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INSECT POPULATION STUDIES ON THE PANTEX SITE, 1970-1971

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ABSTRACT

This report is a summary of insect population studies at the Pantex Site, U.S. IBP, for the period of October 1970 through August 1971. In addition to the standard IBP "quick-trap-D-Vac" sampling technique, pitfall traps, light traps, sweep nets, and direct observations were used to study the insect fauna. Two levels of herbivory--ungrazed and moderately grazed--were studied. Two replicates of each treatment were sampled at approximately biweekly intervals during the growing season and monthly during the remainder of the year. Twelve randomly selected quadrats were sampled within each replicate. Beginning in June 1971 a stratified sampling scheme was used to measure the impact of prickly pear on insect population dispersion. Despite improved sampling and extraction methods, insect numbers were lower in 1971 than in 1970. This may well be due to the severe drought of 1970 which expressed itself through reduced insect numbers in 1971. Insect biomass, due in part to species detected through the improved sampling method, was greater in 1971 than in 1970. Maximum standing crop insect biomass on an ovendry basis on the ungrazed site was 0.22 g/m^2 in 1970 and 0.51 g/m^2 in 1971. On the moderately grazed site the maximum standing crop was 0.15 g/m^2 in 1970 and 1.57 g/m^2 in 1971. The presence of prickly pear was found to cause distinct clumping of insects and to affect species diversity. The effects of preliminary insecticide stressing experiments are discussed. Some preliminary thoughts on energy flow are given, and these indicate that the aboveground insects may require from 10 to 20% of the energy present in aboveground primary production.

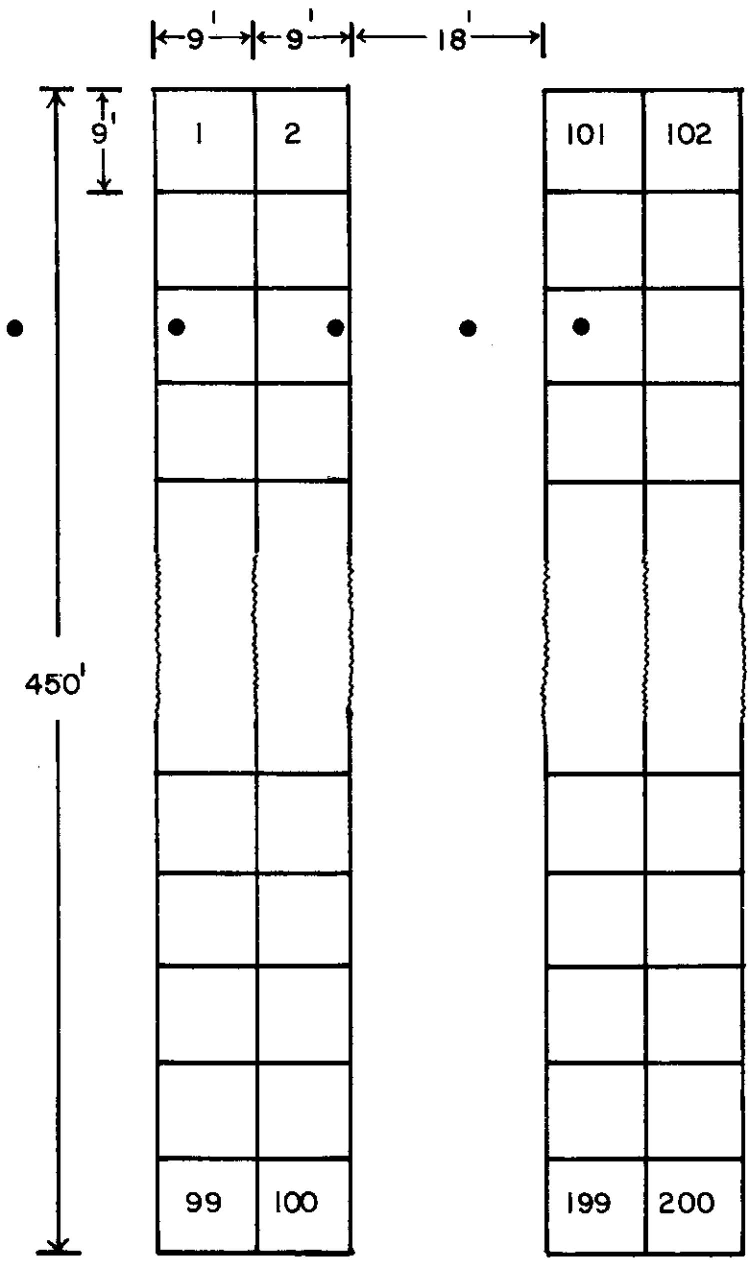
DESCRIPTION OF SAMPLED AREAS

The Pantex Site is located in the northern panhandle of Texas, 15 miles east of Amarillo. Ground elevation is approximately 3,590 ft. Rainfall varies widely from year to year with 70% to 80% of the total occurring between May and October as short, intensive thunderstorms covering small areas. The average annual rainfall is approximately 21 inches with a range of 5 inches in 1970 to 40 inches in 1923. Average annual snowfall varies from <1 inch to over 30 inches with an average of 12 inches; high winds frequently cause considerable drifting. The site is characterized as a shortgrass prairie with blue grama predominating. Throughout the study area plains prickly pear is very evident. Additionally, small colonies of kochia are noticeable near rodent- and ant-disturbed areas. The Pullman silty clay loam is the soil which predominates on the study area. Further description of the Pantex Site is given in Technical Report 45 (Huddleston, 1970).

Two replicates of each of two treatments were used: treatment 1, ungrazed; treatment 3, moderately grazed. Two sampling areas (Fig. 1), 450 ft long by 18 ft wide, in each replicate were used to give 200, 9 × 9-ft quadrates. Six quadrats per replicate per sampling date were randomly selected for sampling. After May 1971 prickly pear and grass were sampled separately in each quadrat. The change in the spacial arrangement of the sampling stations from that used in 1970 was made in order to reduce the amount of personnel and vehicle travel within the sampling area. The scheme used in 1971 provides alleys for travel on each side and between the two lines of plots.

METHODS OF SAMPLING

Again this year the principal sampling method at the Pantex Comprehensive Network Site was the "D-Vac" and "quick trap" combination.



●Approximate location of survey pitfall traps

Fig. 1. Sampling grid for one replicate, Pantex Site, 1971.

This year a comparison was made of data collected by two different trap dropping techniques. One method was hanging the traps from tripods the evening before sampling, then dropping the traps the day of sampling as was done last year; the other method was hand pitching the trap immediately before sampling. Pitching the traps requires less man-hours and less equipment. Comparison of the data obtained showed little or no difference between hanging on tripods and hand pitching the traps. For three different sampling dates, 5,679 insects were caught by hand pitching the traps, and 5,765 insects were caught by hanging them on tripods. Six traps were hung on tripods the night before, and six were pitched the day of sampling for each replicate. Two hand-thrown traps were used on each plot. One was thrown on grass and the other on the nearest prickly pear clump. This was done to determine the differences in insect species and numbers between grass and prickly pear. Although prickly pear only occupies about 12% of the land area on the moderately grazed site and 3 to 4% of the area on the ungrazed site, it has a very significant impact on insect populations as will be presented later in this report.

After the traps were dropped or tossed on the designated plot, they were vacuumed with the "D-Vac" to catch any flying or jumping insects. The standing plant material of each plot was then clipped with a pair of heavy-duty, electric clippers. This material was also vacuumed with the "D-Vac" and tagged. The bag that was used initially was then placed on the "D-Vac", and the litter was taken into this bag. *This is the principal difference between sampling this year and last year.* Last year the trap was only vacuumed down to the crowns, whereas this year with all of the standing plant material removed the ground was scraped, removing all litter and approximately 1/8 inch of soil. By doing this many of the ground-dwelling species buried in the litter or ground were captured. The sample was then removed from the "D-Vac" and tagged. To make sure no insects were missed, the crowns were then clipped off about 1/2 inch below the surface with the heavy-duty clippers. This material was taken up with a large vacuum cleaner, bagged, and tagged.

This type of sampling divides each sample into three components: the aboveground, the litter, and the crowns. Each of these components was then placed into a Berlése funnel for separation. The aboveground samples were placed in small Berlése funnels; the crowns were placed in medium-sized Berlése funnels; and the litter was placed in large Berlése funnels. These Berlése funnels were constructed as follows: the smallest were constructed of 30-lb. lard cans, heated by 60-w light bulbs; the medium funnels were modified 10-gal trash cans, heated by 250-w infra-red heat lamps; and the large funnels consisted of 32-gal trash cans, heated by 250-w infrared heat lamps. Two plastic covered baffles were placed in the funnel of each Berlése to prevent trash from falling into the partially alcohol filled jar on the bottom of each funnel. Maximum temperature reached, using the 250-w infrared heat lamps in the large Berlése, on the first baffle was 93°F at 55 v/bulb and 121°F at 110 v/bulb. The samples were processed for 11 hours at the low temperature and for 1 to 2 hours at the higher temperature. By processing the samples at these temperatures, 90 to 92% separation efficiency was obtained when the sample was less than 3 inches thick.

The extracted insects, in alcohol, were then sorted to easily recognized taxa (family or below) and counted. They were then dried for 48 hours at 70°C and weighed with a Mettler balance to determine dry weight biomass.

Pitfall traps, partially filled with glycerine, have been used as a qualitative method of evaluating the efficiency of the "quick trap" for insects active on the soil surface. These were constructed by burying a widemouthed pint Mason jar in the ground with the top of the jar at ground level. A plastic cup with the same diameter opening was placed in the jar. Approximately 1 inch of glycerine was placed in the bottom of the cup. Two patterns of pitfalls were used: (i) two transects of 10 traps/per line on each of the two treatments (Fig. 1) and (ii) one grid of 50 pitfalls on an adjacent area. The pitfalls in the transects were 5 m apart. These were used as a general survey to test the efficiency of the "quick trap". In the 5 × 10-grid the pitfalls were again 5 m apart. This grid was used to test five different medias: ethyl alcohol, picric acid, ethylene glycol, glycerine, and a dry cup. The results of these tests will be presented in a later section.

Sweep nets, "black light" traps, and Tullgren funnels have also been used as general survey implements. By using these survey methods, the number of voucher specimens has been tripled from the number caught in the quick trap (Appendix II).

STATUS OF 1971 SAMPLES

Last year's report included data collected through October 3, 1970. This year's report includes all data taken since that date. Samples were taken monthly until April. Beginning in April samples were taken bimonthly until September, when samples were taken monthly. Due to adverse weather conditions in May and July fewer samples were taken than were planned. Data from 1971 samples as of late November are summarized in Appendix I.

INTERPRETATION OF DATA

Insect Numbers and Biomass

Despite improved sampling methods and improved Berlése funnels, smaller numbers of insects were detected in 1971 than in 1970 (Fig. 2 and 3). This may well be due to the severe drought of 1970 which expressed itself through reduced insect numbers in 1971 (Fig. 4 and 5). By the use of a stratified sampling scheme it was found that more insects were associated with prickly pear than with buffalo grass and blue grama; however, this is not as pronounced in the ungrazed treatment (Fig. 6) as in the grazed treatment (Fig. 7) where prickly pear occupies approximately 12% of the area as compared with 3 to 4% of the area in the ungrazed treatment. Also, the increased plant biomass associated with prickly pear is not as apparent in the ungrazed plot as in the grazed plot.

In the grazed plot the prickly pear collected snow and limited grazing in the immediate area, thus creating a microhabitat where grass biomass, forb biomass, and litter were much greater than in the adjacent buffalo grass-blue grama dominated spaces. Insect populations were definitely clumped around the prickly pear islands. Total numbers averaged over prickly pear and grass were about the same as in 1970 in the grazed site.

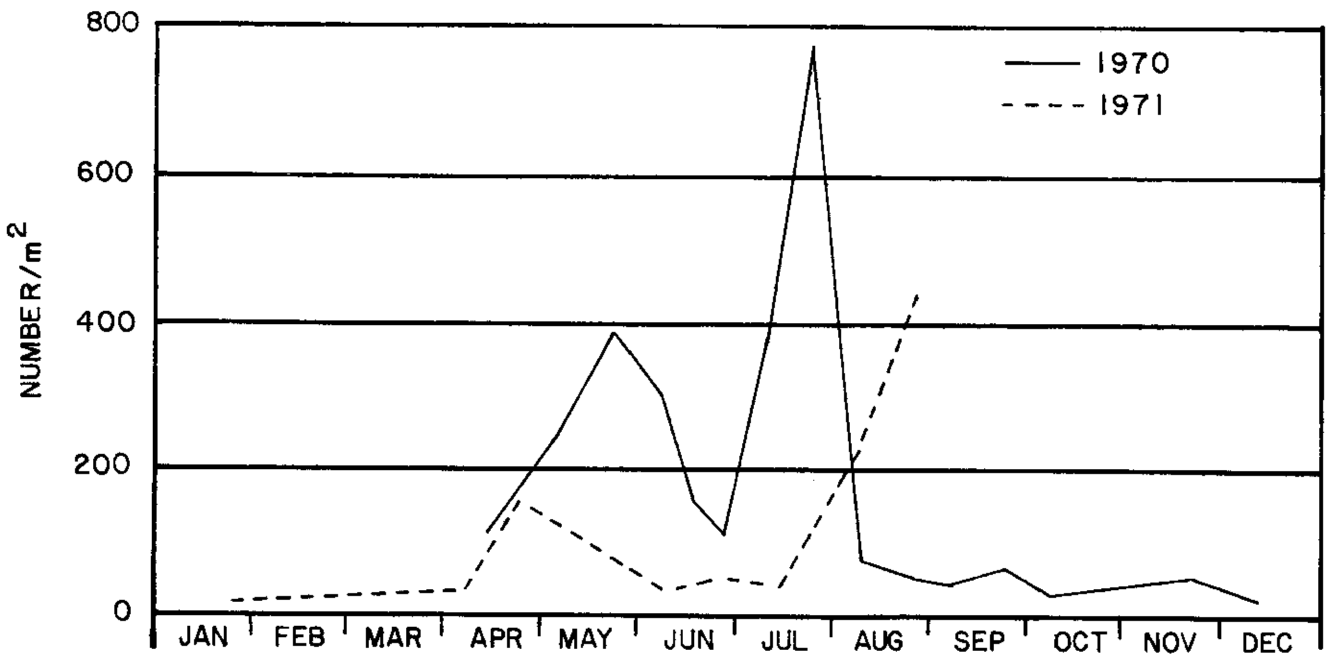


Fig. 2. Insect numbers, 1970 vs. 1971. Treatment 1, ungrazed.

