to black dash, rear of head creaM-gray except for a white patch just behind anterior 5 eyes that barely includes eye #6, two eyes #2 and #6 are smaller than the others, head width 0.9-1.1 MM. Older larva similar to Euphyes vestris, but the vestris head has an extra red-brown vertical band around back of head (just in front of rear rim) that tapers upward to join its fellow on other side at coronal sulcus. There are probably 6 larval stages, though 4th- and 5th-stage larvae have rather variable head widths. PUPA overall appearance

Mouthpart., ventrally to black dash, rear of head creaM-gray except for a white patch just behind anterior 5 eyes that barely includes eye #6, two eyes #2 and #6 are smaller than the others, head width 0.9-1.1 MM. Older larva similar to Euphyes vestris, but the vestris head has an extra red-brown vertical band around back of head (just in front of rear rim) that tapers upward to join its fellow on other side at coronal sulcus. There are probably 6 larval stages, though 4th- and 5th-stage larvae have rather variable head widths. PUPA overall appearance

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Most individuals, but blackish-brown in mouthparts, ventrally to black dash, rear of head creaM-gray except for a white patch just behind anterior 5 eyes that barely includes eye #6, two eyes #2 and #6 are smaller than the others, head width 0.9-1.1 MM. Older larva similar to Euphyes vestris, but the vestris head has an extra red-brown vertical band around back of head (just in front of rear rim) that tapers upward to join its fellow on other side at coronal sulcus. There are probably 6 larval stages, though 4th- and 5th-stage larvae have rather variable head widths. PUPA overall appearance
abdomen light-brown tigressed with an orange-brown dorsal flush and a dark-green heart-band; cremaster blunt (not protruding), 2 mm wide with 2 lateral thick spines on each side but no crochets. In detailed description, pupa head black, orange-brown on ventral part of head of one pupa (above and to side of labrum, on mandible remnants, & labial sclerite, base of proboscis), but on other pupa this area mostly brown (orange-brown only on mandible remnants & labial sclerite & above to side of labrum, the base of proboscis blackish-green); posterior third of eye orange-brown on one pupa, blackish on other pupa; T1 spiracle orange-brown; on one pupa T1 dark orange-brown, T2 blackish-brown with pale middorsal cleavage line, T3 brown, top of A1 brown, top of A2-4 pale brown, A5-6 pale chestnut-brown, A7-10 dark green, on other pupa T1 blackish, T2 blackish with black middorsal cleavage line, T3 blackish-brown, top of A1 brown, top of A2-4 chestnut-brown, top of A5-7 pale chestnut-brown, A9-9 green; on one pupa basal 2/3 of wings and appendages greenish-brown, outer 1/3 of wings dark-green (turning green at the margin), on other pupa basal 2/3 of wings blackish, outer 1/3 of wings greenish-black (the very margin green), appendages dark-green, proboscis blackish-brown; lateral part of T3-A7 green (A4-6 slightly brownish-green on the posterior margin that overlaps the following segment); A1-9 has wide dark-green heart-line (appearing brown beneath brown areas, green on intersegmental areas); abdomen appears mottled due to an internal subcuticular tangle of creamy apparent-fat deposits; pupa covered with long orange-brown setae except on wings and appendages; A5 and A6 have subventral bump covered with setae, the bump higher on A6; a tuft of subventral setae on A4 & A7-9; proboscis extends 2.5 mm beyond wings (2/3 way through A3); end of abdomen truncated, "cremaster" dark-red brown, very broad (2 mm wide) with long 0.5 mm red-brown straight setae instead of crochets, two non-hooked spines 0.2 mm long on each anteriorly expanded and widened lateral end of cremaster.

coronal sulcus, a blackish-brown band (narrower dorsally) near rear of head extends around head just in front of neck (this band near rear distinguishes larva from *Euphyes binaculita*). PUPA head & thorax blackish-brown, blending to greenish-brown on last half of T3, wings blackish-brown (outer third dark-brown) with green edges, abdomen pale yellow-green, the top third of A5-8 suffused with brown, the anterior 2/3 of the dorsal half of each A1-4 suffused with blackish, the telescoping posterior third of each A4-6 segment is shiny brown-green, T1 spiralcr chitin-brown, proboscis chitin-brown where it extends 3.5 mm beyond wings almost to rear of A6, head and T1 and front of T2 have short setae, A4-7 have many shorter ventral setae directed rearward, A8-10 have long ventral setae directed reardward that hold pupa in place in nest, cremaster not protruding (because A8 & A9 are shortened dorsally, twisting the abdomen tip upward), cremaster consists of a transverse dorsal rim on A10 (~1.9 mm wide with ~22 straight unhooked longer setae 0.5 mm long), above each end of this ridge is a projection with two stout spines directed backward.

Not-"*Amblyscirtes*" *simius* Edw. 15 ovipositions all day (9:03, 9:11, 9:55, 10:14, 10:41, 10:50, 11:03, 11:05, 11:35, 11:45, 12:00, 13:00, 13:18, 13:56, 14:44) on underside of leaves (usually near the edge of the clump) of *Bouteloua* (*ChondrosuM*) *gracilis*, and 20 eggs found on *B. gracilis*, 1 mi. up Bear Creek, Chaffee Co. Colo., June 1969 and June 1970. 3 eggs found on short-leaved *Bouteloua gracilis* at lower end of slopes, Midway, El Paso Co., Colo., June 8, 1991. Ovipositing females dart back and forth slowly about 30 cm above the grass before landing and laying (Scott 1973a reports movements and behavior). 3 hours searching *B. gracilis* produced only one empty larval tunnel ~2 cm X 4 mm in soil, probably belonging to *Hesperia*; 1 mi. up Bear Creek, Chaffee Co. Colo., Sept. 5, 1980. 1 mature larva, 1 prepupa, 2 pupae found in silked-leaf-tube nests on *Bouteloua gracilis*, the nests not strictly underground but the lower ends 5-10 mm below ground level deep among tillers, thus lower part of nest is beneath the top of average soil level of clump (soil level is higher upslope of clump than downslope, since this grass is the main soil-holding plant of shortgrass prairie) and nest extends outward about half length of leaves; all grass clumps had 10-15 leaf tips eaten off near nest indicating larvae eat the equivalent of "10" whole leaves in spring after unfed first-stage larvae hibernate; nests were located either by noting the many leaves eaten near nest, or by a chance look straight down open nest tube wherein pale pupae are especially visible; a black wasp crawled into then backed out of one larval nest but could not attack larva because larvae rest with heads upward and heads are too strong to bite; S Midway, Pueblo Co. Colo., May 6, 1992. I have never seen an aerial nest (of any Lepidoptera larva) on *B. gracilis*, therefore every *Hesperiinae* eating it including "*Amblyscirtes*" *simius* must live in a soil/litter tunnel (true *Amblyscirtes* have aerial nests). 1st-stage larvae hibernate evidently unfed; about 50 1st-stage larvae diapaused and died in the lab (except 1 that died in 2nd stage). 1. *simius* nests cannot be found in Sept. because the species has one generation per year and 1st-stage larvae diapause from July to April, then larvae only feed April-June. EGG slightly-yellowish-cream when laid, but after 2-3 days developing a red ring around egg and a second small red ring around top (other *Amblyscirtes* lack red rings); hemispherical, with a definite flange extending outward at base (like that of *Hesperia comma*, and much larger than any true *Amblyscirtes*). 1ST-STAGE LARVA yellow-cream; collar & head black. MATURE LARVA light-(slightly-yellowish)-blue-green including A10, heart dark-blue-green (weak on T1-3), collar green (with a long transverse staple-shaped [points projecting forward] shallow groove lying behind a row of hairs), true legs tan-green at base and chitin-brown at tip, anal comb above anus has shallow teeth; head has a tan-brown stripe beside coronal sulcus (joining its twin on other side dorsally); a tan strip beside that line, that strip edged by a tan-brown vertical band extending down to middle of adfrontal cleavage line and this band forms the medial edge of rest of side of head which is slightly paler; tan-brown (a little darker than the tan stripe due to darker pits) except ventral part of head (at level of labrum and mandibles) is tan, tan lower part of coronal sulcus and ventral adfrontal areas, a dark-brown adfrontal sulcus line and dark-brown adfrontal cleavage line, frontoclypeus tan with a slightly-brown vertical line down middle, a blackish-brown transverse line on lower edge of frontoclypeus, labrum translucent-tan, cutting edge of mandibles black, fangs ABSENT. Waxy powder was not noticed on larvae or pupae, and is absent on so larvae evidently lack waxy powder (intersegmental areas on A6-7 and A7-8 are whiter-blue-green but those on A1-6 are a bit whiter also). PREPUPA same as larva but yellowish-bluish-green, A10 slightly-brown due to lots of setae, head greenish-tan. PUPA tan-cream on head thorax and wings, abdomen cream (later maybe a bit yellow-cream), heart-band light-brown on A4-7, T1 spiralcr red-brown (other spiralcrs cream), antenna club tip becomes red-brown, proboscis orange-
Amblyscirtes, because of numerous differences: in Simius adults mate on hilltops (versus guiches in true Amblyscirtes) during only part of the day (vs. all day in proper weather), the male aedeagus and saccus are shorter (vs. very long), aedeagus has 2 cornuti (vs. none), uncus tips not connected to gnathos tips (connected), female lamella and ductus bursa rather membranous (vs. well-sclerotized), egg develops red rings (vs. no rings), 3rd palp segment shorter and directed more anteriorly (vs. longer and nearly vertical), hostplant a narrow-leaf turfgrass (vs. broad-leaf hay- or hay-bunch grasses), larval nest in soil and lower part of leaves (vs. completely above ground among leaves), larval head lacks fangs (vs. dracula fangs), mature larval collar green (vs. black), side of mature larval head unstriped light brown (vs. pale with reddish-brown vertical stripes), mature larva lacks waxy powder (vs. powder), pupal cremaster extends ventrally and lacks crochets (vs. posteriorly with crochets). Burns (1950) discussed adult morphological traits, but could not find the proper genus for Simius.

Amblyscirtes. Larvae of all species of true Amblyscirtes seem to need dry humidity: when fed the moist grass Poa pratensis, 1st- & 2nd-stage A. vialis and oslari larvae die (the only Hesperiinae I have raised that failed to thrive on this grass) (though I once reared A. aenus on P. pratensis), and mature larvae easily catch a fungus disease causing the true leg tips to rot away. Based on this and the ranges of most species, the genus obviously evolved in the Mexican-SW U.S. deserts. 2 fangs occur on larval heads of all true Amblyscirtes below the ventral end of the adfrontal sulcus; each fang extends forward slightly then curves downward to a point. Observations of A. aenus & phylace larvae show that fangs function to puncture nest intruders when the head is banged up and down, or to crush & tear nest intruders when the head is scraped violently from side to side. Older larvae are rather acrobatic, sometimes hanging upside down from the A10 prolegs, and are occasionally found exposed in nature in daytime (a very rare occurrence in Hesperiidae); evidently their ability to defend themselves allows them to leave the nest, perhaps a useful behavior to locate the green leaves of desert grasses (A. oslari larvae must move to other plants occasionally because of the small size of its host, while A. phylace seldom needs to move because its host is so large).

Amblyscirtes vialis. Oviposition 9:31, she landed on Agropyron (Elytrigia) repens once, landed Bromus (Bromopsis) inermis twice and bent abdomen once, landed on B. inermis leaf top and crawled sideways to rest upside down under horizontal portion of leaf and laid an egg on leaf underside (67 cm above ground on leaf 5 mm wide, 9 cm from leaf tip), this was on sunny valley bottom (B. inermis 0-100, Poa spassizensis 35-100, Agropyron [Elytrigia] repens 40, 80-100); egg found on Bromus (Bromopsis) lanatipes leaf underside (44 cm above ground on 4.5-mm-wide leaf, 7 cm from leaf tip), on lower S-facing slope (B. lanatipes 0-100, Carex probably pennayllica heliophila 50, 100); egg found on horizontal leaf underside of young tiny Bromus (Bromopsis) inermis (16 cm above ground on 6-mm-wide leaf, 7 cm from leaf tip), lower N-facing slope in little clearings in partial shade (B. inermis 20, 25, 30, 50-80, Oryzopsis asperifolia 30, 35, 45, 45, 55, 59, 100, 100, 100, Carex rossii 100); many A. (E.) repens, many Daucus caloncle, some Phleum pratense, one Agropyron (Levysus) ambiguus, 5 Agropyron (Elymus) canadensis, many B. inermis, many B. lanatipes were searched; Tinytown, Jefferson Co. Colo., June 25, 1990. Egg found on horizontal Bromus (Bromopsis) lanatipes leaf underside (16 cm above ground on 5.5-mm-wide leaf, 9.5 cm from leaf tip), in little clearings in valley bottom (B. lanatipes 5, 20, 30, 35, etc. common to 100, Poa pratensis common 2-100); egg found on horizontal Agropyron (Elymus) trachycaulum leaf underside (44 cm above ground on 4-mm-wide leaf, 10 cm from leaf tip), on mostly-sunny bank of tiny gulch (A. (E.) trachycaulum 10-100, B. lanatipes 7, 30, 30, etc. common, P. pratensis 5-100 common, Agrostis gigantea 35-50, 100); Tinytown, Jefferson Co. Colo., June 27, 1990. Egg found on Phleum pratense horizontal leaf underside (20 cm above ground on leaf 5.5 mm wide, 14 cm from leaf tip), in bottom of gulch shaded only in morning (P. pratense common 5-15, 30-100, P. pratensis scattered 7-100, Poa compressa 5, 7, 10-20, small plants common to 100); egg found on horizontal Bromus (Bromopsis) inermis leaf underside (60 cm above ground on leaf 8 mm wide, 9 cm from leaf tip), on E-facing gulch bank (B. inermis 60, 20-100, Agropyron [Elymus] trachycaulum common 25 cm onward, Poa
A. vialis, or E-facing gulch banks/benches); Tinytown, Jefferson Colo., June 11, 1992. Oviposition 12:15 on underside of horizontal portion of egg, grasses recorded for the common hay feeders). 1st-2nd-stage larvae died feeding above ground), small woodland gulch, Tinytown, Jefferson Co. Colo., May 21, 1992. Egg found on Agropyron (Elvumus) canadensis horizontal leaf underside (40 cm above ground on leaf 6 mm wide, 7 cm from leaf tip), on top of W-facing bank (A. [E.] canadensis 0-100, Agrostis gigantea 100); egg found on Agropyron (Elvumus) canadensis on dorsal side of leaf but leaf was twisted so egg was facing downward (40 cm above ground on leaf 6 mm wide, 7 cm from leaf tip), on top of W-facing bank (A. [E.] canadensis 0-100; Agrostis gigantea 100); egg found on Agropyron (Elvumus) canadensis horizontal leaf underside (40 cm above ground on leaf 7 mm wide, 6 cm from leaf tip), on top of W-facing bank (A. [E.] canadensis 0-100); searched for eggs were 50 Dactylis glomerata, some Agropyron (Elvumus) glaucus Buckley, some Phleum pratense, few Orzyopsis asperifolia, some Bromus (Bromopsis) inermis, some Bromus (Bromopsis) lanatipes, some Agrostis gigantea, few Muhlenbergia racemosa, few Andropogon (Schizachyrium) scoparius; Tinytown, Jefferson Co. Colo., June 28, 1990. Egg found on Bromus (Bromopsis) lanatipes leaf underside (30 cm above ground on 6-mm-wide leaf, 12 cm from leaf tip), mostly-sunny bench just E of small gulch bottom 2 m; many A. lanatipes, 50 Dactylis glomerata, a few Phleum pratense, some Agropyron (Elvumus) trachycalami, "10 Calamagrostis purpurascens, 1 Danthonia parviflora, 1-2 Orzyopsis asperifolia, were searched for eggs; Tinytown, Jefferson Co. Colo., July 2, 1990. One 1-cm-long 3rd-stage larva found in silk nest of Agropyron (Elvumus) canadensis leaf tied upward with 8 silk ties (larva on top of leaf)(Festuca pratensis, Phleum pratense, Dactylis glomerata also within 1 m), larva reared through two molts in lab before it died as 5th stage; gulch bottom in Apex Gulch, Jefferson Co. Colo., July 15, 1989. 7 larvae (1 healthy larva 20 mm long, 3 sick or parasitized larvae 12, 12, & 13 mm long, 3 dead shriveled larvae 7, 10, & 12 mm long) were found in rolled-leaf tubes on Agropyron (Elvumus) canadensis; the long-occupied leaf nest seems to consist of a rolled leaf tube, the leaf eaten beyond nest, and the leaf chewed nearly to midrib for 2-3 mm just basal to nest (one young-larval nest had the chewed truncated leaf end folded back, and some leaves merely had the ends truncated or chewed down to the midrib), nearly-Mature larvae make nests on ~3 leaves of the plant, and nearby plants have nests also, so larvae on smaller plants wander to several plants like A. olsarii and some A. phylace; all in partially-shaded small gulches (in gulch bottom or on W- or E-facing gulch banks/benches); Tinytown, Jefferson Co. Colo., Aug. 29, 1990. Mature larva found on Agropyron (Elvumus) trachycalum, in uppermost leaf of plant in leaf tube closed with 4 silk ropes, leaf eaten completely beyond nest and eaten mostly to midrib for 2 cm basal of nest, a leaf lower down was fully eaten except for basal 2 cm but 2 basal leaves were untouched, "15-20 cm" of leaves must be eaten by larva in its lifetime; partially shaded gulch bottom, Tinytown, Jefferson Co. Colo., Sept. 6, 1990. Empty silk-tube nest of 3 leaves (record ignored, because larva was A. vialis or Poanes zebulan taxiles or Ochlodes sylvanoides) found on Festuca arundinacea; Tinytown, Jefferson Co. Colo., Aug. 29, 1990. Oviposition 12:15 under horizontal spot of drooping Agropyron (Elvumus) canadensis leaf (leaf 7 mm wide, egg 9 cm from leaf tip, "20 cm above ground"), sunny area of tiny wooded gulch, Tinytown, Jefferson Co. Colo., May 21, 1992. Egg found on underside of drooping Agropyron (Elvumus) canadensis leaf where it was horizontal (leaf 7 mm wide at egg, "25 cm above ground"), part-shaded little gulch, Tinytown, Jefferson Co. Colo., June 11, 1992. Oviposition 12:15 on underside of horizontal portion of drooping A. (Elvumus) canadensis (egg 9 cm from tip of 7-mm-wide leaf, "20 cm above ground"), small woodland gulch, Tinytown, Jefferson Co. Colo., May 21, 1992. HOSTPLANTS. Obviously hay grasses are the hostplants, including Agropyron (Elvumus) canadensis (11 records), Bromus (Bromopsis) lanatipes (4), Bromus (Bromopsis) inermis (3), Agropyron (Elvumus) trachycalum (2), Phleum pratense (1); no doubt others are eaten as well (A. vialis is not as common as the other hay feeders so I do not have as much data; I have about 15 or more hay grasses recorded for the common hay feeders). 1st-2nd-stage larvae died feeding on Poa pratensis. Agrostis gigantea is probably usually refused because the leaves are mostly vertical and females evidently prefer to oviposit beneath horizontal portions of the leaf; it grows in wet soil also and females evidently seldom lay in wet areas. Many Dactylis glomerata were searched with no results; perhaps the leaves are too succulent for A. vialis. Eggs are laid an average of 40 cm above ground, on leaves 6 mm wide, 9 cm from leaf tip, all on underside of the horizontal portion of the drooping leaf (except one egg that faced to the side and slightly downward on a leaf engulded downward). NEST. Mature larvae usually chew the leaf nearly to midrib for 2-3 mm just basal to rolled leaf nest, and eat the leaf beyond nest. Mature fully-fed larvae hibernate. Eggs slightly-translucent white, turning slightly cream after a few days, with faint little polygons on surface, hemispherical in lateral view (cross-section of lower edge slightly more acute than a right angle but slightly rounded), the very top flat with a slightly sunken circle, with a dark spot on the micropyle
of *Ochlodes sylvanoides*, *Poanes*, etc.). (In contrast, *Piruna pirus* eggs are hemispherical in lateral view, with faint vertical ribs, the center of top is sunken more, into a plate-like area; and *Poanes zabulon* *taxis* eggs are very smooth without polygons, the lower edge more rounded, the top flattened but not indented.) 1ST-STAGE-LARVA yellow-green, after feeding turning light-bluish-yellow-green, collar black, A10 has 2 long setae; head black, conical in front view (the top pointed, much more triangular than the other hay-feeders *Poanes*, *Ochlodes*, *Piruna*, etc.). 2ND-STAGE LARVA head black. 3RD-STAGE LARVA (1 cm long) whitish-green, heart-band darker-green, the narrow black collar ending just above large black spiracle; head dark-brown without stripes, narrowed dorsally in anterior view, the fang represented by only a small bump, head 1.1 mm wide. 4TH-STAGE LARVA pale bluish-green covered with tiny white specks, a middorsal dark blue-green heart-line, Ti collar extending laterally to just above Ti spiracle and whitish on front 40% and black on rear part; head fang short (half the length of mature fang) and rapidly tapered near the tip, color varies between individuals; head mostly black except for a pale area behind eyes; OR head black with glaucous bloom and faint light stripes like those of mature larva; OR head black with orange-brown stripes almost as large as mature larval bands but lateral pale stripe mostly divided in two by a brownish area at about the level of top of frontoclypeus; OR head dark orange-brown and covered with a whitish bloom, the rear rim blackish, a blacker inverted-Y-shaped mark on coronal-adfrontal sulcus, coronal sulcus slightly paler. MATURE LARVA (Table 9) whitish-bluish-green, heart-band gray (slightly-bluish-green), collar narrow & black; head glaucous (with a whitish bloom caused by numerous long flattened pale hairs [which appear under microscope as chitin-tan with translucent whitish margins] covering head & body [other *Amblyscirtes* lack this head frosting--these hairs in *A. oslari* for instance are 1/3 as long and appear translucent under microscope]) cream with orange-brown stripes (a wide orange-brown or blackish-orange-brown band [tapered near rear rim] on coronal sulcus which extends down as an orange-brown or dark-orange-brown edging of adfrontal cleavage line to red-brown fang, an orange-brown or dark-orange-brown vertical spike extends upward from there [directly above fang] to just above level of top of frontoclypeus, a broad orange-brown or dark-red-brown [often blackish-brown near eyes] band extends upward from eyes then curves onto top of head almost to coronal band, rear rim of head broadly blackish-chestnut-brown or black, an inverted blackish or black wishbone-shaped mark is on adfrontal sulci and on that portion of coronal sulcus below adfrontal cleavage line, frontoclypeus completely filled with orange-brown on 2 larvae, filled with blackish-orange-brown on ventral half on 1 larva, filled with orange-brown only on lower edge (plus a vertical orange-brown band to top) on one larva, anteclypeus blackish-orange-brown), head has tiny polygonal pits seemingly different from *Ochlodes sylvanoides*. PUPA unknown in Colo., but must be similar to other *Amblyscirtes*, because described in E U.S. as green, head slightly reddish, proboscis reddish beyond wing cases.