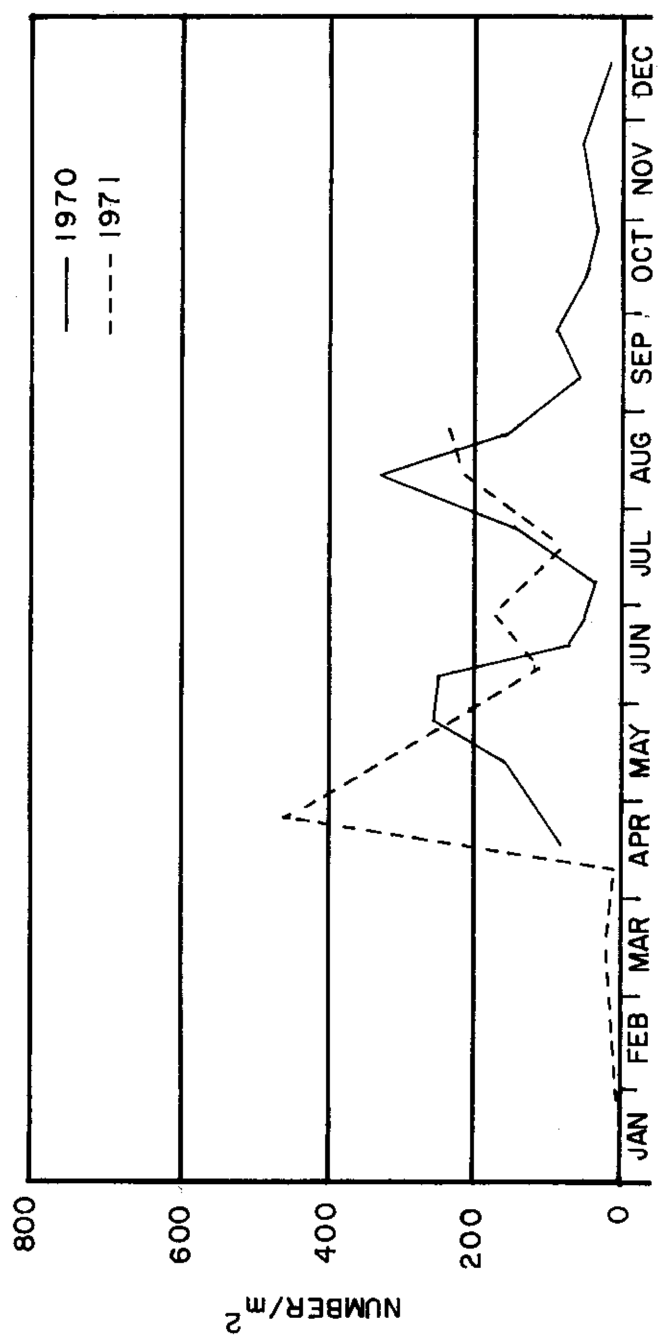


Fig. 3. Insect numbers, 1970 vs. 1971. Treatment 3, moderately grazed.

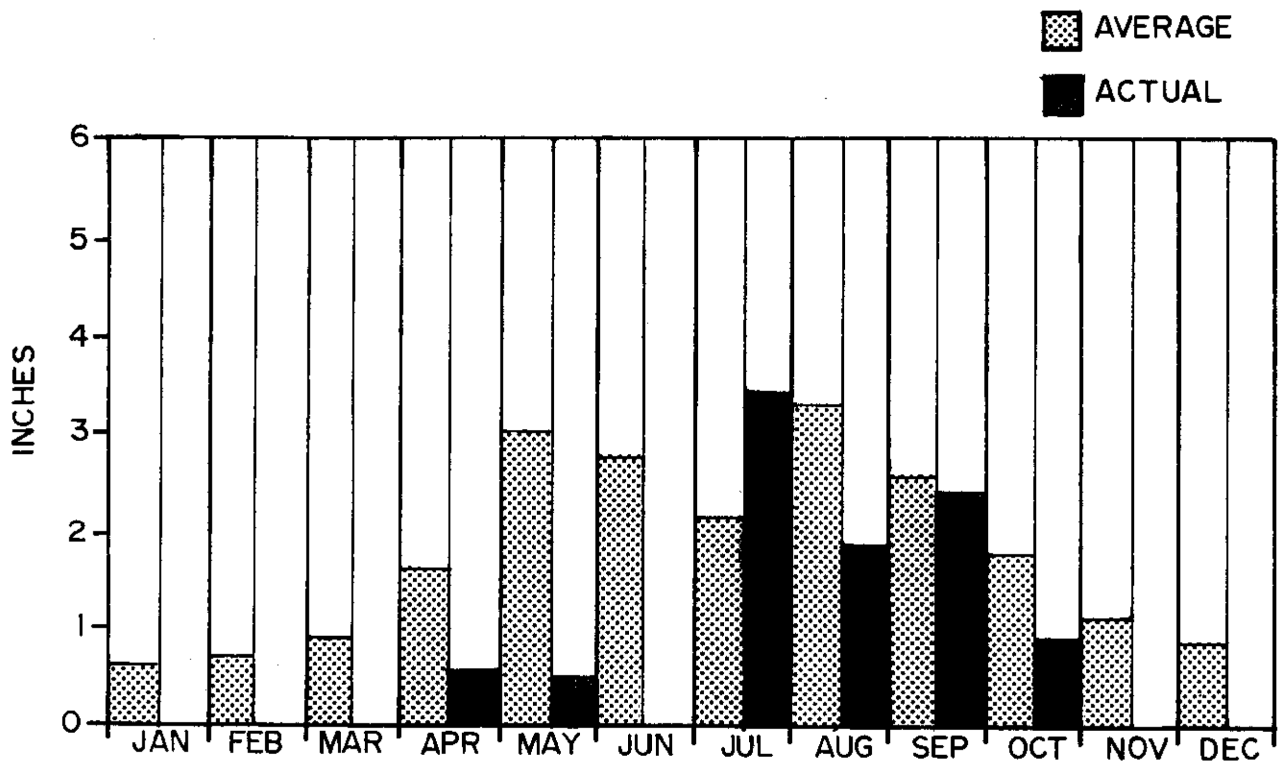


Fig. 4. Summary bar graph depicting the 1971 results of average rainfall vs. actual rainfall, Pantex Site.

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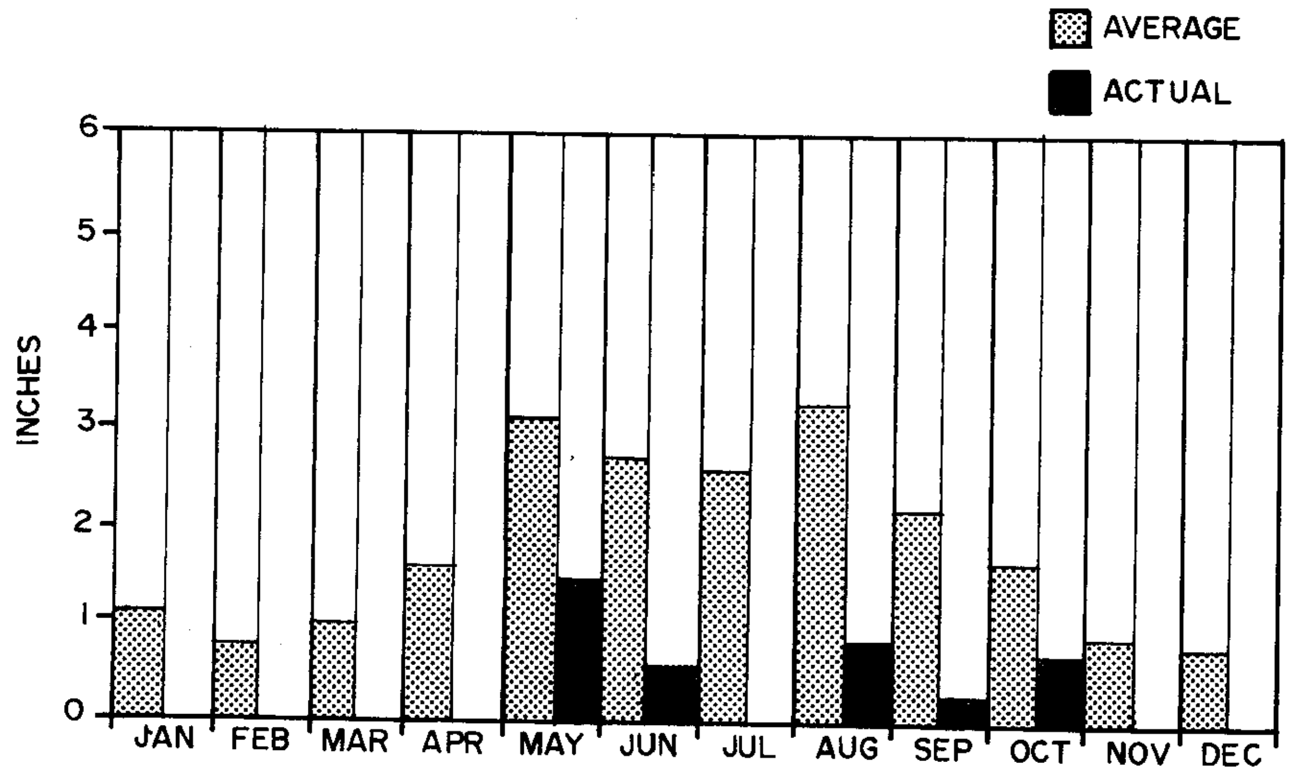

Fig. 5. Summary bar graph depicting the 1970 results of average rainfall vs. actual rainfall, Pantex Site.

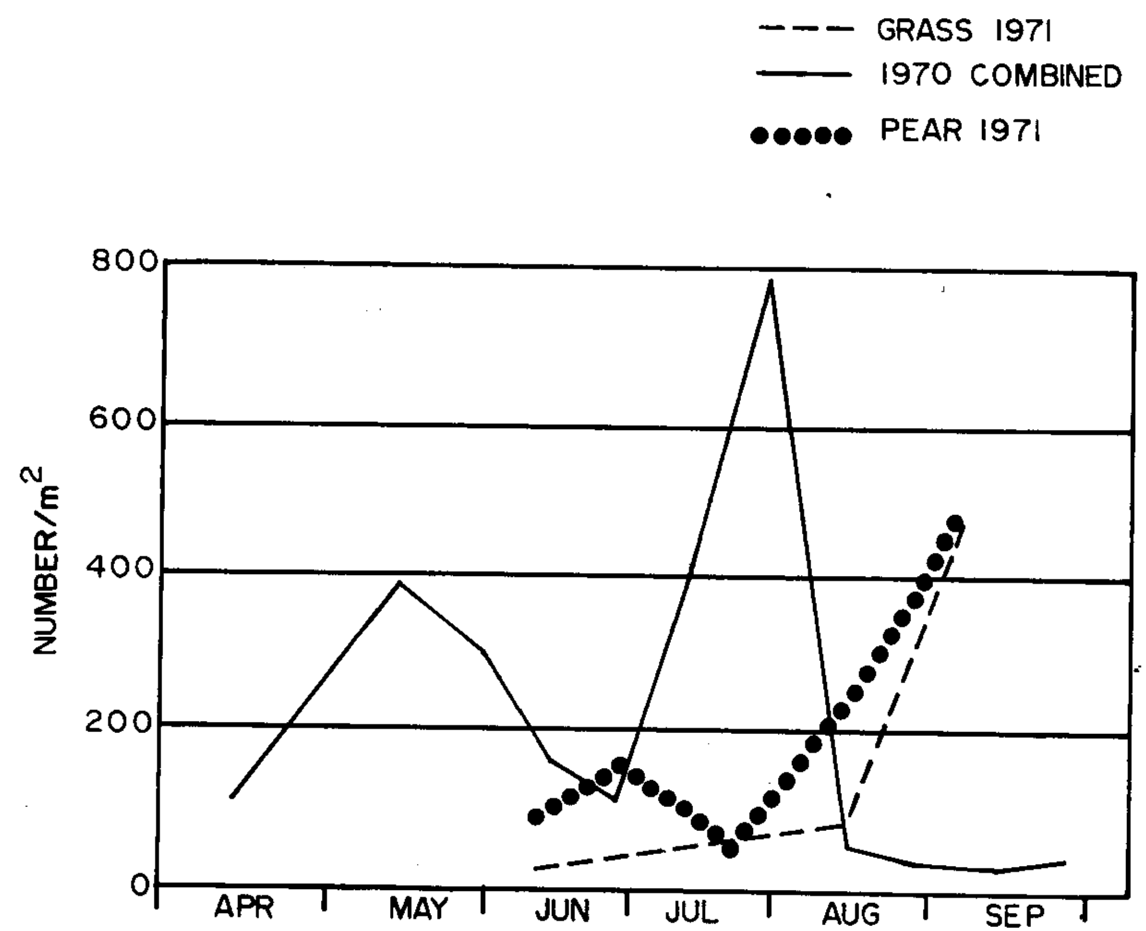

Fig. 6. Insect numbers per meter squared, Pantex Site, 1970-1971, ungrazed.

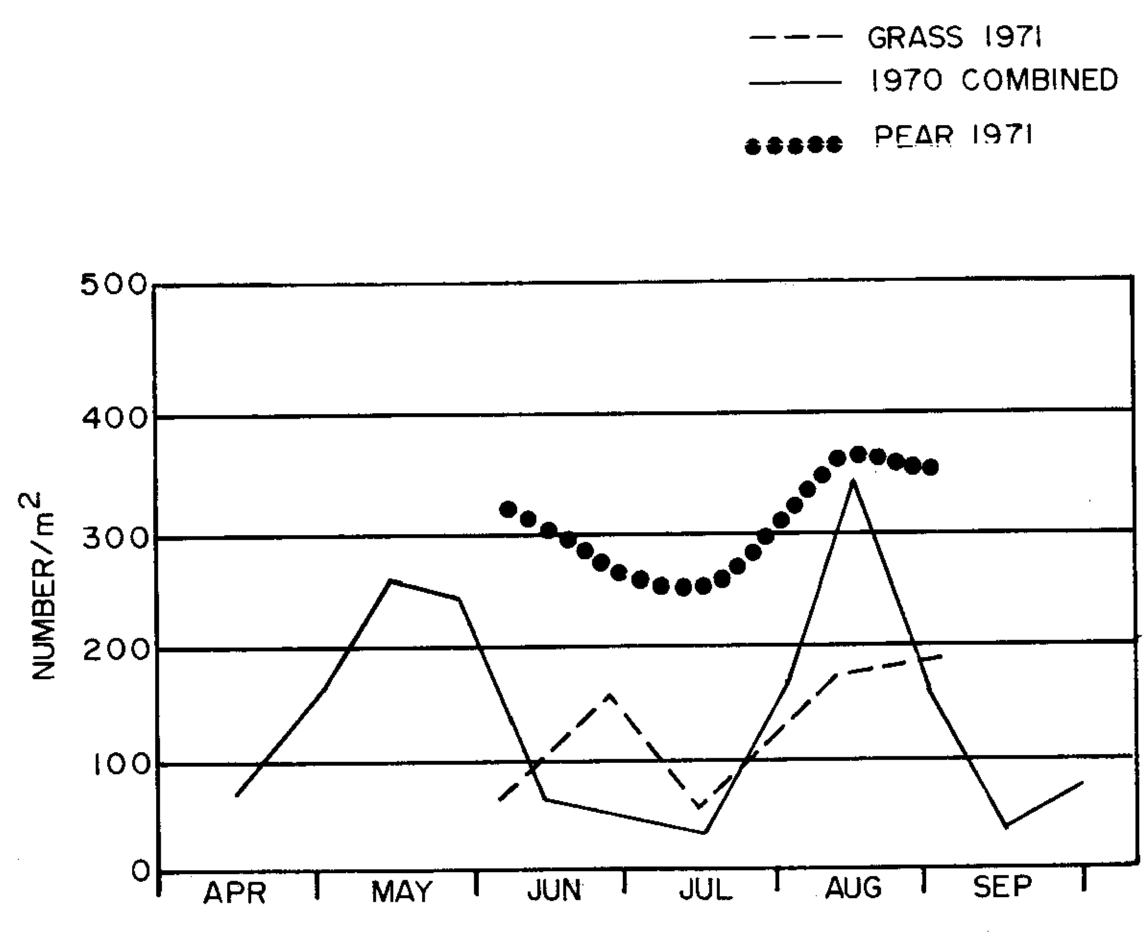

Fig. 7. Insect numbers per meter squared, Pantex Site, 1970-1971, moderately grazed.

Populations in both areas tended to exhibit the bimodal peak which is coming to be accepted as a pattern in grassland insect populations. Population peaks appeared to be delayed in 1971 as compared with 1970; these 1971 population peaks appeared to be correlated with late season rainfall which probably triggered emergence of resting stages (Fig. 8).

Insect biomass data indicated that there was much more insect biomass associated with the prickly pear microenvironments (Fig. 9 and 10). Large peaks in insect biomass occurred in late April in both treatments. These peaks may have been missed in 1970 as sampling had not been initiated early enough to detect these peaks if they occurred. Maximum standing crop insect biomass on an ovendry basis on the ungrazed site was 0.22 g/m^2 in 1970 and 0.51 g/m^2 in 1971 (Fig. 11). Seasonal and yearly averages were, of course, much less. On the moderately grazed site the maximum standing crops were 0.15 g/m^2 in 1970 and 1.57 g/m^2 in 1971 (Fig. 12).

Maximum insect numbers in a given square meter were 7258 in 1970 during a period when there were large but clumped populations of false chinch bugs. Maximum numbers detected in 1971 were 1616 and were primarily leafhopper nymphs.

Biomass peaks in 1971 were caused by large numbers of tenebrionid adults and a few noctuid larvae in the moderately grazed area. In 1971 in the ungrazed area, the greatest biomass during the period of peak standing crop was that of noctuid larvae with scarabid and tenebrionid adults second, but together making up only one-third of the biomass of the noctuids. Peak biomass in 1970 in the grazed area was due to false chinch bugs.

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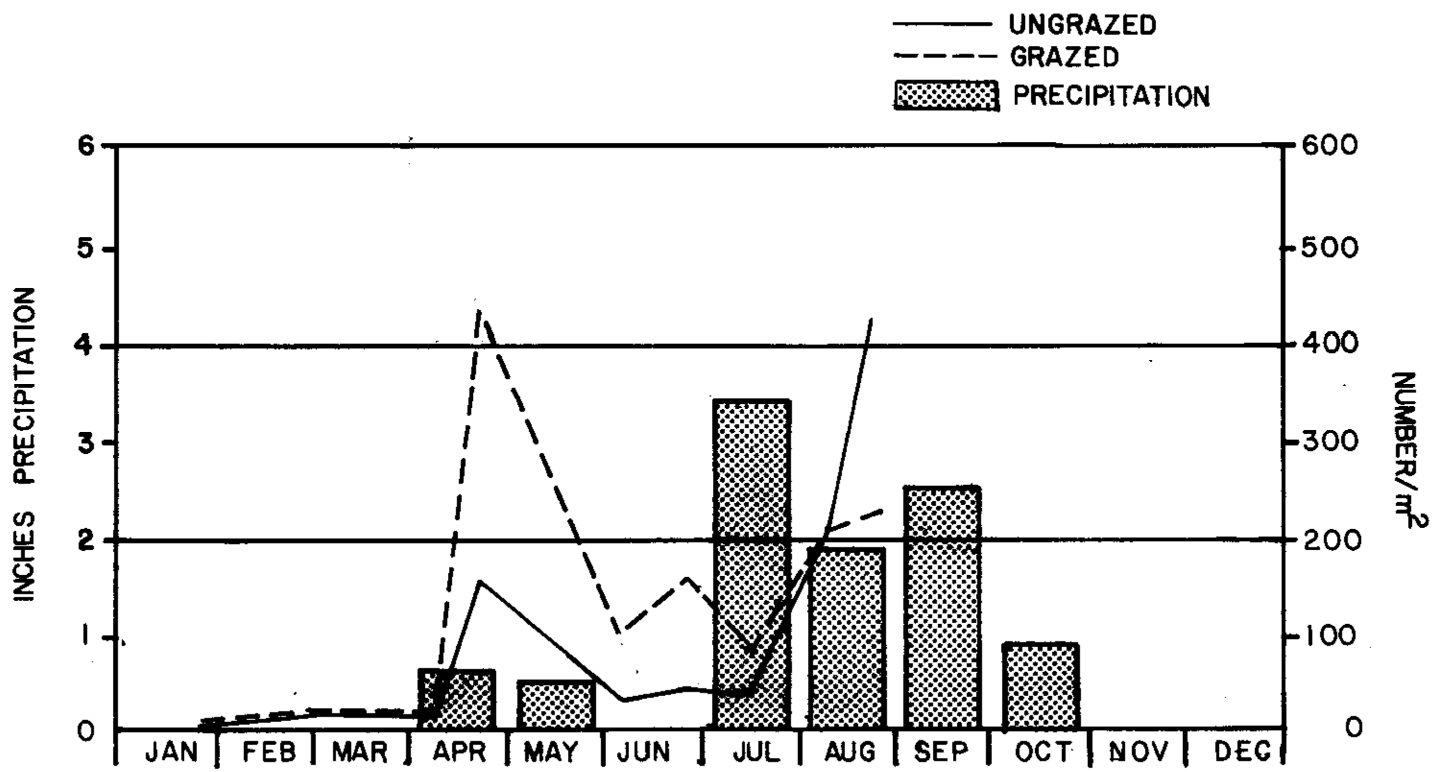


Fig. 8. Precipitation and insect numbers, Pantex Site, 1971.

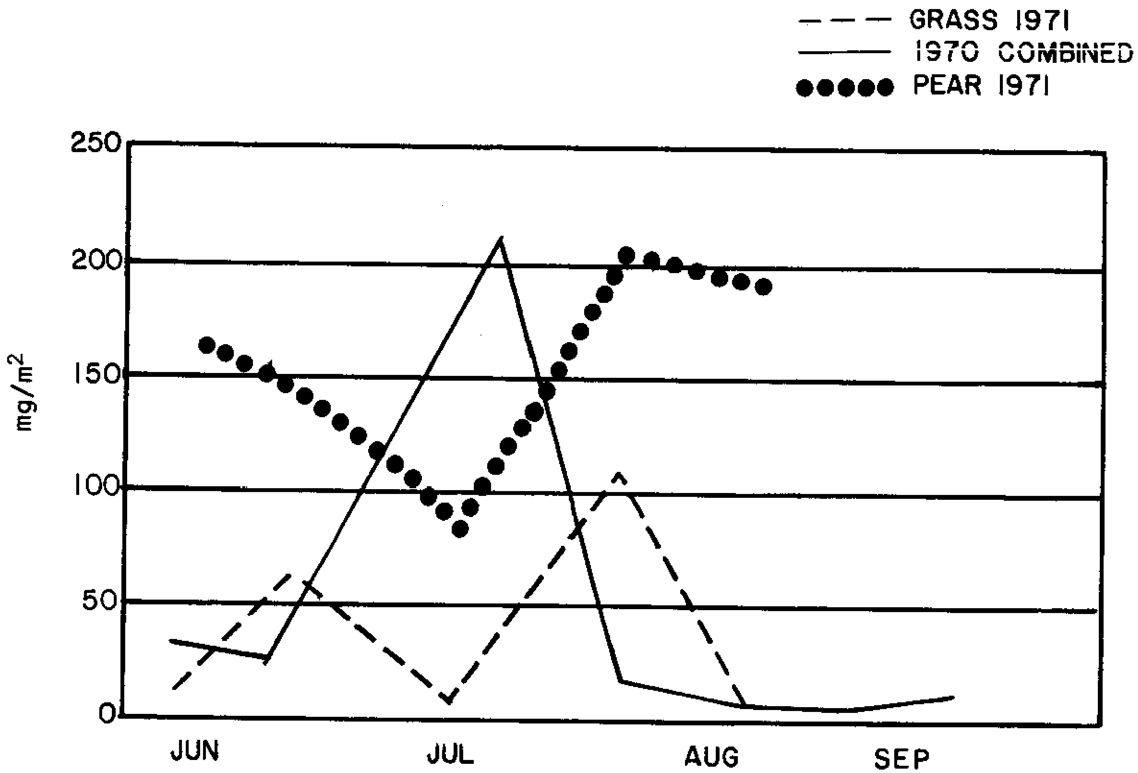


Fig. 9. Insect biomass, Pantex Site, 1970 and 1971, ungrazed.

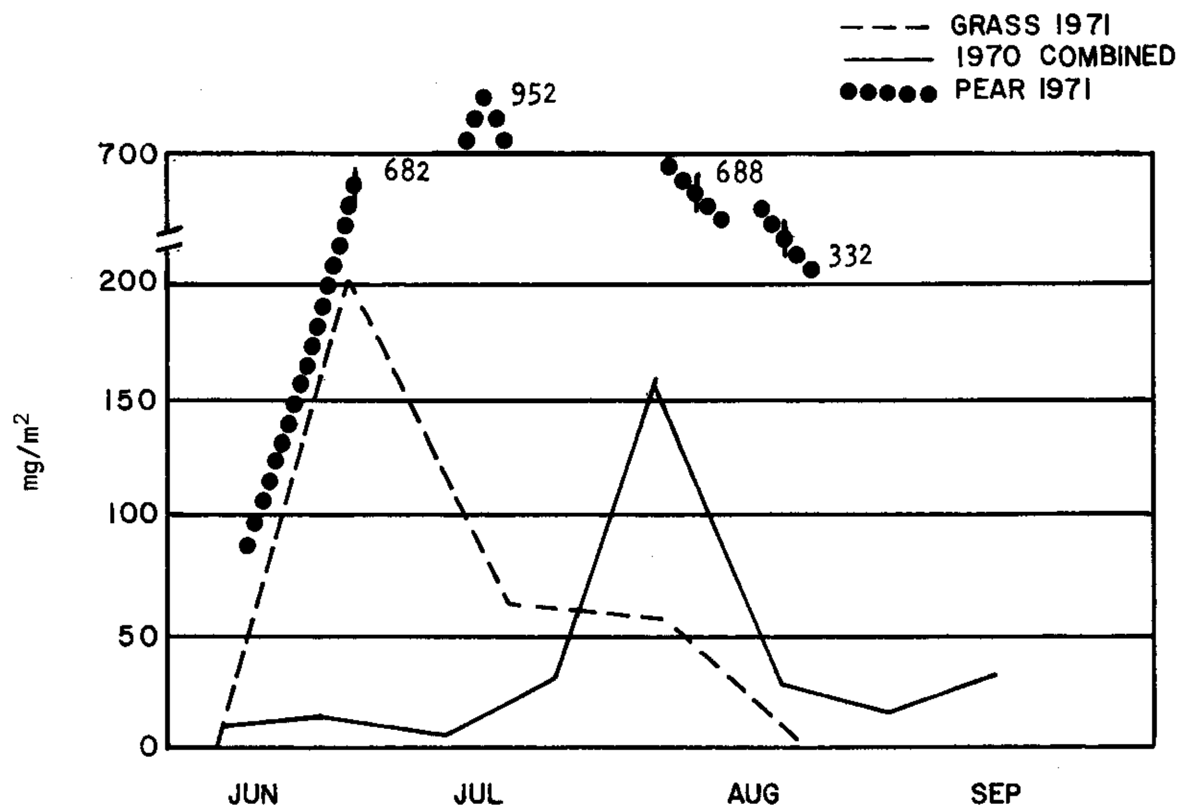


Fig. 10. Insect biomass, Pantex Site, 1970-1971, moderately grazed.