*Amblyscirtes aenus aenus* Edw. 1 nearly-mature larva 22 mm long found on *Agropyron (Levys) ambiguus*, the larva was resting exposed on a leaf several cm from two empty silked-leaf tube nests (both of 2 leaves, the leaves eaten basal and distal to tube, one nest had one leaf chewed to midrib on distal part of tube, other nest had leaf chewed to midrib basal to tube), larva fed on *Poa pratensis* in lab for a week then diapasoned as a mature larva, which was refrigerated for 2 months, then removed from refrigerator but died; N-facing slope on Beaver Brook Trail, Jefferson Co. Colo., Aug. 25, 1995. A female of form *erna* F. (the unh unsotted) from Furnish Can., Baca Co. Colo., laid eggs in the lab, and the larvae were raised on *Poa pratensis*, producing two male offspring of the normal spotted-unh form of *aenus* (thus demonstrating the conspecificity of *erna* and *aenus*, Scott 1977). Mature fully-fed larvae hibernate. 5TH-STAGE MATURE LARVA (Table 9) light whitish-green (turning cream in color after hibernation started), heart gray-green, a faint lateral pale-green band, ventral side of A7-8 with usual waxy-white-powder glands, the narrow collar extends laterally to just above spiracle, the front half of collar chitin-colored, the rear part narrowly black; head cream with orange-brown bands (a narrow vertical orange-brown band on frontoclypeus, a narrow orange-brown band along adfrontal sulcus and extending upward along coronal sulcus a bit, a wider orange-brown band along adfrontal cleavage line [very narrow near coronal sulcus] which is joined to a broad orange-brown band along coronal sulcus, a narrow orange-brown spikelike band extends upward 0.5 mm from upper part of adfrontal cleavage line band to parallel the broad coronal sulcus band, a broad orange-brown band extends upward from anterior four eyes to join broad coronal-sulcus band on top of head, rear rim of head orange-brown (blackish beside
of the true legs (but this behavior has never been observed). The fangs are surely used for defense against intruders into the hibernal nest. I opened the mature larval nest once with tweezers and the larva banged its head up and down quickly a few times, evidently to puncture the intruder with its fangs. Another time I opened the end of its nest with tweezers and the larva scraped its head violently around the nest opening 3 times by turning head to right then to left etc. (the head twisting 90°), which would scrape and tear a small intruder. Older larvae may also use the fangs to help bring leaves close to make a nest, because I once saw the mature larva hanging from a leaf with only the A10 prolegs, holding a leaf with its legs to eat, and once saw the larva hanging from silk on the glass jar from only the A10 prolegs to grasp a leaf; while the larva is making this acrobatic hanging from A10 prolegs, the fangs could hook over the edge of a leaf to bring it within grasp of the true legs (but this behavior has never been observed). PUPA (3 pupal shells, Furnish Can.) proboscis extends to base of cremaster, T1 spiracle tan, front of head slightly tan, most of shells translucent, implying that colors are similar to those of A. oslari, a supraventral slight hill on A4,5,6 contains large oval lenticles.

Amblyscirtes oslari. Oviposition 13:18 on leaf underside of small Bouteloua curtipendula 10 cm long in a line of these plants at the top edge of a small (50 cm wide) bare hollow of slope (B. curtipendula 1-45, Andropogon gerardii 100, Bromus (Anisantha) tectorum 5, 15-100, Stipa comata 15-100); egg found (33 cm from first egg) on B. curtipendula (B. curtipendula 0-60, Stipa comata 15-30, Bromus tectorum 15-100, Sporobolus cryptandrus 45); egg found (45 cm from first egg) on B. curtipendula (B. curtipendula 0-70, Stipa comata 10 cm onward, Bromus tectorum 5 cm onward); many Andropogon gerardii, many Bouteloua (Chondrosus) gracilis, some Andropogon (Schizachyrium) scoparius, and some B. curtipendula & a few others were searched, proving that B. curtipendula is the favorite host; Apex Gulch, Jefferson Co. Colo., June 4, 1990. Preoviposition 13:00; egg found on B. curtipendula leaf underside, at top of steep small bare ground (B. curtipendula 0-100, Stipa comata 25-80, Carex probably pennsylvanica heliophila 30-100, Andropogon (Schizachyrium) scoparius 100, Koeleria macrantha 100, Bromus tectorum 80); 2 eggs found 1 cm from each other on B. curtipendula leaf underside in slight hollow of slope (B. curtipendula 0-50, 60-100, Stipa comata 15, 25, 40 cm onward, Bromus tectorum scattered 15-100, Sporobolus cryptandrus 90-100, Carex probably pennsylvanica heliophila 60); egg found B. curtipendula in hollow below rock pile (B. curtipendula scattered 0-90, Stipa comata common 25 cm onward, Bromus tectorum 15, 30 cm onward, Sporobolus cryptandrus 100, Andropogon gerardii 100); egg found B. curtipendula in part-shade in small hollow of slope (B. curtipendula 7, 12, 30-100, Stipa comata common 10 cm onward, Agropyron [Pascopyrum] smithii 15-20, 35-100, Bromus tectorum 65-70); egg found B. curtipendula on slight hollow of slope (B. curtipendula 0-100, Stipa comata 15, 25, common 40 cm onward, Sporobolus cryptandrus 90-100, Aristida purpurea 100); egg found B. curtipendula beside low spot of slope (B. curtipendula 0-40, 60-70, Agropyron [Pascopyrum] smithii 50-80, Stipa comata 30-45 etc. common, Andropogon (Schizachyrium) scoparius 80-100); egg found B. curtipendula in little low spot of slope (B. curtipendula 5-20, 30, 50-100, Bromus tectorum 8, 15-20, scattered to 100, Stipa comata 10, 15, 20, etc. common, Andropogon gerardii 70-100, Carex probably pennsylvanica heliophila 50-100, Sporobolus cryptandrus 80); egg found B. curtipendula in little clearing of slope (B. curtipendula 0-60, Stipa comata 80, 90, Agropyron [Pascopyrum] smithii 40-100, Carex probably pennsylvanica heliophila common 25 cm onward, Andropogon (Schiz.) scoparius 30-100, Bromus tectorum 5, 10, 20, 30, etc. scattered); egg found B. curtipendula (B. curtipendula 0-25, 40-50, 60, Agropyron [Pascopyrum] smithii 60-100, Carex probably pennsylvanica heliophila 5-35, 50-90, Andropogon (Schiz.) scoparius 30-100, Andropogon gerardii 80, 100, Stipa comata 100, Bromus tectorum 20, 30); some B. curtipendula, a few Bouteloua gracilla, many Andropogon (Schiz.) scoparius, and some Andropogon gerardii were also searched; obviously B. curtipendula is the preferred host; Apex Gulch, Jefferson Co. Colo., June 5, 1990. 1 larva 20 mm long found in B. curtipendula leaf tube of 5 leaves, near "4 short empty leaf tubes; 3 other B. curtipendula plants had empty tubes; S-facing slope, Apex Gulch, Jefferson Co. Colo., Aug. 20, 1990. Mature larva found in B. curtipendula leaf tube, reared to adult, 3 empty tubes found on plant; hilltop Bear Creek, Chaffee Co. Colo., Aug. 21, 1990. Larva 2.5 cm long (head upward) found on Andropogon gerardii, 10 cm from 2 fresh empty nests on B. curtipendula, so larva moved onto A. gerardii after feeding most of its life on B. curtipendula; Apex Gulch, Jefferson Co. Colo., Aug. 23, 1990. Near-mature larva found on Stipa comata (which showed no feeding damage so is not a host) resting in the open 4, 8, 25, 30 cm from large leaf tubes on B.
larvae found in silked-leaf tubes of *A. gerardii* -20 cm above ground, 1 larva was near 3 empty nests, 2 had head downward in nest (3 adult females reared)(3 larvae W-facing slope, 1 N-facing slope, 1 slightly-NW-facing ridgetop); Green Mtn., Jefferson Co., Colo., Aug. 28, 1990. 2 mature larvae (yellowish-green bodies and shortened front-to-back, so in diapause) found (both with head downward) in *A. gerardii* silked-leaf nest tubes; E-facing valley head, Green Mtn., Jefferson Co., Colo., Sept. 1, 1990. *Andropogon gerardii* is obviously the favorite host, *Bouteloua curtioendula* a rare host; both are fairly short open-hillside grasses with wide leaves. Other hosts are surely used southward. A larva was noted to swivel its head from side to side in response to disturbance, permitting its fangs to crush an intruder to the nest. Mature fully-fed larvae hibernate. EGGS cream hemispherical, the lower edge slightly rounded (no flange). 1ST-STAGE LARVA cream, collar & head chitin-brown, head pointed dorsally. MATURE LARVA (Table 9) whitish-green (slightly yellowish at intersegmental folds), heart-band gray-green or grass-green, collar narrow, black head cream (slightly tinged with tan on many larvae), with orange-brown (no black on lower part of face, unlike *A. oslari*) bands (a wishbone-shaped mark over adfrontal sulci extends almost up to adfrontal cleavage line, a vertical band on frontoclypeus extends from anteclypeus 40-90% up to its top, a wide band extends from fang base upward [lateral to and touching adfrontal cleavage line] and forms a broad band over coronal sulcus and narrows to neck (this band is thick at the level of bottom of coronal sulcus, so the lateral edge of this band, like *A. oslari*, is much less concave than in *A. vialis* and *aenus*), a wide band extends upward from eyes #3-6 and curves to join coronal sulcus band on top of head, rear rim of head orange-brown (blackish-brown on ventroposterior corner of postgena), labrum & anteclypeus brown. PUPA on first day light-green on thorax and A1, head tan-green, distal 1/2 of wings cloudy whitish-green, A2-3 greenish-cloudy-cream, on next day becoming pale-dull-yellow, abdomen mottled yellow-white (palest A2-4, less pale AS-7), rear of each A4-7 segment chitin-brown, front of head slightly tan, heart-band slightly darker esp. AS-8, a supraventral low hill on A4,5,6 contains a tuft of reddish hair and large oval lenticles, proboscis chitin-brown where it extends beyond wings 3-4.5 MM (to middle of A7, rear of A8, or cremaster base), T1 spiracle & cremaster orange-brown, when about to emerge eyes become red, then thorax & appendages become reddish-brown, etc. Pupa lasts 18 days in lab.

**Table 9. Amblyscirtes larval differences.**

<table>
<thead>
<tr>
<th>Trait</th>
<th><em>A. vialis</em></th>
<th><em>A. aenus</em></th>
<th><em>A. phylace</em></th>
<th><em>A. oslari</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>head frosting</td>
<td>white</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>color of head bands</td>
<td>dark</td>
<td>orange</td>
<td>orange</td>
<td>orange-brown</td>
</tr>
<tr>
<td>-brown, rear rim often</td>
<td>-brown</td>
<td>-brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vertical orange-brown streak</td>
<td>present</td>
<td>present</td>
<td>absent</td>
<td>absent</td>
</tr>
<tr>
<td>extending up from adfrontal cleavage line</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>orange-brown band beside top of frontoclypeus</td>
<td>narrow</td>
<td>narrow</td>
<td>broad</td>
<td>broad</td>
</tr>
<tr>
<td>vertical stripe on frontoclypeus</td>
<td>running to top, or only from bottom up</td>
<td>running from bottom</td>
<td>running from</td>
<td></td>
</tr>
<tr>
<td>and vague to top or to top to top</td>
<td>ventral</td>
<td>bottom</td>
<td>to middle</td>
<td>bottom</td>
</tr>
</tbody>
</table>
due to food so that 12-3 are light green dorsally, Tl red-brown; head & collar black. 2ND-3RD-STAGE LARVA light yellow including legs and prolegs, Tl red-brown (Tl redder than 1st-stage); head & collar black. mature larva light-(very slightly greenish)-yellow, with many interrupted (dashed) gray transverse lines interspersed with narrow black transverse lines (these black lines limited to top half of body, and one black line on front of each segment is widened subdorsally, above each spiracle is 1 or 2 black transverse dashes; the black lines vary, a larva on R. pseudoachaeaca July 20, 1988, had black lines nearly absent, whereas larvae on E. lepidota Sept. 7, 1989, all had strong black lines), collar red-brown, prothorax reddish beneath, true legs reddish, anterior eight prolegs orangish-yellow, a small black suranal plate on front of A10, spiracles black; head red-brown, with a large orange spot medial to the white eyes. PUPA reddish-brown (orange-brown on abdomen, light orange-brown between segments A4-5, 5-6, 6-7), mottled with fine tiny sinuous black and pale lines, mostly covered with a bluish-white bloom, a weak brown subspiracular band on abdomen, T1 spiral black, lateral base of cremaster black.

Zestusa dorus (Edw.). Adults associated with Quercus gambelii in N New Mex. and SW Colo.


Oviposition 14:44 on leaf underside of L. leucanthus 9-cm-tall seedling, she landed on "15 larger plants before ovipositing, so females must prefer seedlings; Apex Gulch, Jefferson Co. Colo., May 31, 1980. L. leucanthus may be the favorite Colo. host; it has long dried up by Sept., so larvae must mature in July or E Aug., and spend a long time in diapause. Adults associated with Lotus crassifolius (M.), 5 mi. NE Seat Mtn., Colusa Co. Calif., June 8, 1974. EGG creamy-white; no color change even in 4 days.


Thorybes diversus Bell. Adults common associated with Vicia americana, tiny coniferous forest clearings S of Mather, Tuolumne Co., Calif., June 11, 1972.

Erynnis icelus (Scud. & Burg.). Oviposition 12:43 on leaf of 10 cm Populus tremula tremuloides seedling, Hopewell Lake Cgd., Rio Arriba Co. New Mex., June 21, 1978. Oviposition, she fluttered 13:00-13:13 about P. t. tremuloides plants 10-30 cm tall, then found a P. t. tremuloides seedling 10-cm tall with just-emerged leaves (terminal leaves tiny), hovered over it twice and landed twice, laid egg 13:14 on stem 3 cm from seedling tip; Tinytown, Jefferson Co. Colo., June 21, 1980. Females evidently oviposit only on seedlings. EGG cream with scattered tiny yellow spots when laid, when 1 day old turning bright-orange, then red (dark red by 3 days), with "13 vertical ribs.


Preoviposition on probably Q. gambelii undulate (which is actually a hybrid taxon introgressed to other oaks, mostly introgressed to Quercus havardii in this area, so there is not much difference between havardii and undulate; this record was reported as Q. havardii by Scott 1986a)(1 m shrubs in thickets with 3-cm-long live-oak-type leaves), 8 mi. W. Roy, Harding Co. New Mex., May 12, 1985. E. brizo, like its close relative E. icelus, evidently oviposits only on seedling plants, while E. tulemacheri oviposits on young leaves of mature plants. EGG slightly-greenish cream when laid, light-orange (slightly lighter than E. icelus) when 1 day old, orangish-red in 2 days, red a day or so later, with "18 vertical ribs (more than icelus).


as larva develops inside, 2 eggs had 15 and 17 vertical ribs. 1ST-STAGE LARVA ochre; head slightly-ochreous.


Preoviposition 12:25 on *Arctostaphylos uva-ursi* adenophorica (the female perhaps fooled by the prostrate bush and small leaves like the host), Coal Creek, Jefferson Co. Colo., July 17, 1991. Females oviposit on mature plants, near new growth. EGG greenish-cream, either not changing color or the eggs were sterile.


Female preoviposited 10:30-10:50 only on “5 seedlings, oviposition 10:51 on stem among very young 15-17-mm leaves on tip of 10-cm-tall seedling *Q. gambelii*, Tinytown, Jefferson Co. Colo., May 21, 1992. Females evidently prefer to lay eggs on twigs, petioles, and dried leaf tips rather than on green leaves, and oviposit both on tall plants and on seedlings. EGG cream or yellowish-cream when laid, after 1 day turning bright red, with 15-16 vertical ribs. FIRST-STAGE LARVA ochre-tan (cream on rear and neck) or light-brown, appearing brownish internally (due to food?), collar narrow, black; head black with cream setae.

*Ceraunus persius* (Scud.). Oviposition on leaf of *Astragalus* sp. (probably *biscutatus* but no pods present) (G, W), Rosita, Custer Co. Colo., June 27, 1969.


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stage larva found in *T. divaricarpa* leaf nest, Wheatridge, Jefferson Co. Colo., Aug. 12, 1988. Preoviposition *T. divaricarpa* (bent abdomen 2 sec), Tinytown, Jefferson Co. Colo., May 17, 1988. Oviposition 10:45 on stem of small *T. divaricarpa*, Tinytown, Jefferson Co. Colo., June 2, 1992. Oviposition 9:21 on underside of young 1-cm-long leaflet of *T. divaricarpa* after ignoring older plants of *A. flexuosus*, *Trifolium pratense*, *Melilotus officinalis*, oviposition 9:36 on base of leaflet of 2/3-grown 2-cm-long leaflet of *T. divaricarpa*; oviposition 10:23 base of very young 6-mm-long leaflets of *L. argenteus* var. (white flowers no banner spot, glabrous plane leaves; it is not *infracus* which has white flowers but has a banner spot and glabrous folded leaves); Tinytown, Jefferson Co. Colo., June 25, 1990. Oviposition 12:18 on end of petiole just below *L. argenteus* var. (white flowers no banner spot, glabrous plane leaves) leaflets (the plant was 8 cm tall with only 4 leaves), she ignored *A. flexuosus* and *Trifolium repens* for 20 min. before laying; Tinytown, Jefferson Co. Colo., June 21, 1990. Oviposition 13:05 on base of new 6-mm-long leaflets 2 cm from end of young branch of *L. argenteus* var. (white flowers no banner spot, glabrous plane leaves), 2 preovipositions on white var.; Tinytown, Jefferson Co. Colo., June 24, 1990. Orange egg and empty eggshell found on leaflet base (side) of *L. argenteus* var. (white flowers no banner spot, glabrous plane leaves); Tinytown, Jefferson Co. Colo., June 28, 1990. Half-grown larva found in nest of 5 silked-together flowers of *L. argenteus* var. (white flowers no banner spot, glabrous plane leaves); Tinytown, Jefferson Co. Colo., July 15, 1990. Females may prefer *Astragalus* (esp. *flexuosus*), *Lupinus argenteus*, and *Thermopsis divaricarpa* in the Colo. Front Range foothills, but these are the most common hillside legumes, so other legumes may be chosen too when available. *E. afranius* is known to eat the last two plants so may have very similar hostplant preference. Females oviposit on leaflets most often, sometimes on stems, often near new growth or flower buds. Mature larvae hibernate. EGG: Cream, turning light orange in 1 day, orange 3-4 days later, with 15 vertical ribs. 1ST-STAGE LARVA pale ochre with cream setae, collar brown; head brownish-black. MATURE LARVA: light-creamy-green, slightly pinkish in intersegmental areas, heart-band darker green, a narrow cream subdorsal line, a very faint slightly paler spiracular band; head black with ochre-cream areas (one tiny dark-ochre spot on lower corner of frontoclypeus, a rectangle on forehead [lateral to coronal sulcus] extends upward and then turns laterally and narrows and runs a short distance to side of head, just above [and broadly-connected to] an oval on side of face, which is narrowly-connected to an oval on front of gena [which lies mostly below rectangle], a pale comma behind eyes); head is blacker with much smaller and paler spots than *E. afranius*, the pale color limited to discrete spots and not diffused over head as in afranius.

Adults associated with blooming Potentilla pulcherrima (W), and with Potentilla pensylvanica, Bartlett Mesa N of Raton, Colfax Co. New Mex., May 15, 1985; the abundant males patrolled about these females here, and perched among them about 50% of the time to await females; a few males perched in an adjacent gulch bottom (the preferred mate-location site at low density). Adults associated with both Potentilla pensylvanica (W) and Potentilla hippiana (W) at 4 sites: at Rosita, Custer Co. Colo., May 1972, Luders Creek Cgd., Saguache Co. Colo., May 28, 1972, Poncha Pass, Saguache Co. Colo., May 27, 1972, and Trout Creek Pass, Chaffee Co. Colo. Adults associated with Potentilla hippiana (W) and perhaps others at Devil’s Hole, Huerfano Co. Colo. (Note: the Potentilla hippiana plants from the last 5 sites were previously misidentified as Potentilla [Argentina] anserina [see Scott 1975b and Scott & Scott 1980] but have been reidentified as Potentilla hippiana (all W and myself); Potentilla anserina is an erroneous host record.) Adults associated with Potentilla pensylvanica, Bartlett Mesa N of Raton, Colfax Co.
New Mex., May 3, 1972. Females evidently prefer to lay eggs inside host flowers if present, but lay on young leaves if flowers are not common. *P. pulcherrima* seems to be the most common Colo. hostplant, because the larvae were found on it, it blooms when the adults fly, eggs evidently are preferably laid on flowers or new growth, and ovipositions have been seen on it. *P. hippiana* could be a host also, because it is common wherever *P. xanthus* occurs, usually the commonest *Potentilla*; but there are no records yet, and it blooms in July so females could not lay in its flowers. Larvae ate *P. pulcherrima* and *P. hippiana* well in lab. *Potentilla pensylvanica* and *P. anserina* are much less common, and both bloom in July, as does many *P. hippiana* X *P. pulcherrima*; *P. anserina* is less likely to be a host because it is in a separate subgenus. Adults fly only 2-5 cm above ground. No diapause in lab (but pupae could hibernate because they were pickled). EGG pale-green. HALF-GROWN LARVA dull pale creamy-bluish-green with many cream dots (each bearing a seta), heart-line darker bluish-green, TI gray-black, legs & collar black; head black; larva rests in a silk nest on top of a leaf, the head & thorax curved so that head faces toward rear. HALF-GROWN LARVA cream-tan with slight blue-green tinge in middle of body (the blue-green becoming more widespread by 4th-stage, heart-line green, 2 lateral rows of faint tan lines; collar and head black. MATURE LARVA green, the dorsal half of body slightly-reddish-yellow (reddish-yellow on intersegmental areas), a darker gray-green heart-band, a pale dot at base of each whitish hair, TI black, legs & collar black; head black. PUPA less than 1 day old head & top of thorax greenish-black, appendages & wing bases dark green, wing tips olive green, abdomen dark-orange-brown with many black spots (including black patches near heart-line, subdorsal and supraventral black spots, the front half of A5, A6, & A7 brownish-black), cremaster blackish-brown, long ("0.5 mm) tan hairs common all over body except absent on wings & appendages. Pupa after about a day bluish-gray (glaucous, because the greenish head, thorax, & wings have become mostly glaucous) with black pattern, head glaucous but front of head and orbit blackish, blackish lines edge the appendages, wing veins pale glaucous, wing cells slightly darker glaucous-tan, abdomen dark-orange-brown (including intersegmental areas), a middorsal blackish band on thorax, a row of black abdomen spots just beside middorsal area, a subdorsal black band on thorax and a subdorsal row of black spots on abdomen, front half of each abdomen segment black (the black rim widest anteriorly). Pupa attached by cremaster (no silk girdle), in nest made by silking a web over host leaf.