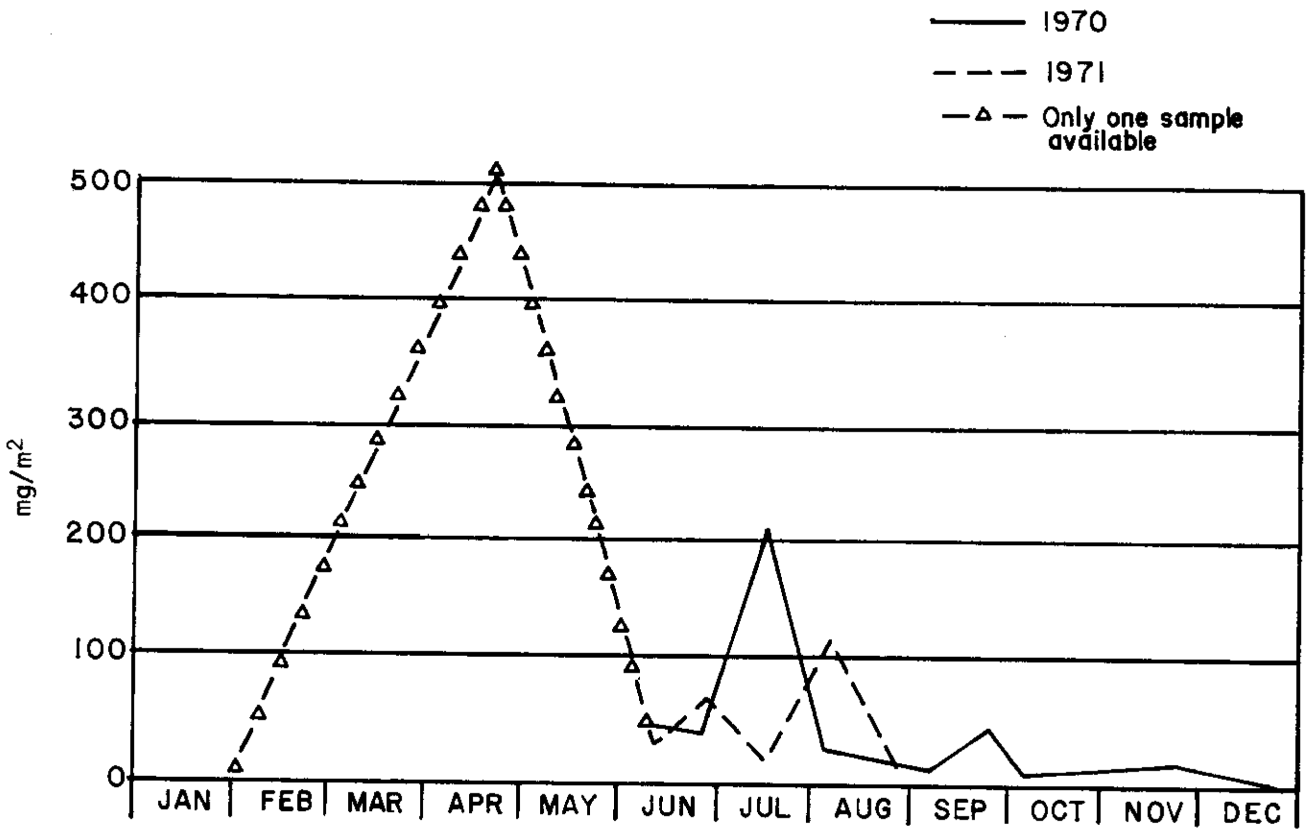


Fig. 11. Insect biomass, 1970 vs. 1971. Treatment 1, ungrazed.

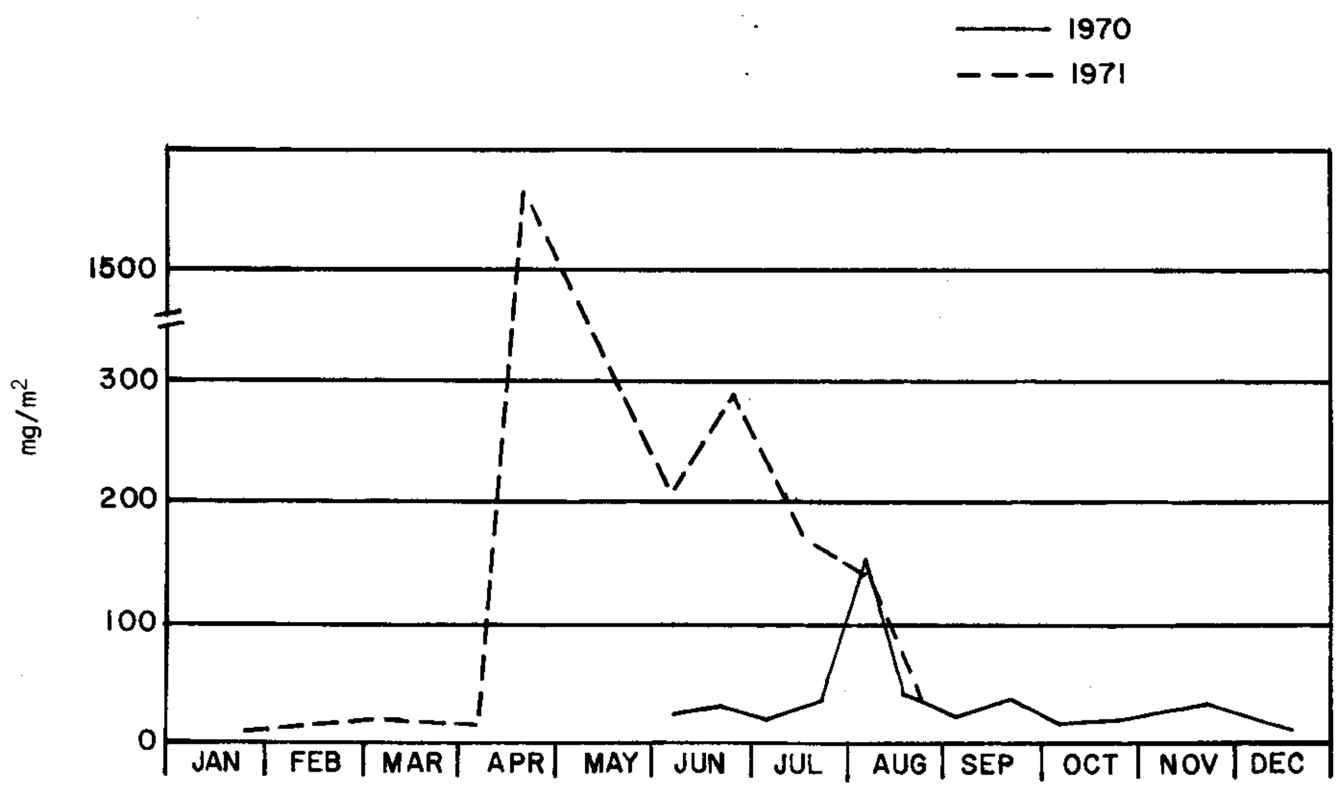


Fig. 12. Insect biomass, 1970 vs. 1971. Treatment 3, moderately grazed.

These data indicate that interseasonal dynamics of insect populations on grasslands are highly variable and may take many years to present a complete pattern of population dynamics and species diversity.

Effect of Herbivory on Species Diversity

A total of 119 taxa (family and below) were found during 1971 by the "quick trap" technique. Of this number, 23 taxa were unique to the ungrazed treatment, and 32 were unique to the moderately grazed treatment (Table 1). These differences in species composition are shown to be less significant when it is noted that 39 of the 55 incongruities were due to the presence of only one or two specimens.

The only insects which were noticeably more numerous in the ungrazed treatment were the immature stages of one or more leafhoppers. Several species were more numerous in the moderately grazed treatment; these were phloeothrips, corieds, mealybugs, elaterids, tenebrionids, and ants. Most of these differences in favor of the grazing treatment appear to be associated with the presence of larger amounts of prickly pear in the grazing treatment. It is interesting to note that no differences in mites or spiders were detected by this sampling method.

Because of the obvious effect of prickly pear on insect numbers, data for certain of the more numerous species were analyzed for species composition associated with the prickly pear and grass strata on the two treatments (Table 2). These data point to very specific affinities for specific plant species groups. It is interesting to note the small differences in total insect numbers on the different strata during this 6-week period during the summer of 1971. Since leafhoppers were mainly found on the ungrazed site, much of the difference in insect numbers on the two herbivory treatments can be explained by this one taxon.

Table 1. Treatment differences in insect species and numbers, Pantex Site, 1971. Totals over nine dates (Jan. 23 to Aug. 23, 1971).

Taxon	Treatment 1	Treatment 3	Taxon	Treatment 1	Treatment 3
Thys. Lepi. 01	1	0	Cole. Cara. 05	0	48
Coll. Ento. 01	1	5	Cole. Cara. 07	6	0
Coll. Smin. 01	151	128	Cole. Cara. 08	0	1
Orth. Gryl. 01 Ny.	4	3	Cole. Cara. 10	0	2
Orth. Locu. 01	1	5	Cole. Chry. 01	12	79
Orth. Locu. 01 Ny.	11	10	Cole. Chry. 02	3	2
Psoc. 01	4	13	Cole. Chry. 03	5	8
Thys. Phlo. Oed. 01	189	986	Cole. Cler. 01	0	1
Thys. Thri. Bre. 01	16	0	Cole. Cocc. 02	4	2
Thys. Thri. Fra. 01	0	2	Cole. Cocc. 04	2	15
Hemi. Ny.	9	12	Cole. Curc.	11	22
Hemi. 05	2	1	Cole. Curc. 01	1	0
Hemi. 08	7	3	Cole. Curc. 05	0	2
Hemi. Core 01	1	26	Cole. Curc. 10	0	1
Hemi. Core. 01 Ny.	1	67	Cole. Curc. *Ger.*	3	25
Hemi. Core. 02	0	1	Cole. Curc. *Sphe.*	0	2
Hemi. Lyga. Bli. 01	0	5	Cole. Curc. *Sphe. comp.*	1	2
Hemi. Lyga. *Geo.* 01	18	19	Cole. Curc. *Tych.*	1	0
Hemi. Lyga. *Geo.* 01 Ny.	11	7	Cole. Elat. 01	1200	1753
Hemi. Nied.	0	1	Cole. Elat. 02	16	22
Hemi. Pent. 02	0	2	Cole. Elat. 03	0	1
Hemi. Pent. 03	0	1	Cole. Hist. 01	3	18
Hemi. Pies. 01	2	1	Cole. Lar.	112	37
Hemi. Redu. 01	1	0	Cole. Mala. 01	1	0
Hemi. Ting.	0	1	Cole. Melo. 01	1	0
Homo. Aphi. 01	10	8	Cole. Mely. 01 Lar.	4	17
Homo. Cica. 01	51	40	Cole. Mord. 01	3	0
Homo. Cica. 01 Ny.	3767	930	Cole. Scap. 01	0	1
Homo. Cica. 03	1	20	Cole. Scar. 01	1	0
Homo. Cica. 05	0	2	Cole. Scar. 02	8	3
Homo. Cica. 08	1	0	Cole. Scar. 03	1	2
Homo. Cica. 11	1	0	Cole. Scar. 04	6	4
Homo. Dact. 01	10	30	Cole. Staph. 03	1	1
Homo. Pseu. 01	10	169	Cole. Tene. 01	2	42
Cole. Anth. 01	28	108	Cole. Tene. 02	586	4218
Cole. Anth. 02	1	2	Cole. Tene. 03	0	3
Cole. Anth. 03	26	91	Cole. Tene. 03 Lar.	0	3
Cole. Anth. 07	2	12	Cole. Tene. 05	2	0
Cole. Cara. 02	3	23	Cole. 02	1	0
Cole. Cara. 03	3	4	Cole. 03	1	0
Cole. Cara. 04	12	177			

Table 1. (Continued).

Taxon	Treat-ment 1	Treat-ment 3	Taxon	Treat-ment 1	Treat-ment 3
Cole. 04	1	0	Dipt. 12	0	1
Cole. 05	0	1	Dipt. 15	3	0
Cole. 06 Lar.	0	3	Dipt. 16	0	5
Cole. 07	3	29	Dipt. 17	0	10
Cole. 09	1	5	Dipt. 20	2	0
Cole. 14	1	1	Dipt. Culi. 01	1	0
Cole. 15	0	5	Hyme. Micro.	0	1
Cole. 17	0	17	Hyme. Form. Cre. 01	872	1045
Neur. Myrm. 01 Lar.	0	17	Hyme. Form. Pog. 01	10	172
Lepi. Adult	21	16	Hyme. Form. 02	17	248
Lepi. 02	2	2	Hyme. Form. 03	31	194
Lepi. 02 Lar.	1	4	Hyme. Form. 06	27	109
Lepi. 04 Lar.	0	1	Hyme. Form. 07	1	0
Lepi. Lar.	20	35	Hyme. 05	0	1
Lepi. Noct. 01 Lar.	59	22	Hyme. 15	0	3
Dipt. 01	1	17	Hyme. 16	0	1
Dipt. 02	1	0	Hyme. Chal. 05	1	0
Dipt. 05	0	1	Acarina	3027	2607
Dipt. 10	1	0	Araneida	329	283

Table 2. Effect of herbivory and plant stratification on number of selected insect taxa for three sampling dates, Pantex Site, 1971.