Pholisora melicanus (Reak.). Many larvae found on Amaranthus retroflexus reared to adults, Woodmen Valley, El Paso Co. Colo., Aug. 26, 1973. Several larvae from A. retroflexus reared to adults, Woodmen Valley, El Paso Co. Colo., July 10, 1977. Oviposition on top of leaf of Amaranthus blitoides (=graecizans), Kerr Gulch, Fremont Co. Colo., Aug. 15, 1973. A young larva ate Chenopodium sp. in the lab. Larvae roll leaves and have the same habits as catullus; adults fly along gulch bottoms, railroad tracks, and roadsides. No diapause in lab. Early stages from Colo.: EGG reddish-tan, which about 9 bumps around the top. MATURE LARVA green, with ochre-yellow areas, a middorsal dark-green band, a weak supraspiracular ochre-yellow band, a tiny pale dot beneath each short knobbed tan hair, a black collar divided middorsally; head black with short tan hairs. PUPA chitin-brown, but covered with a bluish-white bloom, Ti spiracle red-brown with black center and protruding, numerous hairs on head, top of thorax, and abdomen (the hairs longer than those of P. catullus').

Hesperopsis libya confertiblanca J. Scott, NEW SUBSPECIES. (Note: the ending -a in this and my previous published names does not constitute a gender but is used merely for better pronunciation [the name confertiblanca has no gendars or hormones or sex whatsoever], so ICZN-pedants should not change the ending to -us in their ludicrous perverted lust to match the sex of species and subspecies names with the sex of genus names.) All adults have the unh TOTALLY cream (the only mark being a slightly-whiter central spot), the upf with a distinct median white band, distinguishing them from other ssp. (which have the unh mostly black). Types: all from type locality N Montrose, Montrose Co. Colo., July 19, 1988: holotype male and allotype female to Nat. Hist. Mus. Los Angeles County, 16 male 9 female paratypes in my coll. Occurs on hot lowland desert scrub hills at least in Montrose and Delta Cos., Colo.; probably Garfield Co., Colo. Oviposition 9:17 on top of leaf (the female upside down while ovipositing) of Atriplex confertifolia. 28 eggs and 3 1st-stage larvae found on A. confertifolia (all eggs on top of leaves), mostly near ends of branches that stick up on side or top of plant but some low down on side of bush, all on the more succulent bushes, the 1st stage larvae crawl to where 2 leaves are just ~1 mm apart and silk them together for a nest; N Montrose, Montrose Co. Colo., July 19, 1988. The hostplant is unique, because other P. libya ssp. eat Atriplex canescens. A. canescens occurred low on a W-facing slope at this site, but adults ignored it (they often landed on A. confertifolia), and larvae refused to eat it in lab (they ate A. confertifolia in lab). EGG tan on top, whitish-tan on sides. FIRST-STAGE LARVA light-ochre; head black.

Hesperopsis alpheus alpheus. Adults associated with Atriplex canescens in Pueblo and Fremont Cos., Colo.
DISCUSSION AND CONCLUSIONS

Oviposition Time. 1509 total ovipositions were observed, including 1402 ovipositions with time recorded, and 107 ovipositions without time recorded (Table 10). 10:00 to 12:30 is the most common time. There is not much difference between taxa in times of observed oviposition, although Lycaenidae seem to have a wider spread of oviposition times (frequent from 9:00-14:30), and Pyrginae may have a slightly-wider-than-usual spread of oviposition times (but with comparatively few records). The few Limenitis ovipositions were mostly in morning-midday. Speyeria ovipositions were nearly all very close to midday. However, the data in general do not contradict the conclusion that females oviposit all day, during warm sunny weather, because afternoons in Colo. are often cloudy, so 10:00 to 12:30 closely approximates the most frequent time of day when both weather was warm and sunny and I was there to observe ovipositions. An ideal analysis would record exact time of day in the field, together with weather conditions, to derive a curve representing the amount of time spent in sunny warm weather in the field at each time of day, with which to compare to the oviposition curve; such data were not gathered. I probably spent somewhat more time in the field in the Morning because afternoons are often cloudy. It is possible that a female only has a certain number of eggs mature enough to be laid during a day, and if the day is warm and sunny all day long, the female could lay eggs freely and run out of mature eggs by noon or so, giving results like those in Table 10. Perhaps this did occur at times, but I have no evidence to prove it. The conclusion, in contrast to mate-locating behavior (which genetically occurs only during part of the day in many butterfly species), is that oviposition occurs all day in warm sunny periods in all species I am familiar with, though occasionally a female may exhaust her day's supply of eggs while there is still sunny warm weather suitable for oviposition.

Table 10. Time of day of observed ovipositions (24-hour standard time). Headings are first three letters of subfamily or tribe or (capitalized headings) family totals or the overall total.

<table>
<thead>
<tr>
<th>Time</th>
<th>PAP</th>
<th>Pap</th>
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Egg Mimics and Egg Camouflage. Most Pieridae eggs turn orange after a day, and in Calif. and the tropics some plants have been reported to produce red egg-mimics to deter oviposition (females sometimes refuse to oviposit if they see another egg on the plant). But I have not seen any Colorado plants with egg mimics; indeed, the opposite was found, a butterfly egg mimicking a plant. The main hostplant of Nathalia iole, Dyssoodia papposa, has orange-yellow foul-smelling glands roughly the size and shape of iole eggs. When these glands first evolved they may have been egg-mimics (if the color evolved before the glands' odor—this may have occurred, because most plant glands producing odor chemicals are not large or colorful). But an egg-mimicry origin is dubious, and even if true, the glands are no longer egg mimics because their foul odor presumably protects the plants from herbivores and the glands are now ineffective in deterring oviposition (Dyssoodia is the most common host, and the glands are common all over the plant so a female cannot avoid landing near them). After the glands developed their foul odor, N. iole eggs then apparently became mimics of the glands (by becoming orange-yellow, versus orange in other Pieridae eggs) in order to gain protection from predation by insect predators by mimicking an inedible foul-smelling gland. All things considered, the conclusion of egg mimicking foul-smelling gland is much stronger than the idea of gland mimicking egg. The scenario might have been this: N. iole laid eggs on D. papposa, the plants evolved orange egg-mimics to mimic the orange eggs of ancestral iole, the chemicals in the orange plant glands somehow had or developed an additional property of being distasteful to some herbivores so the egg-mimics evolved into foul-smelling glands, these glands now conferred enough protection to the plant that their orange color and former function as egg mimics was no longer needed and the color lessened to orange-yellow also. But a simpler hypothesis is that Dyssoodia developed its glands independent of butterflies, N. iole began preferring it as a host because the plant glands reduced consumption by herbivores such as buffalo, antelope, and prairie dogs (also reducing consumption of eggs and larvae on it), and then eggs mimicked the glands in color (becoming less orange) to reduce predation by insect predators.

Most eggs are cream or pale green when laid, and turn somewhat darker later. The green eggs are camouflaged, of course. Papilio multicauta, Coenonympha, Erebia, and Polites themistocles eggs develop reddish-brown dots for apparent camouflage. Papilio machaon-group, Atrytone, Anartlytone, Euphyes, "Amblyscirtes" simius, and Epargyreus eggs develop reddish rings for possible camouflage.

But some eggs are not camouflaged. Some stay whitish during development (Parnassius, Denea, Lycaenini, some Eumaeini, many Hesperinae), and are not camouflaged. Most Pieridae eggs (except N. iole) turn orange as just noted, and Erebia eggs turn orange or red. AgathyMus alliae eggs become dull red, then silky bluish-gray.

Fragile Eggs. Eggs of Lethe eurydice were found to be so fragile that they are killed by drying of the leaf they were laid on if the leaf is clipped (to prevent death the eggs must be removed from the leaf by dissolving the glue with water). Eggs of other butterflies are strong enough to withstand this, and Satyrium californica, S. acadica, and Neophasia menapia even protect their hibernating eggs with a cover of clear copious glue, which forms a "glue window" in the Satyrium.

Oviposition Flight. Ovipositing females have a distinctive slow hovering flight, landing often on plants to test them for suitability. This hovering flight is rather obvious in most butterflies, except for those butterflies with slow wingbeat frequency (Pieris rapae, P. napi, and Satyrinae), in which preoviposition hovering is not as different from normal flight. Ovipositing Satyrinae fly slowly near the ground, but they do not flap their wings very
fast; the wingbeat frequency is faster than normal flight (which has slow wingbeat frequency), but slower than the wingbeat frequency of other butterflies. Also, some Satyrininae (Cercyonis) often let the egg fall from the abdomen rather than attaching it to a plant, and various alpine Satyrinae deliberately oviposit on large rocks, and some *Oeneis* oviposit on trees, so obtaining ovipositions of Satyrinae requires more careful watching than for other butterflies, because the observer must watch all females that flutter slowly and must follow them closely to see the extruded egg.

*Papilio* females continue to flutter while they oviposit, while other butterflies are generally motionless with wings closed (I cannot recall any oviposition in which her wings were spread). Hairstreaks do not flutter before landing and ovipositing, they merely land on the host then crawl to oviposit.

**Egg Placement.** Females generally land, head upward, on the plant and curve the abdomen down and forward to oviposit. *Euphyes bimacula* females also do this, but usually back down the sedge blade to the plant base before ovipositing. But females face head downward and curve the abdomen away from the wings and downward to oviposit in these species: *Neophasia menapia*, *Nymphalis antiope*, *Hesperocallis libva confertabilia* (new subspecies).

Females generally oviposit on the underside of leaves etc. However, females oviposit on top of leaves in the *Papilio glaucus*-group, *Limenitis* (in those two the female lands on a leaf, the leaf lowers under her weight and her body becomes nearly vertical as she lays an egg on top of the leaf tip), many Coliadinae (Collas, *Natalie*, and relatives), *Pholisora*, *Hesperocallis*, *Calliphrys sheridanii* frequently, and *Pieheus icarcides* sometimes. *Euclioe ausonia* often oviposits on top of flower buds. Several unrelated Lycaenidae crawl down plant stems and oviposit on litter at the plant base (most *Lycaena* except *L. heteronea* & *L. cupreus*, *Harkenclenus titus* sometimes, *Satyrium fuliginosum*, *Pieheus melissa*). Some species oviposit on twigs rather than leaves: *Asterocampa celtis* sometimes, *Nymphalis antiope*, *Lycaena arcta*, several Eumaeini species (*Hypaurotis*, *Satyrium*, *Harkenclenus* sometimes). Some oviposit on dead leaves low on the host: *Ochlodes sylvanoides* and *0. yuma*, and *Lycaena* on hostplants growing in water; some Satyrinae. *Erebia epipsidea* prefers to oviposit on a dead blade tip rather high in the turf and females can be somewhat acrobatic as they place the egg on dead grass blade tips. Some alpine species prefer to oviposit on large rocks beside the hostplant (*Denais polixenes*, *0. melissa*, *Erebia medallena*, *Lycaena cupreus snow*). *Denais chryxus* oviposits on branches (on the tree or fallen) above the host.

**Egg Clusters.** It is well known that Meliteinae and *Nymphalis* lay large egg clusters, and *Neophasia* lays about a dozen eggs in a row on a host needle. Less well known is the fact that some species oviposit in small clusters of a few eggs: *Lethe eurydice* (average 2.0 eggs/cluster), *Boloria aurota* (2.9), *Polyovia* sometimes (1.9 in *P. faunus hylas*, 2-5 in *P. satyrus*), *Harkenclenus titus* sometimes (up to 5), *Satyrium californica* (3.7), *acidia* (3.2), *sylvina* (~2), *fuliginosum* (usually 2).

**Oviposition Away from the Host.** Some species oviposit in unusual places. *Boloria* often oviposit on litter up to 10-20 cm or more from the host; *Boloria euonymia* lays eggs mostly on green seedlings, and *B. titana* usually oviposits on green plants, though in both species the oviposition plants are often not hosts. *Boloria fringa* and many Satyrinae (Erebia theano and callias, *Denais uhleri*, Erebia epipsidea, and Coenonympha tullia often, Cercyonis catus sometimes) and *Ochlodes sylvanoides* oviposits mostly on DEAD blades of grass/sedge on or near the host. *Denais chryxus* oviposits on branches/bark of lower limbs or fallen limbs over or very near the Carex hosts. *Cercyonis* and at least three *Polites* often let the egg fall from the abdomen tip rather than attach it to a plant; they oviposit on or near the hosts, which grow in swarms so the hatching larva has no problem finding food. *Polites themistocles* usually oviposits on small dicotyledon plants near the hostplant grasses (its hosts also grow in swarms), and *Polites draco* does this for about half its eggs. *Polites sabuleti* often oviposits on inedible *Juncus*, *Equisetum*, etc. near the grass hosts. And *Polites mystic*, *sonora*, and *neckius* usually rest on the hostplant and drop eggs from the abdomen tip. Female *Speyeria* of dryland species generally delay oviposition until late summer, when they often oviposit in litter under shrubs or in hollows between dense grass, where violets will not appear until the next spring. *Parnassius* oviposits apparently randomly on low vegetation (often various grasses) averaging 17.4 cm away from the hostplant. *Lethe eurydice* and *Coenonympha tullia* usually oviposit on a host, but sometimes oviposit haphazardly nearby. Some Lycaenidae (most *Lycaena*, *Satyrium fuliginosum*, *S. titus*, *Pieheus melissa*) oviposit on hostplant stem bases, or on litter up to 5-10 cm away. Several late-summer *Hesperia*, esp. *H. luna*, place eggs on seed heads of *Bromus tectorum* and larvae then eat the seedlings beneath.
Thermoregulation seems to be the primary goal in choice of oviposition sites in some species. Four alpine species lay on large rocks, which would produce a more constant temperature for the egg, rather than the alternating hot and cold air temperatures of partly-cloudy alpine weather. *Genias polixenes* and *melissa* oviposit on tiny rock walls or banks of vegetation that face the morning sun, evidently to speed development in the cool alpine zone. *Frebia magdalenae* and *Lycana cupreae snowi* oviposit just over the edge of rocks also, which may have a similar purpose in solar heating. At a lower-altitude site, *Neopnoins ridingsii* usually oviposits on the host, but in hot weather lays on top of shrubs above the hot ground; in this species excess heat is the problem. The hay-feeding skippers also seek cooler temperatures; they mostly oviposit in partial shade at comparatively hot low altitudes and have only one generation per year, a slowing of development compared to many other skippers there that have several generations.

**Hostplants of Haphazard Ovipositors.** Considerable progress was made on elucidating the natural hostplants of species which oviposit haphazardly. A procedure was developed to determine main hostplants of haphazard ovipositors: 1) recording all plants near each oviposition/egg/larva found (the logic being that adults oviposit on or near the main hostplant in nature, and of course that adults must be associated with the hostplant in nature); 2) conducting lab feeding tests of plants found near eggs to prove that larvae eat and survive on the hostplant(s); 3) then, the plants that are nearest the eggs/larvae in nature and that are most palatable to larvae are determined to be main hostplants, plants that are eaten in the lab but are less often oviposited near in nature (less often associated with adults in nature), are determined to be occasional hostplants, and lastly, plants that females occasionally oviposit on but larvae refuse are determined to be occasional oviposition-site non-hostplants (these are of little interest because haphazard oviposition guarantees many of them).

Females of *Speyeria* and *Boloria* oviposit rather haphazardly near the hostplants. Females of "dryland" *Speyeria* (aphrodite, callippe, edwardsii, coronis) have adult diapause and oviposit in late summer, either near green violets or often under bushes and in hollows where violets are dormant for the year but will appear the next spring; "wetland" *Speyeria* (nokomis, mormonia, atlantis) lack a female diapause and oviposit only near green violets. Larvae of most *Boloria* are rather polyphagous, in lab eating about half the dicotyledon species present at each locality, and various *Boloria* have similar broad lab host preference (though a few are host-specific); but my extensive oviposition records now show that hostplant choice is more specialized in nature, where *B. eunomia* remains polyphagous, but *B. friega* chooses *Salix*, and *B. titania* and *B. freija* greatly prefer *Vaccinium*. *Boloria bellona* and probably *B. selene* are exceptional in eating only one genus, *Viola*. *Boloria* inhabit bogs or other wet places, and bog butterflies in general are rather polyphagous; for instance the willow-bog *Colias scudderii* is semipolyphagous (*Vaccinium*, *Salix*, *Polygonum*, perhaps *Viola*).

Do grass/sedge feeders choose all grasses/sedges haphazardly? This is partly true for *Satyrinae*, which oviposit very haphazardly (females usually place the egg on dead substrates such as dead grass blades or rocks). Despite considerable effort, *Satyrinae* species (Coenonympha tullia, Frebia), still seem to show little discrimination among grasses/sedges. Even *Lethe euclidus*, reported to feed on sedges elsewhere, eats grasses most often in Colo. *Frebia epipsodea* and *Carevania* seem to prefer to oviposit on *Poa* (epipsodea and *penala* on *P. pratensis*, *petus* on its close relative or subspecies *P. agassizensis*), and lay less often on other grasses and sedges. *Neopnoins* and perhaps *Carevania* *mead alamosa* prefers *Bouteloua gracilis* at certain shortgrass prairie areas, though they eat other grasses elsewhere. *Genias alberta* eats bunchgrasses (*Festuca idahoensis*), *O. uhleri* at least several turf and bunchgrasses, *O. chryxus* several *Carex* growing in the shade of trees, *O. polixenes* (and perhaps *O. melissa*) probably *Carex rupestris drummondiana* most often and grasses less often. It may take a large amount of effort, both in nature and lab, to determine the main natural hosts for many *Satyrinae*, because females oviposit somewhat haphazardly, and I have never found a *Satyrinae* larva in nature, evidently because larvae do not make leaf nests and larvae are camouflaged and must spend most of their (day)time within a clump and only feed at night.

But *Heteropterinae* and *Hesperiinae* species choose only some of the grasses/sedges available in the habitat: each insect usually eats a number of plant species, but they are chosen from only one type of grass or sedge (the polyphagous *OarisMa garita* is exceptional in ovipositing on a very wide variety of grasses and sedges, of many sizes and shapes, and larvae grow on grasses and sedges equally well in the lab). For instance, interesting differences in hostplant preference of four *Hesperia* species are documented by large sample
sizes: a comparison of the grasses preferred by different *Hesperia* species at
the same site and at different sites indicates that females choose their hosts
primarily by biochemical means rather than by size or shape or degree of
succulence. *Hesperia juba* is the first butterfly known to have a generation
that depends greatly on winter annual grasses (grasses which are dead in
summer). *H. juba* oviposits on the perennial green grass *Bouteloua gracilis*, and
only various green grasses are chosen during the generation that flies in May-
June, but the generation that overwinters as larvae also oviposits (in Sept.-
Oct.) on dead seed inflorescences of the dead winter annual grass *Bromus
tectorum* and on "dead" clumps of a winter perennial *Poa secunda*, and the tiny
larvae crawl to the ground and feed on small green shoots of both of these,
shoots which grow only in fall-spring. A faster larval growth rate allows *H.
juba* to produce two generations whereas other *Hesperia* have only one. *H. comma
assimilis* prefers *Carex* sedges but is a generalist and also chooses *Bouteloua
gracilis* and occasionally dead *Bromus tectorum* inflorescences (larvae eat the
tiny green shoots) as well as (rarely) four other grasses; *H. comma colorado
also eats *Carex*. *H. leonardus ownee*, *H. l. montana*, *H. uncas*, *H. viridis*, and
*H. naches* prefer *Bouteloua gracilis*. *H. nevada* prefers *Festuca saximontana
(2nd choice *Koeleria macrantha*, 3rd choice *Stipa comata*) in the Front Range,
*Festuca idahoensis* at western sites. *Polites draco* at the first site prefers
*Koeleria macrantha* and *Poa pratensis*. *H. ottoe*, *Polites origenes*, *Atrytone
arogos*, and *Amblyscirtes phylace* prefer the "hay bunchgrass" *Andropogon
gerrardii*, whereas the related *P. thomistocles* (and *P. mystic* and *P. somora*)
turf grasses esp. *Poa*, and *Amblyscirtes oslari* prefers wide-leaf
*Bouteloua curtipendula*. *Polites sabulati* chooses "crunch grasses": several
alkaline-tolerant tough dry low grasses that "crunch" when stepped on. These
differences between species of *Hesperia* and *Polites* may show that hard work and
large sample sizes may be necessary to demonstrate real hostplant preferences of
grass/sedge-feeding butterflies that oviposit somewhat haphazardly.

While *Hesperia* show evidence of biochemical hostplant choice, the
similarity of hostplant choice of *Piruna pirus*, *Poanes zabulon taxiles*, *Ochlodes
sylvanoides*, *Anacyloxypha numitor*, and *Amblyscirtes vialis*--all choose "hay"
grasses (wide-leaf usually tall non-clumped grasses), usually in shade--seems to
indicate visual choice of hostplant, because many taxonomically unrelated
grasses are chosen (14-24 for each of the best-known first three species).

This hay-feeding *Lepidoptera* guild in CO includes only one moth, the
noctuid *Anoea finitima* (Guenee)(det. Douglas C. Ferguson, 2 adults 2 pupae "7
larvae deposited in Smithsonian); its larvae silk hay leaves together; I found
larvae on *Andropogon gerrardii* (3 records), *Andropogon* (Schizachyrium) *scoparius
(1), *Dactylis glomerata* (2), *Aenopyron (Elymus) canadensis* (1), *Dichanthelium
oligoaethes* var. *scribnerianum* (1), *Bromus* *Bromopsis* *porteri* (1), *Bromus
(Bromopsis) lanipes* (1), *Bromus* *Bromopsis* *inermis* (1).

*Andropogon gerrardii* also has wide leaves, but is somewhat shorter than most
"hay" grasses; it can be called a "hay bunchgrass." It must be biochemically
different from the hay grasses, because it is the main host of four species
(*Hesperia ottoe*, *Polites origenes*, *Atrytone arogos*, *Amblyscirtes phylace*) which do NOT eat hay grasses; the first three species evidently followed the grass
westward from the Great Plains.

**Lab Hostplants of Grass Feeders.** In the lab, most grasses and perhaps even
sedges are suitable food; most *Satyrinae* may eat both well. *Poa pratensis* has
proven to be an acceptable lab host of every grass-feeding butterfly. The only
exception is *Amblyscirtes*, because *A. oslari* and *A. vialis* young larvae died
eating it; the hypothesis is that *Amblyscirtes* evolved in deserts of the Mexican
Plateau and larvae require drier leaves than *Poa pratensis*, which is a moist-
meadow grass.