Taxon	Total Numbers of Selected Insect Taxa by Strata and Treatment			
	Prickly Pear		Grass	
	Ungrazed	Grazed	Ungrazed	Grazed
Leafhopper nymphs	1802	475	1960	432
Ant 03	4	0	6	0
Ant 06	0	0	0	14
Grasshopper	2	6	0	4
Phleothrips	86	300	0	6
Chinch bugs	0	7	0	1
Coreidae adults	1	21	0	1
Coreidae nymphs	1	46	0	0
Mealybugs	10	40	0	6
Ant Crematogaster	377	462	115	64
Tenebrionid 01	0	13	0	0
Tenebrionid 02	293	2052	61	78
Melyridae larvae	0	7	0	0
Carabid 04	24	99	5	30
All insects	3210	4287	6947	1289

Pitfall Trap Comparison Test

The pitfall trap, while not recognized as a quantitative sampling method, is nevertheless an excellent survey tool for qualitative analysis of ground-dwelling insects. This tool as used at the Pantex Site has been useful in detecting species missed by the "quick trap" method. During the summer of 1971 a study was conducted to determine the effectiveness of several liquids as collecting and preserving materials for pitfall traps. Four materials (glycerine, ethyl alcohol, picric acid, and ethylene glycol) were compared with dry cups. In addition, in order to better understand diurnal fluctuations in insect activity, cups were collected every 12 hours.

The results of three day replicates and three night replicates were analyzed. In general, the traps collected more insects during the day periods than the night periods. During the day period glycerine, ethyl alcohol, and ethylene glycol were equally effective, and all three were found to catch more insects than the dry traps, which probably permitted the more active insects to escape, and the saturated aqueous solution of picric acid, which may have repelled certain insects. During the night periods all liquids caught more insects than the dry cups. Although alcohol caught more insects, due to the variability in catch per cup this material was not significantly better than the other liquids (Table 3).

As a result of this test and the use of the pitfall trap technique a large number of new species were added to the Pantex Site species list.

Table 3. Average number of insects/12 hour period/trap.

Time of Day	Picric Acid	Dry	Ethylene Glycol	Glycerine	Alcohol
Day	10.0	13.7	23.6	24.9	24.8
Night	10.0	4.4	14.6	11.7	16.9

Insecticide Stressing

A preliminary experiment was conducted to gain information on the use of insecticide stressing techniques for manipulation of grassland insect populations. A simple, randomized block design, consisting of four replicates of six treatments was used. Plots, 15 × 60 ft, were treated with a hand-pulled cart which carried a nitrogen-powered sprayer with a boom equipped with nine, FS-6 nozzles located 20 inches apart on the boom. Pressure was maintained at 30 psi, and the cart sprayer was pulled at a speed of 4 mph. Four insecticides (chlordane, a soil insecticide; Kelthane, an insecticide and miticide; lead arsenate, a stomach poison; and Di-Syston, a systemic insecticide in a granular formulation) were used. In addition, a mixture of broad spectrum insecticides (DDT, toxaphene, and methyl parathion) was used as another treatment. An untreated check was the sixth treatment. All insecticides were applied at or near the manufacturers' recommended dosage.

The plots were treated on August 8, 1971, and sampled by the standard IBP sampling method on August 15, 1971. Immediately after treatment two standard IBP cellulose litter bags were buried 3 to 5 cm beneath the soil surface, and two were placed on the soil surface in each plot. These litter bags were collected and visually rated as to amount of decomposition 60 days after insecticide application. Soil microarthropods were sampled 1 week after treatment by the method used by Crossley, Proctor, and Gist (1972) at the Pawnee Site. Soil microarthropod data are not complete at this time.

Insect numbers were selectively modified by the treatments chosen (Table 4). Population reductions ranged from 76% for the broad

Table 4. Effect of insecticide stress on insect numbers, Pantex Site, 1971.

Insecticide	Reduction in Population (%)	
	Insects	Mites
Mix	76	38
Chlordane	72	0
Kelthane	20	0
Lead arsenate	19	0
Di-Syston	12	0
Untreated	0	0

spectrum mix to 12% for the Di-Syston. The mix was the only material that reduced those taxa of mites which are caught by the "quick trap" technique. While no differences in the rate of cellulose decomposition in the aboveground bags could be detected, there were significant differences in the rate of decomposition of buried cellulose in the different insecticide treatments (Table 5). The Di-Syston and Kelthane treated plots had 48 and 50% decomposition, respectively, while the untreated check had 81% decomposition. As an aid to future interpretation of this data, Table 6 is presented as a summary of the total numbers of insects by taxon found in three replicates of each treatment.

SOME PRELIMINARY THOUGHTS ON ENERGY FLOW

As a preliminary approach to modelling the insect compartment, the insect data have been analyzed to obtain the mean monthly numbers and ovendry biomass per square meter on the grazed and the ungrazed sites. Maximum numbers occurred in August on the ungrazed site and in May on the grazed site. Maximum biomass was found in May on both sites (Table 7).

One approach to the problem of energy flow through the insect compartment is to use general values from the literature and to calculate the energy requirements of the standing crop of insects. When the average insect biomass by month is multiplied by the caloric requirements, the results indicate a need for 36.5 kcal/m^2/year for the insects on the ungrazed site and 97.1 kcal/m^2/year for the grazed site. Meeting these requirements would require 5.6% of the maximum aboveground standing crop of plant biomass for the grazed site (384 g/m^2)

Table 5. Effect of insecticide stress on cellulose decomposition, Pantex Site, 1971.

Insecticide	% Decomposition (60 days)	
	Aboveground	Belowground
Di-Syston	21	48
Kelthane	22	51
Mix	16	71
Chlordane	14	75
Lead arsenate	24	84
Untreated	20	81

Table 6. Summary of total numbers of insects by taxon found in three replicates of each treatment.

Taxon	Check	Di-Syston	Lead arsenate	Kelthane	Chlordane	Mix
Sminthuridae	7	0	0	0	0	0
Entomobryidae	0	0	0	25	0	0
Acrididae	1	0	0	0	0	0
nymphs	0	1	0	0	0	0
Aphidae	0	0	0	0	0	0
Pseudococcidae	13	3	14	3	9	10
Geocoridae	2	1	1	0	0	0
Psocoptera	0	1	0	0	0	0
Phloeothripidae	25	19	24	32	5	1
Bregmatothrips	0	6	2	0	0	1
Poduridae	0	0	24	0	0	0
Elateridae 01	120	151	141	89	39	53
Tenebrionidae 01	0	0	0	0	1	1
02	52	13	11	9	2	13
Anthicidae 01	14	20	18	7	4	3
03	9	9	8	8	0	8
Coccinellidae 02	0	0	0	0	0	0
04	10	0	1	0	0	0
Staphylinidae	0	1	0	1	0	1
Coleoptera larvae	0	6	2	4	0	0
Lepidoptera	0	0	0	1	0	0
larvae	0	1	1	0	0	2
Carabidae 04	18	16	21	26	0	5
Cleridae 01	0	0	1	0	0	0
Diptera adults	0	1	0	2	3	1
Hemiptera 08	0	1	3	0	0	0
Formicidae Cre	9	1	2	10	1	1
Pog	3	0	0	2	1	1
02	2	0	0	0	1	0
06	44	33	12	39	0	13
Hymenoptera	0	1	2	2	1	5
Cicadellidae 01	1	5	2	1	7	2
01 nymphs	141	211	60	111	59	2
03	4	0	0	1	0	0
06	0	1	0	0	0	0
Myrmeleontidae larvae	0	0	0	0	0	1
Araneida	1	3	0	3	0	2
Melyridae larvae	1	0	0	3	1	2
Acarina	305	475	405	188	425	332
Insecta larvae	0	0	0	4	0	0

Table 7. Monthly summary of numbers, biomass, and food requirements of insect compartment and energy available to other carnivores from insect compartment, Pantex Site, 1971.

Month	Number/m²		Biomass (g/m²)		Food (kcal/m²) per day		Food (kcal/m²) per month		Available Energy (kcal/m²)	
	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed
Sept.	17.83	53.50	.00968	.00737	.01452	.01106	.43560	.33180	.05227	.03980
Oct.	25.30	27.00	.01042	.01179	.01563	.01769	.46890	.53070	.05627	.06367
Nov.	32.83	54.83	.01119	.02981	.01679	.04472	.50370	1.34160	.06043	.16097
Dec.	7.67	11.50	.00165	.00457	.00248	.00686	.07440	.20580	.00891	.02468
Jan.	3.17	5.17	.00097	.00164	.00146	.00246	.04365	.07380	.00524	.00886
Feb.	12.50	13.95	.00248	.00734	.00372	.01101	.11160	.33030	.01339	.03964
Mar.	14.33[a]	22.75	.00819[a]	.01300	.01229[a]	.01950	.36870[a]	.58500	.04423[a]	.07020
Apr.	7.43[a]	11.80	.00025[a]	.00400	.00038[a]	.00600	.01125[a]	.18000	.00135[a]	.02160
May	164.60	449.30	.50600	1.57300	.75900	2.35950	22.77000	70.78500	2.73240	8.49420
June	35.40	86.17	.04598	.24320	.06897	.36480	2.06910	10.94400	.24829	1.31328
July	32.51	87.51	.01530	.17320	.22950	.25980	6.88500	7.79400	.08260	.93530
Aug.	319.60	208.80	.06078	.08950	.09117	.13425	2.73510	4.02750	.32820	.48330
TOTAL	673.17	1032.28	.67289	2.07787	1.21591	3.23765	36.4770	97.12950	3.63358	11.65550

a/ Estimate

and 2.6% for the ungrazed site (314 g/m^2). These figures were derived by taking the following values from Odum (1971). The following values result if live weight is assumed to be 2/3 water:

1. Insect biomass = 5.4 kcal/g of dry wt.
2. Terrestrial plants = 4.5 kcal/g of dry wt.
3. Insect food requirements = 0.5 kcal/g live body wt or .5 kcal/1/3 g dry wt = 1.5 kcal/g dry wt.

There are several limitations to this approach; one of the more obvious is that the insects occupy more than one trophic level and the energy requirements would therefore differ widely. The insect data was partitioned in a very general way (and based on very incomplete host data) into biomass of herbivores, carnivores, scavengers, and parasites for each month and averaged over the year (Table 8). Maximum herbivore biomass was present in May at a time when plant growth probably was most susceptible to growth retardation due to feeding. Maximum carnivore biomass was present in May; maximum scavenger biomass was also present in May. The percentage composition by trophic level that was obtained is unexpected because of the high percentage of scavengers in the grazed site. Almost all of the scavenger biomass is due to the large numbers of Tenebrionidae adults found in the litter and upper soil. Since the immature stage which is probably the main feeding stage is herbivorous, this value should probably be depreciated by some factor. The percentage composition on an annual basis is given below:

Table 8. Monthly summary of biomass of insect compartment partitioned into trophic levels, Pantex Site, 1971.

Month	Herbivore		Carnivore		Scavenger		Parasite	
	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed
Sept.	.00566	.00064	.00318	.00430	.00000	.00000	.00000	.00000
Oct.	.00606	.00737	.00418	.00349	.00000	.00000	.00000	.00000
Nov.	.00730	.00918	.00393	.01947	.00000	.00000	.00000	.00000
Dec.	.00092	.00303	.00073	.00171	.00000	.00000	.00000	.00000
Jan.	.00066	.00123	.00031	.00081	.00000	.00000	.00000	.00000
Feb.	.00530	.00210	.00015	.00138	.00054	.00100	.00000	.00000
Mar.	.01000	.01000	.00100	.00100	.00000	.00000	.00000	.00000
Apr.	.00300	.00300	.00200	.00200	.00000	.00000	.00000	.00000
May	.37700	.20400	.02100	.12800	.08400	1.21400	.00600	.00600
June	.02530	.04350	.00680	.07350	.03450	.33500	.00200	.01400
July	.00115	.05300	.00900	.02650	.02500	.00200	.00250	.00200
Aug.	.03780	.03780	.02640	.01340	.00000	.00000	.01139	.07950
Total	.48015	.37490	.07868	.27560	.14404	1.55200	.02189	.01015
Mean	.04001	.03124	.00656	.02297	.01200	.12933	.00182	.00085

	Theoretical Literature Value	Ungrazed	Grazed (without Tenebrionidae)	Grazed with Tenebrionidae)
Herbivore	50%	66%	38%	17%
Carnivore	15%	11%	28%	12%
Scavenger	20%	20%	33%	70%
Parasite	10%	3%	1%	1%

An average between the biomass values for the ungrazed and the grazed (without Tenebrionidae) is a reasonably close approximation to the theoretical literature value. These averages were used to construct the following comparmental model (Fig. 13) in which the Tenebrionidae are ignored in the development of the percentages, and the mean annual biomass was partitioned.

The preparation of an energy budget or balance sheet is not possible with the data available. A very crude approximation, again based on literature values, is given in the following diagram (Fig. 14).

Waldbauer (1968) developed a consumption index (C.I.) based on the dry weight of the food consumed and the dry weight of larvae. This value ranged from 2.9 to 3.22 and would indicate that certain insects during larval growth would use 2.9 to 3.22 g of plant material for each gram of insect material per day on an ovendry basis. If this is accurate, it would indicate a feeding rate far in excess of Odum's 0.5 kcal/g live weight/day which I have taken as 1.5 kcal/g dry weight/day which is equal to .33 g/g dry weight/day. Waldbauer's data would average about 3.1 g/g/day or approximately 14 kcal/g day during the active growth period. One explanation is to say that about 1/10 of the life cycle is spent feeding. Since it is probably more, Odum's figure is probably low.