**C3 Versus C4 Grass Hostplants.** Grasses--like other plants--may have either C3
"cool season" or C4 "warm season" types of photosynthesis. C4 plants
photosynthesize at a greater rate (and photosynthesize more at high temperature
so grow more later in the season), utilize more CO₂ and more light, require half
as much water, produce different initial compounds in the chemical process, etc.
than C3 plants. There have been reports that herbivores (grasshoppers) shun C4
grasses and the "sheath barriers" to utilization of starch prevents herbivores
from digesting C4 grasses; however steers prefer C4 grasses, and recent research
has proven that lepidoptera caterpillars (the butterfly *Paratrytone melane*,
Barbehenn 1992)---unlike grasshoppers---can digest the nutrients inside plant cells
even if the cell walls are not broken by the jaws or during passage through the
intestine (*Satyrinae* and *Hesperinae* have shear mandibles without teeth, and
Heteropterinae mandibles have weak teeth, so these grass-feeders do not crush
their food with jagged molars as other butterflies and grasshoppers do). Waller
Biochemicals? There is no evidence that they do, and the associations that Sporobolus, are less polyphagous but eat plants of several families, the last two only on great in shape. The Lycaena rubidus hosts vary from tiny to of shade, as well as by using biochemicals; females of the hay feeder Ochlodes sylvanoides probably check to see if the plant looks like a grass and has grass biochemistry, check to see if it is tall and has leaves at least 4 mm wide, check to see if the plant is near shrubs or trees (in semi-shade), then find a dead dried lower leaf to oviposit on. The resemblance of linear Ancaria to grass probably led to the oviposition of several Hesperia comma eggs on it. Plebejus saepiolus host plants have been reported to be only Trifolium; however, females from the Colo. Front Range prefer to oviposit on two Astragalus in two subgenera, perhaps because their inflorescences are spherical like those of Trifolium. And Limenitis weidemeyeri evidently chooses hostplants with deciduous shrub/small tree shape rather than by using biochemicals.

Shape of Plant Affects Oviposition. No doubt many butterflies use shape in part to select their oviposition site. For instance hay-feeding skippers probably select their oviposition site by height of grass, width of leaf, amount of shade, as well as by using biochemicals; females of the hay feeder Ochlodes sylvanoides probably check to see if the plant looks like a grass and has grass biochemistry, check to see if it is tall and has leaves at least 4 mm wide, check to see if the plant is near shrubs or trees (in semi-shade), then find a dead dried lower leaf to oviposit on. The resemblance of linear Ancaria to grass probably led to the oviposition of several Hesperia comma eggs on it. Plebejus saepiolus hostplants have been reported to be only Trifolium; however, females from the Colo. Front Range prefer to oviposit on two Astragalus in two subgenera, perhaps because their inflorescences are spherical like those of Trifolium. And Limenitis weidemeyeri evidently chooses hostplants with deciduous shrub/small tree shape rather than by using biochemicals.

But there are numerous examples of hostplants of one species that vary greatly in shape or size, indicating that biochemicals are more important for host selection. For instance, legume feeders do not seem to use leaf size or shape to choose oviposition sites, because the host plant leaves eaten by many legume feeders vary from very small to large, with three leaflets per leaf or one leaflet or many; for instance, the giant 3-parted leaves of Thermopsis look nothing like the tiny multi-pinnate leaves of Astragalus flexuosus and Dalea jamesi has a strange inflorescence with yellow flowers among vast white fluff, that looks nothing like the inflorescence of other legumes, yet Hemerocallis isolepis likes it. Likewise, Apiaceae, Malvaceae, and Aster hosts vary considerably in leaf size and shape, etc. Polygonia satyrus oviposits on two hosts whose leaves are grossly different in shape. The Lycana rubidus hosts vary from tiny to gigantic (1000 times larger). And Hesperia nevada prefers to oviposit on Festuca, even though the preferred species vary from small to large in size; an analysis of its hosts clearly suggests that females choose them biochemically.

Polyphagous Species. Strymon melinus was found to be the most polyphagous butterfly, eating flowers/fruits of numerous families. Papilio multicaudata, Limenitis weidemeyeri, Praxia coenia, several Polygonia, Nymphalis antiopa, Euptoieta claudia, Calastra lucia-type, and Callophrys affinis homoplera are less polyphagous but plants of several families, the last two only on flowers/fruits. Vanessa cardui eats several families also, but Cirsium is greatly preferred. Boloria aunca is the most polyphagous Boloria, eating many families, and B. titania and freija are much less polyphagous (preferring Vaccinium), while B. frigga, belleria, and sele are essentially monophagous. The most polyphagous grass/sedge feeder was found to be Calissa paraca which eats all types of grasses as well as sedges. Lathoe evursivae eats tall green grasses and sedges, and some Satyriinae—difficult to study—may also eat many grasses and sedges.

Hostplant Switching. The normally scarce Euphydryas chalcedona/anicia capella ordinarily feeds on several Penstemon, but has added an introduced abundant weed Linaria giganteifolia macedonica in one area, where the population has exploded. The geographic restriction of the latter explosion suggests that there has been natural selection for the ability to eat the introduced hostplant. A case of larval hostplant switching was discovered in which Phyciodes picta (Nymphalidae) originally fed on Aster (Asteraceae) but now feeds on the recently introduced Convolvulus arvensis (Convolvulaceae), a completely unrelated weedy vine. So in
Larval competition. In general, there seems to be an absence of larval competition among Colorado butterflies.

The main evidence for lack of competition is that many butterfly species eat certain popular plants, while other closely-related plants are shunned. There are many popular plants. For example, in Colorado, numerous butterflies eat *Bouteloua gracilis* leaves (12 species, and 2 others rarely, 1 other probably), *Lupinus argenteus* (10 species [4 eat leaves, 2 eat mostly leaves, 4 eat fruits], and 4 others eat leaves of other *Lupinus*), *Quercus gambelii* leaves (8 species), *Ceanothus fendleri* (8 species [1 rarely]6 leaves, 2 fruits), *Poa pratensis* and the related ssp. or sp. *Poa angasiensis* leaves (17 species, of which “8 species eat them often, “4 occasionally, 4 rarely; 20 species total eat Poa), *Bromus inermis* (8 species, 5 often, 3 occasionally), *Salix exigua* leaves (7 species, and 6 others eat other *Salix*), *Astragalus bisulcatus* (8 species [4 leaves, 1 mostly leaves, 3 fruits]), *A. flexuosa* (7 species [3 leaves, 1 mostly leaves, 3 fruits], *A. adsurgens* (6 species [2 leaves, 1 mostly leaves, 3 fruits]), *A. agrestis* (6 species [3 leaves, 3 fruits]), (14 spp. eat various *Astragalus* [7 leaves, 2 mostly leaves, 5 fruits]), *Festuca idahoensis* leaves (6 species, 3 of which also eat the closely-related *Festuca saximontana* leaves, and 2 other species eat the closely related *Festuca brachyphylla* leaves), *Viola nuttallii* leaves (6 species [1 rarely], and 8 others eat other *Viola* spp. leaves), *Medicago sativa* (6 species [2 leaves, 1 mostly leaves, 3 fruits]), *Andropogon gerardii* leaves (7 species [1 rarely]), *Thermopsis divaricarpa* (6 species [5 leaves, 1 fruit]), *Lathyrus leucanthus* (6 species often [3 leaves, 2 fruits/leaves], and 2 species sometimes [1 fruits, 1 fruits/leaves]), several *Descurainia* spp. (5 species [1 leaves, 5 mostly fruits]), *Aegopodium gigantea* leaves (6 species, though not the sole host for any), *Carex pennsylvanica heliochila* leaves (6 species, of which 3 species eat it usually, 3 sometimes; 18 species in all eat *Carex* spp.), *Trifolium repens* (6 species [2 leaves, 4 fruits, 1 rarely], and 4 other species eat other *Trifolium* [2 leaves, 2 mostly leaves]), *Eriogonum umbratum* (5 species [2 leaves, 3 fruits], and 5 other species eat other *Eriogonum* [1 leaves, 4 fruits]), *Arabis alpina* leaves and fruits (5 species [1 leaves, 4 fruits], and 3 others eat other *Arabis* [1 leaves, 3 mostly fruits]), *Koeleria macrantha* leaves (9 species, though just an occasional host for all but 1), *Agropyron* spp. leaves (11 species total, but only 5 species eat the most-often chosen *A. trachycaulun* and *canadensis*, only 4 eat *A. repens, ambiguus*), *Vicia americana* (5 species [3 leaves, 2 fruits]), etc.

In addition, numerous closely-related pairs of butterflies have nearly identical hostplants, suggesting that they compete little if at all (Papilio zelicaon-polyxenes, *Colias eurytheme-philodice*, *Euchloe auronia-olympia-Pieris rapae-Pontia protodice-P. callidex*, *Speyeria callippe-coronis-edwardsii*, *Lycaena*, many *Satyrium*, *Callophrys polios-augustinus*, *Hesperia pahaska-viridia*, *Thorybes pylades-mexicana*, *Erynnis incl. percaius-afranius, martialis-pauvius*, *Pholisora catullus-mexicana*, etc.).

The fact that certain popular plants have numerous butterflies that eat them suggests that there is no competition for food on them. It should also be noted that all these popular plants are common in nature; in fact, there are no butterflies in Colo. that I know of that eat truly rare plants. Semipolyphagous species may occasionally eat locally scarce plants, but obviously there are no butterfly species that are specifically adapted to prefer rare plants. The obvious explanation is that any butterfly species that was restricted to eating a rare plant would soon become extinct because the females could not find enough hostplants for oviposition. Rare plants in general do not have host-specific insects feeding on them because such insects become extinct, so the reasons for their rarity must be due to poor chemical or physical defenses against polyphagous herbivores that eat them, "less viable genes" such as susceptibility to microbial pathogens, extinction of host-specific pollinators, or some such cause. (It has been proven that insect herbivores can greatly reduce the density of an abundant plant, for instance the beetle *Chrysolina quadrigemina* was introduced to control Klamath Weed *Hypericum perforatum* in northern California, and these plants, formerly superabundant, are now uncommon—but they have not become rare as a result. If the plant did become rare locally, the insect would die out at that site.)

In contrast to these popular plants, most families and genera of Colorado plants are not eaten at all by butterflies. A survey of the plant families and their popularity as hosts is useful, especially to note the plants that are closely related to popular hostplants yet are shunned by butterflies. Among Brassicaceae, *Lesquerella montana* is shunned by butterflies, *Thlaspi arvense* is...
salicaceae and crucifers. so me Chenopodiaceae are popular hostplants that seem to be chosen with little preference (though Polanisia has no records so may be shunned, but it is uncommon), except that some butterflies prefer certain habitats so choose only crucifers growing there (for instance Pieris prefer wet habitats and the crucifers there, while Pontia protodice is migratory so often chooses weedy crucifers). Some Chenopodiaceae are popular hosts, but the superabundant Kochia is shunned. Among Fabaceae, Astragalus flexuosus is one of the most popular, and it also has the smallest leaflets. Several legumes are unpopular, including Oxytropis which is almost never chosen, and Psoralea which is covered with small glands and is never chosen (even though its flowers are popular with Plebeius melaissa adults and melissa larvae eat other legumes). Trifolium pratense is by far the least popular Trifolium, perhaps because of some repellent biochemicals. The legume feeders usually feed on a number of genera, but most are somewhat specialized among genera; for instance Polias do not seem to prefer Lupinus, whereas several Polyommatini eat only Lysirinus. Butterflies that eat Ribes prefer some species and dislike others. Among Scrophulariaceae, some Penstemon, some Castilleja, and Besseya seem to be the only popular genera in Colorado so far, and such fairly abundant plants as Verbasuim (all introduced), Linaria, Scrophularia, Pedicularis, Veronica, and Mimulus are underutilized. Eriogonum feeders, as Polyommatini, discriminate among species and even among varieties. Danaus plexippus eats Asclepiadaceae but ignores the closely-related Apocynaceae. Butterflies that eat Asteraceae or Rosaceae generally choose only one or a very few genera or species, whereas Malvaceae or Apiaceae feeders seem to eat all the genera. Stipa comata is eaten by 7 species, but all but one eat it only occasionally or rarely, so this grass is an unpopular hostplant, and I doubt that any butterfly eats it often; its abundance in nature may be because the leaves are so tough that most herbivores refuse it. Other Stipa are also shunned, except for S. scribnneri which is eaten by two species and is preferred by one. Puccinellia virgatum is a large grass but is shunned evidently because of repellent or unattractive biochemicals. Such grasses as Aristida purpurea, Danthonia parryi, Festuca arundinacea, Lolium perenne, Oryzopsis eugia, Sataria viridis, Sporobolus cryptandrus, Buchloe dactyloides, and Vulgina octoflora are common but are mostly shunned by grass-feeding butterflies. Some butterflies choose several widely separate plant families, which suggests some biochemical explanation: Polyomma faunus on Salix and Ribes, Nympbalis antiopa on Salicaceae and Ulicaceae, Callophrys affinis homoperplexa on Ceanothus and Eriogonum.