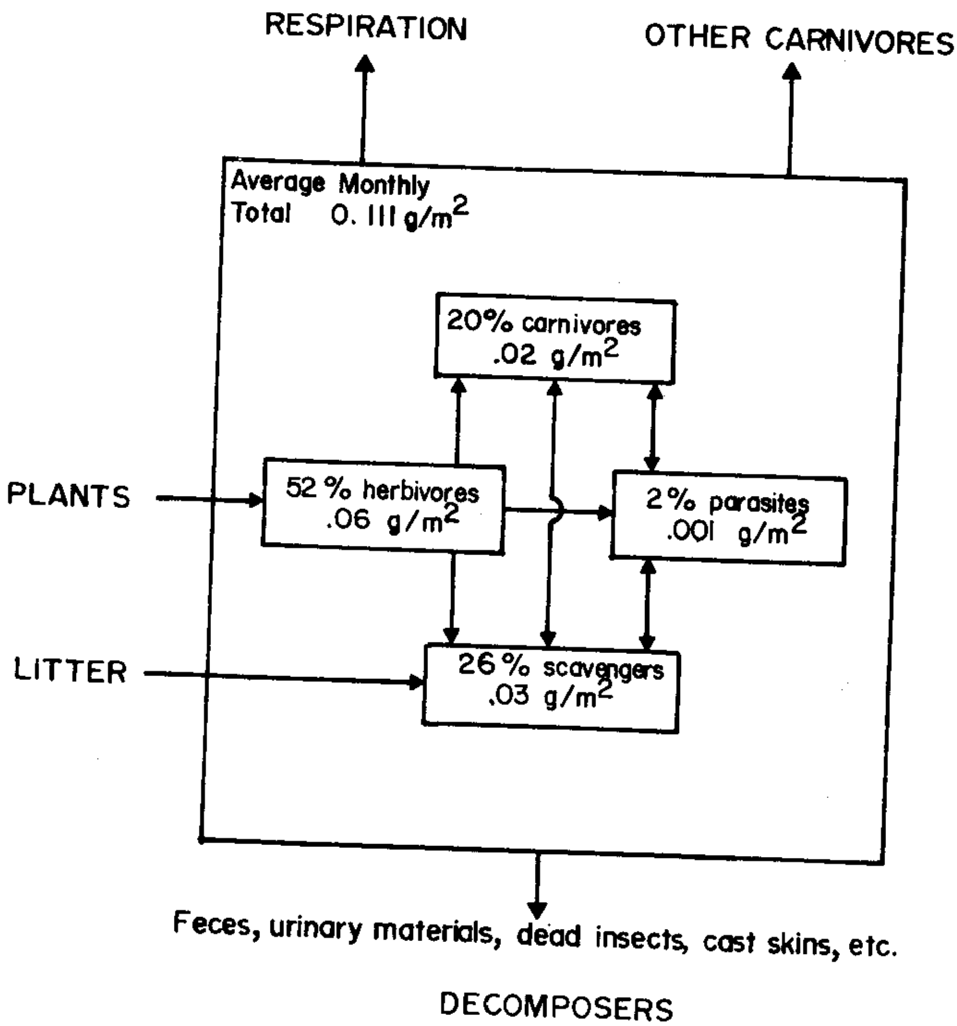


Fig. 13. Energy flow diagram.

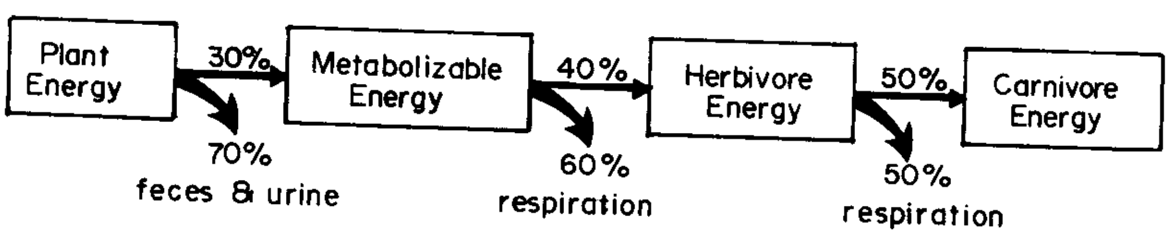


Fig. 14. Some energy flow pathways.

To arrive at an estimate we can start with data on approximate digestibility (A.D.) which is given as:

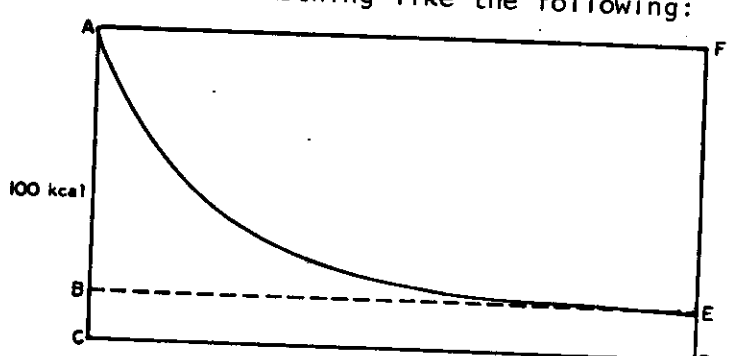
$$A.D. = \frac{\text{wt of food ingested - wt of feces}}{\text{wt of food ingested}} \times 100$$

Literature values for A.D. vary from 60% to 20% for herbivorous insects and may average around 30% (Fig. 14). The efficiency with which digested food is converted to body substance (E.C.D.) is given as:

$$E.C.D. = \frac{\text{wt gained}}{\text{wt of food ingested - wt of feces}} \times 100$$

Literature values for E.C.D. vary from 69% to 14% for herbivorous insects with a probable average of about 40% (Fig. 14). For scavengers the A.D. and E.C.D. values may well be lower. For carnivores the values are probably higher, but it must be remembered that the energy has had to pass through one extra trophic level with its attendant losses. Using these values and assuming 20% of the population to be carnivores, we can account for approximately 90% of Odum's (1971) estimated energy requirements.

Since Odum's data may well ignore natural mortality in a population, it does not appear unreasonable to assume that his figure should be multiplied by some positive number for a first approximation. Since actual survivorship or net production is a function of mortality which acts at all stages of the life cycle, the curve of net primary production (which we measure) has to look something like the following:



ACDF = Potential net production for X amount of plant energy = Odum's values
ACDE = Actual net production from X amount of plant energy

Based on these figures one would expect that a loss of 75% of the potential net production would not be unrealistic. This would lead to a multiplier of 4 for Odum's figures which would place the energy needs of insects in the area from 22 to 10% of the net primary aboveground productivity of the grasslands.

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APPENDIX I

SUMMARY OF INSECT NUMBERS AND BIOMASS PER METER SQUARED

Pantex Site, 1970-1971

Date	Treat-ment	Repli-cate	Quadrat (total no./m^2) 1	2	3	4	5	6	Biomass (m^2)
3 Oct. 70	1	1	8	4	78	2	4	22	.01637
	1	2	12	4	18	28	32	2	.00300
	3	1	2	4	0	8	12	8	.00686
	3	2	20	16	20	14	12	526	.00788
	5	1	6	18	60	48	14	12	.00913
	5	2	10	22	26	26	18	38	.01134
23 Oct. 70	1	1	38	0	22	0	20	0	.00973
	1	2	0	0	0	34	116	72	.0111
	3	1	0	64	64	0	34	0	.00942
	3	2	0	66	0	36	0	64	.01417
	5	1	0	92	0	14	0	22	.006
	5	2	108	0	234	0	22	0	.03142
20 Nov. 70	1	1	24	30	62	22	2	70	.00472
	1	2	24	12	52	30	10	56	.01766
	3	1	156	48	10	24	40	42	.02464
	3	2	70	110	26	14	14	104	.03497
	5	1	12	50	40	2	22	120	.00607
	5	2	16	50	38	30	58	10	.03163
22 Dec. 70	1	1	12	14	16	8	6	0	.00189
	1	2	0	16	4	0	4	12	.00140
	3	1	12	30	4	8	2	4	.00549

APPENDIX I (Continued)

Date	Treat-ment	Repli-cate	Quadrat (total no./m^2)						Biomass (m^2)
			1	2	3	4	5	6	
22 Dec. 70	3	2	12	16	16	10	6	18	.00400
	5	1	6	14	12	2	4	16	.00201
	5	2	0	6	6	0	8	6	.000794
23 Jan. 70	1	1	4	4	4	2	2	6	.00107
	1	2	2	4	2	6	2	0	.00087
	3	1	2	0	3	0	0	2	.0060
	3	2	10	14	14	6	2	6	.00347
	5	1	0	6	0	0	0	4	.00033
	5	2	0	10	0	0	0	2	.00120
13 Mar. 71	3	1	4	2	6	8	6	6	.011
	3	2	88	58	22	30	26	24	.014
	5	1	60	6	6	16	4	18	.031
	5	2	8	28	30	148	14	32	.025
10 Apr. 71	3	1	4	2	12	8	14	6	.003
	3	2	8	8	16	20	16	22	.006
	5	1	202	4	72	8	6	26	.007
	5	2	24	10	24	16	6	2	.009
24 Apr. 71	1	1	166	76	234	128	130	254	.506
	3	1	494	336	352	370	866	258	1.573
8 June 71	1	1(G)*	14	24	40	8	6	44	.018
	1	1(P)**	74	86	190	154	70	62	.190
	1	2(G)	20	64	32	46	28	28	.019
	1	2(P)	80	62	32	116	50	80	.141
	3	1(G)	122	80	38	36	118	18	.103

APPENDIX I (Continued)

Date	Treat- ment	Repli- cate	Quadrat (total no./m²)						Biomass (m²)
			1	2	3	4	5	6	
8 June 71	3	1(P)	226	288	338	410	246	206	.957
	3	2(G)	40	118	30	114	80	26	.117
	3	2(P)	394	408	224	432	246	336	.824
21 June 71	1	1(G)	12	20	22	100	44	8	.049
	1	1(P)	138	278	426	248	130	452	.165
	1	2(G)	18	24	22	8	82	24	.073
	1	2(P)	30	46	60	16	62	28	.145
	3	1(G)	42	28	40	514	46	178	.153
	3	1(P)	444	188	240	440	414	62	.970
	3	2(G)	168	270	44	306	96	148	.247
	3	2(P)	86	174	420	272	280	248	.394
13 July 71	1	1(G)	42	32	36	40	26	30	.022
	1	1(P)	76	96	40	84	56	34	.060
	1	2(G)	20	40	22	56	18	14	.001
	1	2(P)	36	64	34	14	44	102	.095
	3	1(G)	96	70	16	18	18	40	.051
	3	1(P)	266	352	298	166	866	156	1.279
	3	2(G)	32	56	166	112	24	66	.083
	3	2(P)	104	354	138	76	386	198	.624
3 Aug. 71	1	1(G)	108	326	98	112	424	188	.110***
	1	1(P)	334	204	568	300	250	372	.205***
	1	2(G)	90	76	160	408	120	54	.110***
	1	2(P)	148	96	142	574	128	158	.205***
	3	1(G)	146	266	132	288	134	204	.058***

APPENDIX I (Continued)

Date	Treat-ment	Repli-cate	Quadrat (total no./m^2)						Biomass (m^2)
			1	2	3	4	5	6	
3 Aug. 71	3	1(P)	322	206	312	778	394	156	.688***
	3	2(G)	178	46	164	166	204	112	.058***
	3	2(P)	376	660	150	436	306	162	.688***
23 Aug. 71	1	1(G)	436	1616	414	266	244	126	.005***
	1	1(P)	344	336	360	268	248	622	.198***
	1	2(G)	620	378	242	484	228	272	.005***
	1	2(P)	338	740	350	436	588	740	.198***
	3	1(G)	58	294	122	104	90	128	.002***
	3	1(P)	294	330	318	250	230	602	.332***
	3	2(G)	226	242	200	138	176	188	.002***
	3	2(P)	424	202	378	582	232	284	.332***
18 Sept. 71	No data analyzed								
6 Nov. 71	No data analyzed								

* (G) = grass strata

** (P) = prickly pear strata

*** Replicates were combined on these two dates; data not returned from computer.

NOTE: Stratification was initiated on 8 June 1971 and is being continued.

APPENDIX II

SUMMARY OF TAXA COLLECTED WITH CORRESPONDING ABBREVIATIONS

Pantex Site, 1971

TAXON	ABBREVIATION
Collembola	COLL
Entomobryiidae	ENTO
sp 01 (adult)	
Smithuridae	SMIN
sp 01 (adult)	
Ephemeroptera	EPHE
sp 01 (adult)	
Odonata	ODON
Coenagrionidae	COEN
sp 01 (adult)	
Libellulidae	LIBE
Sympetrum	SYM
corruptum (Hagen)	cor
Orthoptera	ORTH
Acrididae	ACRI
sp 01 (adult)	
sp 03 (adult)*	
sp 04 (adult)*	
sp 05 (adult)*	
sp 06 (adult)*	
sp 08 (adult)*	
sp 10 (adult)*	
sp 11 (adult)*	
sp 12 (adult)*	
sp 13 (adult)*	
sp 14 (adult)*	
sp 15 (adult)*	
sp 16 (adult)*	
sp 17 (adult)*	
sp 01 (nymph)	
Arphia	ARP
simplex Scudder (=ACRI sp 09)*	sim
Mermeria	MER
bivittata	biv
maculipennis Bruner (=ACRI sp 07)*	mac
Xanthippus	XAN
corallips	cor
pantherinus (Scudder) (=ACRI sp 02)*	pan
Gryllacrididae	
sp 01 (nymph)*	
Gryllidae	
sp 01 (adult)	
sp 02 (adult)*	
Mantidae	MANT
sp 01 (adult)*	

APPENDIX II (Continued)

TAXON	ABBREVIATION
Tettigoniidae	TETT
sp 01 (adult)*	
sp 02 (adult)*	
Thysanoptera	THYS
Aeolothripidae	AEOL
Aeolothrips	Aeo
sp 01 (adult)	
Phloeothripidae	PHLO
Oedolothrips	Oed
sp 01 (adult)	
sp 01 (nymph)	
Thripidae	THRI
Bregmatothrips	Bre
sp 01 (adult)	
sp 01 (nymph)	
Hemiptera	HEMI
sp 01 (missing)	
sp 02 (=CORE sp02)	
sp 03 (missing)	
sp 04 (missing)	
sp 05 (=LYGA sp04)	
sp 06 (=NABI sp02)	
sp 07 (=CORI sp02)	
Anthocoridae	ANTH
sp 01 (missing)	
sp 02 (adult)	
Coreidae	CORE
sp 01 (adult)	
sp 02 (adult)	
sp 01 (nymph)	
Corimelaenidae	
sp 01 (adult)	
sp 02 (adult)*	
Corizidae	CORI
sp 01 (adult)	
Cydnidae	CYDN
sp 01 (adult)*	
Lygaeidae	LYGA
sp 01 (adult) (missing)	
sp 04 (adult)	
sp 05 (adult) (=LYGA sp04)	
sp 07 (adult)*	
sp 01 (nymph)	
Blissus	Bli
sp 01 (adult)	
Emblethis	Emb
vicarius Harvath (=EMB sp01)	vic

APPENDIX II (Continued)

TAXON	ABBREVIATION
Lygaeus	Lyg
kalmii kalmii Stål (=Lyga sp 03)	kal
Neocoryphus	Neo
lateralis (Dallas)	lat
Nysius	Nys
raphanus Howa (=LYGA sp02)*	rap
Oncopeltus	Onc
fasciatus Dallas (=LYGA sp09)*	fas
Phlegius	Phl
annulicrus Stål (=LYGA sp08)*	ann
Pseudopamera	Pse
nitidula (Uhler) (=LYGA sp10)*	nit
Sphragisticus	Sph
nebulosus (Fallen)(=LYGA sp11)	neb
Xyonysius	Xyo
californicus Stål (=LYGA sp06)	cal
Miridae	MIRI
sp 01 (adult)*	
sp 02 (adult)*	
sp 03 (adult)*	
sp 04 (adult)*	
sp 05 (adult)*	
sp 06 (adult)*	
sp 07 (adult)*	
sp 08 (adult)*	
sp 09 (adult)*	
sp 10 (adult)*	
Nabidae	NABI
sp 01 (adult)	
sp 02 (adult)	
sp 01 (nymph)	
Neididae	NEID
sp 01 (adult)*	
Pentatomidae	PENT
sp 03 (adult)*	
sp 04 (adult)*	
Aelia	Ael
americana (Dallas) (=PENT sp01)	ame
Mecidea	Mec
sp 01 (adult) (=PENT sp02)*	
Peribalus	Per
limbolarius Stål (=PENT sp02)	lim
Phymatidae	PHYM
sp 01 (nymph)	
Piesmidae	PIES
sp 01 (adult)	
sp 02 (nymph)	
Pyrrhocoridae	PYRR
Araphe	Ara
sp 01 (adult)*	

APPENDIX II (Continued)

TAXON	ABBREVIATION
Reduviidae	REDU
sp 01 (adult)*	
sp 02 (adult)*	
sp 03 (adult)	
sp 02 (nymph)	
Arilus	Ari
cristatus (Linné) (=REDU sp04)	cri
Scutellaridae	SCUT
sp 01	
Tingidae	TING
sp 01 (adult)	
sp 02 (adult)	
Homoptera	HOMO
Aphidae	APHI
sp 01 (adult)	
Cicadellidae	CICA
sp 01 (adult)	
sp 02 (adult)	
sp 03 (adult)	
sp 04 (adult)	
sp 05 (adult)	
sp 06 (adult) (=CICA sp03)	
sp 07 (adult)	
sp 08 (adult)	
sp 09 (adult) (=CICA sp03)	
sp 10 (adult) (=CICA sp03)	
sp 11 (adult) (=Cixiidae)	
sp 12 (adult)*	
sp 13 (adult)*	
sp 14 (adult)*	
Cicadidae	CIC 1
sp 01 (adult)*	
Cixiidae	CIXI
sp 01 (adult)	
Dactylopidae	DACT
sp 01 (adult)	
Delphacidae	DELP
sp 01 (adult)	
Dictyopharidae	DICT
Scolops	Sco
sp 01 (adult)*	
sp 02 (adult)*	
Issidae	ISSI
Aphelonema	Aph
sp 01 (adult)*	
Membracidae	MEMB
sp 01 (adult)*	
sp 02 (adult)*	

APPENDIX II (Continued)

TAXON	ABBREVIATION
Pseudococcidae	PSEU
sp 01 (adult)	
sp 02 (adult)	
Coleoptera	COLE
sp 07 (adult)	
sp 09 (adult)	
sp 17 (adult)	
sp 20 (adult)	
sp 21 (adult)	
sp 22 (adult)	
Alleculidae	ALLE
sp 01 (adult)*	
Anobiidae	ANOB
sp 01 (adult) (=COLE sp23)	
Anthicidae	ANTH
sp 01 (adult)	
sp 02 (adult)	
sp 03 (adult)	
sp 04 (adult) (=ANTH sp02)	
sp 05 (adult) (=ANTH sp02)	
sp 06 (adult) (=ANTH sp01) 1971	
sp 07 (adult) (=ANTH sp03)	
sp 08 (adult) (=ANTH sp03)*	
sp 09 (adult)*	
Notoxus	Not
sp 01 (adult)	
Bruchidae	BRUC
sp 01 (adult)*	
Buprestidae	BUPR
sp 01 (adult)*	
Cantharidae	CANT
Chauliognathus	Cha
sp 01 (adult)*	
sp 02 (adult)*	
Carabidae	CARA
sp 01 (adult)	
sp 02 (adult)	
sp 03 (adult)	
sp 04 (adult) (=CARA sp01)	
sp 05 (adult)	
sp 06 (adult) (=TENE sp02)	
sp 07 (adult)	
sp 08 (adult)*	
sp 09 (adult)	
sp 10 (adult) (=*Pasimachus*)	
sp 11 (adult)*	
sp 12 (adult)*	
sp 14 (adult)*	
sp 15 (adult)*	

APPENDIX II (Continued)

TAXON	ABBREVIATION
sp 16 (adult) (=*Calasoma* sp01)*	
sp 17 (adult)*	
sp 18 (adult)*	
sp 19 (adult) (=*Scarites* sp01)*	
sp 20 (adult)*	
sp 21 (adult)*	
sp 22 (adult)*	
sp 23 (adult)*	
Colliurus	Col
pennsylvanicus (Linné)(=CARA sp24)*	pen
Harpalus	Har
caliginosus (Fab.)(=CARA sp13)*	cal
Cerambycidae	CERA
Tetraops	Tet
femoratus Lec.*	fem
Chrysomelidae	Chry
sp 01 (adult)(=Phyllotrela?)	
sp 02 (adult)(=CHRY sp01)	
sp 03 (adult)(=*Psylliades & Chaetocnema* spp.)	
sp 04 (adult)	
sp 06 (adult)	
sp 10 (adult)(=*Altica* sp01)*	
sp 11 (adult)	
sp 12 (adult)(=COLE sp24)	
sp 13 (adult)*	
Blepharida	Ble
rhois (Forester)(=CHRY sp05)	rho
Diabrotica	Dia
undecimpunctata Mann. (=CHRY sp08)*	und
Galerucella	Gal
luteola (Muller)(=CHRY sp07)*	lut
Leptinotarsa	Lep
decimlineata (Say)(=CHRY sp09)*	dec
Cicindellidae	CICI
Cicindela	Cic
obsoleta	obs
prasina Lec.	pra
punctulata	pun
punctulata Olivier	pun
Cleridae	CLER
Enoclerus	Eno
sp 01	
Coccinellidae	COCC
sp 01 (missing)	
sp 04 (adult)(=May equal COCC sp03)	
sp 05 (adult)	
Hippodamia	Hip
convergens (Guerin)(=COCC sp02)	con

APPENDIX II (Continued)

TAXON	ABBREVIATION
Hyperapsis	
sp 01 (adult)(=COCC sp03)	Hyp
Olla	Oll
addominalis (Say)(=COCC sp06)	add
Curculionidae	CURC
Anacentrinus	Ana
deplanatus (Casey)*	dep
Anthonomus	Ant
squamosus Lec.	squ
Apion	
sp 01	Api
Baris	
sp 01*	Bar
Ceutorhynchus	Ceu
convexicollis (Lec.)	con
Endalus	End
limatulus (Gyll.)*	lim
Gerstaeckeria	Ger
lecontei (Lec.)	lec
porosa (Lec.)	por
indistincta O'Brien	ind
basalis (Lec.)	bas
Hyperodes	
sp 01	Hyp
Listronotus	Lis
similis Henerson*	sim
Macrorhoptrus	Mac
hispidus	his
Mesagroicus	Mes
parmerensis Burke	par
Ophryastes	Oph
vittatus (Say)(=CURC sp10)	vit
Pnigodes	
sp 01	Pni
Promecotarsus	Pro
densus Casey*	den
Smicronyx	Smi
fulvus Lec.*	ful
sordidus Lec.*	sor
centralis Dietz*	cen
Sphenophorus	Sph
compressirostris (Say)	com
Tanymecus	Tan
confertus (Gyll.)*	con
Trichobaris	Tri
texana *	tex
Tychius	Tyc
soltavi Casey	sol
Dasytidae	
sp 01 (adult)*	DASY

APPENDIX II (Continued)

TAXON	ABBREVIATION
Elateridae	ELAT
sp 01 (adult)	
sp 02 (adult)	
sp 03 (adult)	
Histeridae	HIST
sp 01 (adult)	
sp 02 (adult)*	
sp 03 (adult)*	
Lathridiidae	LATH
sp 01 (adult)	
Malachiidae	MALA
sp 01 (adult)	
sp 02 (adult)*	
sp 03 (adult)*	
Meloidae	MELO
sp 04 (adult)*	
sp 05 (adult)*	
sp 06 (adult)*	
sp 07 (adult)*	
sp 01 (larva)	
Melyridae	MELY
sp 01 (larva)	
Mordellidae	MORD
sp 01 (adult)*	
sp 02 (adult)*	
Nitidulidae	NITI
sp 01 (adult)*	
Pselaphidae	PSEL
sp 01 (adult)	
Scaphidiidae	SCAP
sp 01 (adult)	
Scarabaeidae	SCAR
sp 02 (adult)	
Aphodius	Aph
lividus (Oliv.)(=SCAR sp01)	liv
Bolbocerastes	Bol
serratus Lec. (=SCAR sp05)	ser
Canthon	can
sp 01 (adult)(=SCAR sp06)*	
Ochodaeus	Och
sp 01 (adult)(=SCAR sp04)	
Phyllophaga	Phy
sp 01 (adult)(=SCAR sp03)	
sp 02 (adult)(=SCAR sp07)*	
lanceolata (Say)(=SCAR sp08)*	lan
Silphidae	SILP
sp 01 (adult)*	
Staphylinidae	STAP
sp 01 (adult)	
sp 02 (adult)	

APPENDIX II (Continued)

TAXON	ABBREVIATION
sp 03 (adult)	
sp 04 (adult)*	
Tenebrionidae	
sp 02 (adult)	TENE
sp 03 (adult)	
sp 04 (adult) (=TENE sp02)	
sp 06 (adult)	
sp 01 (larva)	
Eleodes	
opaca (Say) (=TENE sp01)	Ele
suturalis	Opa
texana Lec. (=TENE sp05)	sut
tricostata (Say)*	tex
	tri
Neuroptera	
Myrmeleontidae	NEUR
sp 01 (adult)	MYRM
sp 01 (larva)	
Chrysopidae	
sp 01 (adult)*	CHRY
Lepidoptera	
sp 01 (adult)	LEPI
sp 02 (adult)	
sp 03 (adult)	
sp 04 (adult)	
sp 05 (adult)	
sp 06 (adult)*	
sp 07 (adult)*	
sp 08 (adult)*	
sp 01 (larva)	
sp 02 (larva)	
sp 03 (larva)	
sp 04 (larva)	
sp 05 (larva)	
Arctiidae	
Apantesis	ARCT
vittatus Fab. (adult)*	Apa
Noctuidae	vit
sp 01 (adult)*	NOCT
sp 02 (adult)*	
sp 03 (adult)*	
sp 04 (adult)*	
sp 05 (adult)*	
sp 06 (adult)*	
sp 07 (adult)*	
sp 08 (adult)*	
sp 09 (adult)*	
sp 10 (adult)*	
ap 11 (adult)*	
sp 01 (larva)	

APPENDIX II (Continued)

TAXON	ABBREVIATION
Autographus	Aut
sp 01 (adult)*	
sp 02 (adult)*	
Schinia	Sch
tertia Grote*	ter
Theracia	The
flabicosta Smith*	fla
Pieridae	PIER
Colias	Col
eurytheme	eur
keewaydin Edwards*	kee
Pterophoridae	PTER
sp 01 (adult)*	
Satyridae	SATY
sp 01 (larva)	
Sphingidae	SPHI
Celerio	Cel
lineata Fab.	lin
Diptera	DIPT
sp 01 (adult)	
sp 02 (adult)	
sp 03 (adult)	
sp 04 (missing)	
sp 05 (adult)	
sp 06 (adult)(=DIPT sp02)	
sp 07 (adult)	
sp 08 (adult)(=HYME,CHAL)	
sp 09 (adult)	
sp 10 (adult)(=HYME,CHAL)	
sp 11 (adult)(=DIPT sp09)	
sp 12 (adult)	
sp 13 (adult)	
sp 14 (adult)(=DIPT sp07)	
sp 15 (adult)	
sp 18 (missing)	
sp 19 (missing)	
sp 20 (adult)(=DIPT sp12)	
sp 21 (adult)	
Asilidae	ASIL
sp 01 (adult)	
sp 03 (adult)*	
sp 04 (adult)*	
sp 05 (adult)*	
sp 06 (adult)*	
sp 07 (adult)*	
Bombyliidae	BOMB
sp 01 *	
sp 02 *	
sp 03 *	
sp 04 *	

APPENDIX II (Continued)