Some butterflies avoid competition on the same hostplant by eating different parts of the plant, such as flowers/fruits versus leaves. For instance some legume feeders eat leaves, whereas others (such as Glauconyphe hydnamus) eat flowers/fruits. The same is true of Brassicaceae feeders such as most Pieris which eat leaves, Pieris sisybriian/Eucherio which eat flowers/fruits, etc. Callophrys augustinus and polios both feed on Arctostaphylos uva-ursi, but do not compete for food because C. augustinus eats mainly flowers-fruits, C. polios young leaves. On Quercus gambelii, Erynnis brizo eats only seedlings, whereas E. telemaechus eats young growth of large and small plants. But most of the butterflies that eat the same hosts eat the same plant parts (usually leaves).

Competition for larval food between species must be rare, because Colo. hostplants are almost never defoliated or denuded by butterfly larvae. If there is any competition involving butterfly larvae, it is between butterfly larvae and other insects that feed on the same plants; but because the butterfly hostplants are almost never defoliated, it can be concluded that competition is very small among these other insects also. defoliation generally happens only on the favorite hosts of Vanessa cardui during its vast migrations about every 7 years, on small hostplants eaten by butterflies which oviposit in large egg clusters (Melitaeini, Nympbalis), and on a few isolated inflorescences chosen by butterflies that eat flower buds/fruits. Flower buds/fruits are the most limited food supply, and the occasional competition for food that must result as maturing fruits are exhausted must be the most common larval competition in butterflies.

Convergence. In contrast to the absence of larval competition, numerous examples of convergence were observed. The Dacisia garita larva amazingly resembles Satyrinae: it lacks a nest like Satyrinae, has camouflage stripes like Denesia, and is polyphagous like many Satyrinae. One of the most striking convergences involves Hespeteria ottio and Polites origenes. These two genera are so closely related that they are probably just subgenera; all have underground/litter larvae and feed on narrow-leaf grasses, except H. ottio and
P. orion geographically feed on fairly-wide-leaf Andropogon gerardii and have aerial larvae in leaf-tube nests. Evidently underground soil/litter nests are more difficult to make than aerial leaf nests, and enlarging the nest by removing soil in place must be especially difficult, so the switch to a wide-leaf grass rapidly led to evolution of the aerial nest. The underground larval nest itself has been convergently evolved by grass feeders eating turf grasses or short narrow-leaved grasses. Vanessa atalanta and Piruna pirus have rolled-leaf nests that hang from a narrowed chewed midrib/stem, perhaps to diminish predation by ants tightrope-walking the narrow midrib. Numerous taxa convergently evolved rolled-leaf larval nests (Anaea, Vanessa atalanta, Hesperiidae), egg clusters, feeding on inflorescences rather than leaves, ovipositing on litter near the host, etc. Many species convergently have the same hostplants, as already noted. Perhaps the most interesting are the hay feeders; once a species evolves to feed on one hay grass it is then able to eat them all (except for certain exceptional wide-leaf grasses such as Andropogon gerardii which is eaten only by specialists, Paniire virgatus which seems to be biochemically shunned, Festuca arundinaceae which is probably shunned because of toughness, etc.). The larval heads of most aerial-nest Heteropterinae/Hesperiinae (Piruna, Lerana, Anclyloxypha, Copaeodes, Thymelicus, Atrystone, Atrystone, Ochledes, Euphyes, Amblyscirtes) have red-brown stripes, which may be a type of camouflage; underground larvae generally have dull unstriped heads, as do some other aerial larvae. Larvae of Papilio machaon group, Pontia silviorum and Danaus Plexippus are similar in appearance and evidently form a Mullerian mimicry complex (Scott 1986b). Euchloe and Pontia protodice-callidice larvae are very similar in appearance, even though these are supposedly not very closely related, evidently because of convergent camouflage to match the pale and dark lines while resting on narrow pods ("siliques"), or because they ARE actually very closely related phylogenetically.

Underground Larvae. Alpine Parnassius rhesus larvae may hibernate underground the second winter. Neominosis ridegssii has underground pupae, and some Genesia and Erebia pupae may also be underground or in litter. Many Hesperiinae larvae are underground; Hylephila phyleus, Vretera rhesus, all Hesperia except ottoe, all Polites except orion, Atalopedes campestris, not Amblyscirtes simius, and perhaps Atrystone viezecki. The common link among these is that larvae eat narrow-leaved turfgrasses, or narrow-leaved short grasses.

Taxonomic Changes. Biological research showed that Antraktyone longus is a distinct genus from Atrystone arcos: in contrast, Hesperia and Polites and Atalopedes are nearly identical and are probably subgenera. The immatures and underground nest of "Amblyscirtes" simius reinforce the conclusion that it does not belong to Amblyscirtes. Hostplant differences led to the conclusion that there are two—not one—Gelastrina species in Colo.

Anti-Predation Behavior. Pieris rapae and Colias older larvae whip violently from side to side when touched or picked up, to deter predators. Nymphalis antiopa pupae twitch violently also when disturbed. Nymphalis sylvester young larvae see have an ant-repellent chemical from the ventral neck gland; perhaps all larvae with this gland (Hesperiidae, Pieridae, and Nymphalidae) have this ant-repellent chemical.

"Dracula Caterpillars" were discovered, the older larvae of Amblyscirtes (except for the "Amblyscirtes" simius). The head of these larvae have two chitin fangs, just above the usual mandibles, that seem to be used to puncture and tear predators (the fangs are apparently not used in nest construction). These larvae are found outside their nest in daytime much more often than other Hesperiinae, and are more acrobatic in their movements.

Construction of larval nests deters predation. Vanessa atalanta and Piruna pirus both make leaf tube nests that droop because the leaf basal to the midrib has been chewed around the midrib, perhaps to make access to the nest harder for predators like ants. Atrystone arcos forms a leaf nest of two leaves, and chews the leaf bases until they form two stilts, perhaps also to deter predators.

Nest Shape. Some unusual larval/pupal nests were discovered. Parnassius larvae worm themselves into small spaces such as pebbly soil, and evidently overwinter in loose soil or debris, partly silked together. Piruna pirus makes an unusual hanging silken-leaf nest, by rolling the leaf into a tube as usual but then chewing the grass leaf down to the midrib for several cm basal to the tube, so that the tube nest dangles at a steep angle from the bare midrib. The Piruna nest is reminiscent of the Vanessa atalanta silk-leaf nest which is also a dangling tube where the leaf edges are bent upward around the larva, but the leaf edges because the larva chews into the leaf base at and near the midrib. Polygonia satyrus makes a leaf nest by bending the leaf edges downward while the
larva rests on the leaf underside, but the main leaf vein is not cut. Hibernating *Atrytone argopes* make a typical Hesperiidae rolled-leaf nest out of two grass leaves, but it is unusual in resting on two "stilts" formed by chewing the two leaves nearly to the midrib below the nest, and the upper end of the nest is closed with a silk screen. *Papilio multicaudata* and relatives rest on a leaf that is bowed upward somewhat with silk. *Nympheis milberti* young larvae live in a silk nest, and older larvae rest on top of a leaf that is curled upward somewhat but usually not joined together above larva. *Vanessa cardui* & *carve* make a silk nest on top of a leaf, while *U. virginiensis* silk several leaves together for a nest. *Boloria improba* pupae rest horizontally in a loose silk nest among leaves. *Euhydryas cheleodena/anicia* young larvae live in a silk web nest. *Pieris siasmbril* the pods (siliques) together, but does not live inside a nest. *Anaea andria* larvae make rolled-leaf nests like Hesperiidae. *Anodema neis* larvae live between silked-together leaves. *Carisma garita* is highly exceptional in lacking the usual silked-leaf nest of all other Hesperiidae, and it also has camouflaged striped larval color, in contrast to the noncamouflaged unstriped green or tan color of most Hesperiidae. *O. carita* has "satyr any": it resembles Satyrinae such as *Oeneis* in its hostplant polyphagy, striped larval body pattern, and lack of larval nest.

Lack of Butterfly Communities. Butterfly "communities"—functionally related sets of species—do not exist, except as accidents of their larval and adult hostplants and climatic tolerances. For instance, a colony of *Euphilotes rita coloradensis* was found growing on *Eriogonum effusum* growing on pure sawdust from a former lumber mill. And a colony of *Harkenclenus titus* was found on a pure stand of *Pruitus virginiana melancarna* growing on pure sand dunes. *E. rita gallescena* occurs on pure sand dunes in Nevada. *Lycaena helleides* & *L. hyllus* sometimes occur on pure stands of *Polygonum coccineum*. *Polites themistocles* and *P. neckius* sometimes occur on pure *Poa pratensis* lawns. Obviously, the only butterfly "communities" that exist are very simple ones, consisting of hostplant, butterfly eating hostplant, and perhaps parasitoids (most parasitoids on butterflies evidently eat many lepidoptera species, but this is not well known). Predators of butterflies are generalists that eat many insects so do not belong to a functional butterfly community.

Literature Cited


Scott, J. A. 1974a. Adult behavior and population biology of two skippers


DEDICATION

This research would not have been possible if the profession of biology/entomology had provided good jobs (if it had, I would have spent the time that I spent researching this paper, on teaching more biology students who could not get jobs, etc.). Entomology is a Jekyll and Hyde profession: go to college because you like bugs and plants and nature and research, and become Dr. Jekyll the learned scholar; graduate and find the only jobs are for Mr. Hyde the exterminator. My research would not have been possible without the hundreds of colleges and universities across the country and their thousands of teachers who crank out tens of thousands of biology graduates yearly, only ~10% of whom can now find jobs; if they had not glutted the job market I surely would have been making money instead of doing the present research. (Clearly, the only useful degrees related to biology today are in biochemistry, gene transplanting, and medicine [nursing, M.D., etc.]; today's "environmental" jobs are only for environmental engineers, organic chemists, hydrologists, toxicologists etc., biologists need not apply.) Too, this research would not have been possible without the racial and sexual discrimination initiated and practiced by the U.S. federal government and forced upon federal agencies and lesser governments and colleges and large private companies (nearly all entomologists except roach exterminators must work for one of these) under the name of "affirmative action"; blatant discrimination in which women, minorities, veterans, handicapped, etc. etc. (even the Purple Wurpulores from Hoogistan) are all given preference in hiring, except white males, even though white males form a minority of less than 30% of the U.S. population. Too, this paper would not have been possible were it not for those insecure incompetents who are afraid to hire high-quality persons because the new person might threaten their future status in their hierarchy. Unfortunately there is little reward in entomology for innovative or top-quality work, and the intelligent person would be well-advised to go into some profession such as engineering or medicine or the construction skills or baking where individual competence can translate into concrete rewards and higher income. And if a person has the persuasive personality and fund-raising skills necessary to merely scrape by in biology today, he would be well-advised to put those skills to far more rewarding use in another field such as sales and marketing.

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