TAXON	ABBREVIATION
Calliphoridae	CALL
sp 01	
sp 02*	
Chirondmidae	CHIR
sp 01*	
sp 02*	
Chloropidae	CHLO
sp 01*	
Culicidae	CULI
Aedes	Aed
sp 01*	
Anopheles	Ano
sp 01*	
Culex	Cul
*tarsalis**	tar
Psorophora	Pso
ciliata *	cil
Muscidae	MUSC
Musca	Mus
domestica	dom
Psychodidae	PSYC
sp 01 (adult)(=DIPT sp16)	
Sciaridae	SCIA
sp 01 (adult)(=DIPT sp17)	
Sepsidae	SEPS
Sepsis	Sep
sp 01*	
Syrphidae	SYRP
sp 04*	
Baccha	Bac
clavata Fab. (=SYRP sp02)*	cla
Eristalis	Eri
aeneus (Scopoli)(=SYRP sp03)*	aen
Mesograpta	Mes
marginata (Say)(=SYRP sp01)	mar
Tabanidae	TABA
Tabanus	Tab
sp 01 (adult)*	
Tachinidae	TACH
sp 01 (adult)*	
sp 02 (adult)*	
Tephritidae	TEPH
sp 01 (adult)*	
Therevidae	Ther
sp 01 (adult)(=ASIL sp02)	
sp 02 (adult)*	
Hymenoptera	HYME
Apoidea	APOI

APPENDIX II (Continued)

TAXON	ABBREVIATION
Apidae	APID
sp 02 (adult)*	
sp 03 (adult)*	
sp 04 (adult)*	
sp 05 (adult)*	
Hemisialanosa	Hem
sp 01 (adult)*	
Halictidae	HALI
sp 01 (adult)*	
sp 02 (adult)*	
sp 03 (adult)*	
sp 04 (adult)*	
Megachilidae	MEGA
sp 01 (adult)*	
Bethyloidea	BETH
Dryinidae	DRYI
sp 01 (adult)	
Gonotopus	Gon
sp 01 (adult)	
Chalcidoidea	CHAL
sp 01 (adult)(=HYME sp01)	
sp 02 (adult)(=HYME sp03)	
sp 04 (adult)	
sp 05 (adult)(=HYME sp11)	
sp 06 (adult)	
sp 07 (adult)	
sp 08 (missing)	
sp 09 (adult)(=HYME sp01)	
sp 10 (adult)(=HYME sp02)	
sp 11 (adult)(=HYME sp10 & sp13)	
sp 12 (missing)	
Chalcididae	CHA 1
sp 01 (adult)(=HYME sp07)	
sp 02*	
Mymaridae	MYMA
sp 01 (adult)(=HYME sp08)	
Ichneumonoidea	ICHN
Ichneumonidae	ICH 1
sp 01 (adult)*	
Compsocryptus texensis	Com tex
Braconidae	BRAC
sp 01 (adult)*	
sp 03 (adult)*	
sp 04 (adult)*	
sp 05 (adult)*	
sp 06 (adult)*	
sp 07 (adult)*	

APPENDIX II (Continued)

TAXON	ABBREVIATION
Iphianlax	Iph
sp 01 (adult)*	
Proctotrupoidea	PROC
sp 01 (adult)(=HYME sp03, sp06 & sp09)	
sp 02 (adult)(=HYME sp05)	
Scolioidea	SCOL
Formicidae	FORM
sp 01 (adult)	
sp 02 (adult)	
sp 03 (adult)	
sp 04 (adult)(=FORM sp01)	
sp 07 (adult)(=FORM sp02)	
sp 08 (adult)(=FORM sp02)	
sp 09 (adult)(=FORM sp10)	
sp 10 (adult)(=FORM sp01)	
Crematogaster	Cre
sp 01 (adult)	
sp 02 (adult)(=HYME sp06)	
Pogonomyrmex	Pog
sp 01 (adult)(=HYME sp05)	
Sphecoidea	SPHE
Sphecidae	SPH 1
sp sp 02 (adult)*	
sp 04 (adult)*	
sp 05 (adult)(=HYME sp16)	
Chlorion	Chl
sp 01 (adult)(=SPHE sp01)*	
Sphex	Sph
sp 01 (adult)(=SPHE sp03)*	
Tenthredinoidea	TENT
Diprionidae	DIPR
sp 01 (adult)*	
Vespoidea	VESP
Pompilidae	POMP
sp 01 (adult)*	
Araneida	ARAN
sp 01 (adult)	
Lycosidae	LYCO
sp 01 (adult)	
sp 02 (adult)	
Salticidae	SALT
sp 01 (adult)	

APPENDIX II (Continued)

TAXON	ABBREVIATION
Microaraneidae	MICR
Solpugida	SOLP

*Specimens taken not by quick trap, but as the result of a survey.

APPENDIX III

FIELD DATA

Insect population data collected at the Pantex Site in 1970 and 1971 is Grassland Biome data set A2U300A. Data were collected on form NREL-30. A copy of the form and an example of the data are attached.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - INVERTEBRATE

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	QUADRAT	TROPHIC	HOST	ORDER	FAMILY	GENUS	SPECIES	SUBSPECIES	LIFE STAGE	TOTAL NO.	DRY WT.	NO. WEIGH
			Day	Mo	Yr															
1-2	3-4	5-7	8-9	10-11	12-[illegible]	14	[illegible]	[illegible]	[illegible]	23	25-29	31-33	35-37	39-40	42-43	45	47-48	50-55	57-62	64-[illegible]

DATA TYPE
- 01 Aboveground Biomass
- 02 Litter
- 03 Belowground Biomass
- 10 Vertebrate - Live Trapping
- 11 Vertebrate - Snap Trapping
- 12 Vertebrate - Collection
- 20 Avian Flush Census
- 21 Avian Road Count
- 22 Avian Road Count Summary
- 23 Avian Collection - Internal
- 24 Avian Collection - External
- 25 Avian Collection - Plumage
- 30 Invertebrate
- 40 Microbiology - Decomposition
- 41 Microbiology - Nitrogen
- 42 Microbiology - Biomass
- 43 Microbiology - Root Decomposition
- 44 Microbiology - Respiration

SITE
- 01 Ale
- 02 Bison
- 03 Bridger
- 04 Cottonwood
- 05 Dickinson
- 06 Hays
- 07 Hopland
- 08 Jornada
- 09 Osage
- 10 Pantex
- 11 Pawnee

TROPHIC
- 0 Unknown
- 1 Plant feeding (tissue)
- 2 Plant feeding (sap)
- 3 Plant feeding (pollen and nectar)
- 4 Plant feeding (seed)
- 5 Predator
- 6 Parasitoid
- 7 Parasite
- 8 Scavenger
- 9 Non-feeding stage

TREATMENT
- 1 Ungrazed
- 2 Lightly grazed
- 3 Moderately grazed
- 4 Heavily grazed
- 5 Grazed 1969, ungrazed 1970
- 6
- 7
- 8
- 9

LIFE STAGE
- 00 Undetermined
- 10 Adult
- 20 Pupae
- 30 Egg
- 40 Nymph or Larva
- 41 Nymph or Larva, early
- 42 Nymph or Larva, middle
- 43 Nymph or Larva, late
- 50 Instar
- 51 Instar, 1st
- 52 Instar, 2nd
- 53 Instar, 3rd

+++ EXAMPLE OF DATA +++

```
         1         2         3         4         5         6
123456789012345678901234567890123456789012345678901234567890123456789

3010GRG21067111   .5 1 5      THY2PHLOOED      10     5  .0004   12
3010GRG21067111   .5 1 1      COLECHRY       2 10     1  .0001    1
3010GRG21067111   .5 1 8      COLETENE       2 10     7  .3044   65
3010GRG21067111   .5 1 1      COLEELAT       1 10    47  .0377  485
3010GRG21067111   .5 1 1      COLEANTH       3 10     1  .0019    4
3010GRG21067111   .5 1 5      ARAN             00     2  .0150   33
3010GRG21067111   .5 1 0      COLE           7 10     2  .0006    2
3010GRG21067111   .5 1 5      ARAN             00     4
3010GRG21067111   .5 2 2      HOMOAPHI         10     4  .0006    4
3010GRG21067111   .5 2 5      THY2PHLOOED      10     2
3010GRG21067111   .5 2 1      COLEELAT       1 10    22
3010GRG21067111   .5 2 8      COLETENE       2 10     9
3010GRG21067111   .5 2 1      COLEANTH       1 10     1  .0004    2
3010GRG21067111   .5 2 5      COLEHIST       1 10     1
3010GRG21067111   .5 2 5      ARAN             00     4
3010GRG21067111   .5 2 5      ARAC             10    15
3010GRG21067111   .5 2 0      COLESCAR       2 10     1  .0561    2
3010GRG21067111   .5 2 6      HYMEFORMCRE    1 10    78  .0533  243
3010GRG21067111   .5 2 2      HEMIPIES       1 10     1  .0003    1
3010GRG21067111   .5 2 1      COLEELAT       2 10     1  .0626    5
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3010GRG21067111   .5 3 8      COLETENE       2 10     3
3010GRG21067111   .5 3 6      HYMEFORMCRE    1 10   154
3010GRG21067111   .5 3 5      ARAN             00     2
3010GRG21067111   .5 4 5      THY2PHLOOED      10     3
3010GRG21067111   .5 4 8      COLETENE       2 10    11
3010GRG21067111   .5 4 1      COLEELAT       1 10   100
3010GRG21067111   .5 4 5      COLECARA       4 10     1  .0172    1
3010GRG21067111   .5 4 5      ARAN             00     5
3010GRG21067111   .5 4 1      COLEELAT       2 10     2
3010GRG21067111   .5 4 5      ARAC             00     1
3010GRG21067111   .5 4 5      COLECOCC       4 10     1
3010GRG21067111   .5 5 8      COLETENE       2 10     9
3010GRG21067111   .5 5 1      COLEELAT       1 10    35
3010GRG21067111   .5 5 5      ARAN             00     2
3010GRG21067111   .5 5 0      COLESCAR       2 10     1
3010GRG21067111   .5 5 1      COLEELAT       2 10     1
3010GRG21067111   .5 5 5      ARAC             00    16
3010GRG21067111   .5 5 1      COLEMELY       1 40     1  .0019    1
3010GRG21067111   .5 6 0      HEMILYGAGEO    1 10     1  .0010    1
3010GRG21067111   .5 6 8      COLETENE       2 10    17
```

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3010GRG21067111	.5	6	1	COLEANTH	3	10	3		
3010GRG21067111	.5	6	6	HYMEFORM	3	10	1	.0001	2
3010GRG21067111	.5	6	5	ARAN		00	11		
3010GRG21067111	.5	6	5	ARAC		00	9		
3010GRG21067111	.5	6	6	HYMEFORMPOG	1	10	1	.0025	1
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3010GRG21067111	.5	6	6	HYMEFORMCRE	1	10	11		
3010GRG21067111	.5	6	1	COLECHRY	1	10	1	.0004	1
3010GRG21067112	.5	1	5	THY2PHLOOED		10	2	.0016	11
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3010GRG21067112	.5	2	8	COLETENE	2	10	5		
3010GRG21067112	.5	2	1	COLEELAT	1	10	3	.0018	7
3010GRG21067112	.5	2	0	COLECURCGER		10	4		
3010GRG21067112	.5	2	5	ARAN		00	6		
3010GRG21067112	.5	2	5	ARAC		00	3		
3010GRG21067112	.5	2	2	HOMOCTCA	1	40	1	.0001	1
3010GRG21067112	.5	3	1	ORTHACRI	1	40	1	.0155	1
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3010GRG21067112	.5	3	1	COLEELAT	2	10	2	.0269	2
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3010GRG21067112	.5	3	5	ARAN		00	1		
3010GRG21067112	.5	3	5	ARAC		00	12		
3010GRG21067112	.5	3	1	COLEELAT	1	10	2		
3010GRG21067112	.5	3	5	COLECARA	7	10	1	.0016	2
3010GRG21067112	.5	3	0	COLECURCTYC		10	1	.0029	1
3010GRG21067112	.5	3	0	COLECURCGER		10	1		
3010GRG21067112	.5	4	8	COLETENE	2	10	1		
3010GRG21067112	.5	4	1	COLEELAT	1	10	1		
3010GRG21067112	.5	4	5	ARAN		00	2		
3010GRG21067112	.5	4	5	ARAC		00	4		
3010GRG21067112	.5	5	1	COLLENTO		10	2	.0001	2
3010GRG21067112	.5	5	5	THY2PHLOOED		10	1		
3010GRG21067112	.5	5	9	COLETENE	2	10	2		
3010GRG21067112	.5	5	0	COLESCAR	2	10	1		
3010GRG21067112	.5	5	1	COLEELAT	1	10	1		
3010GRG21067112	.5	5	5	ARAN		00	8		
3010GRG21067112	.5	5	5	ACAR		00	12		
3010GRG21067112	.5	5	2	HOMOCTCA	8	10	1	.0006	1
3010GRG21067112	.5	5	0	COLECURCGER		10	1		
3010GRG21067112	.5	5	0	COLE	7	10	2	.0004	2
3010GRG21067112	.5	6	5	THY2PHLOOED		10	2		
3010GRG21067112	.5	6	0	COLESCAR	2	10	2		
3010GRG21067112	.5	6	0	COLECHRY	3	10	1	.0109	1
3010GRG21067112	.5	6	5	COLECARA	7	10	1		
3010GRG21067112	.5	6	6	HYMEFORM	2	10	2	.0006	2
3010GRG21067112	.5	6	5	ARAN		00	1		
3010GRG21067112	.5	6	5	ACAR		00	3		
3010GRG21067112	.5	6	0	COLECURCGER		10	2		
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3010GRG21067131	.5	1	1	COLEELAT	1	10	40	.0347	440
3010GRG21067131	.5	1	5	COLECARA	4	10	5	.1248	12
3010GRG21067131	.5	1	8	COLETENE	1	10	2	.4884	17
3010GRG21067131	.5	1	5	COLECOCC	4	10	1	.0042	4
3010GRG21067131	.5	1	5	ARAN		00	8	.0193	24
3010GRG21067131	.5	1	6	HYMEFORMPOG		10	20	.1166	31
3010GRG21067131	.5	1	8	COLETENE	2	10	80	2.1484	447
3010GRG21067131	.5	1	0	HEMICORE	1	40	6	.0336	9
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3010GRG21067131	.5	1	0	COLECURCGER		10	1	.0964	5
3010GRG21067131	.5	1	6	HYMEFORMCRE	1	10	53	.0453	179
3010GRG21067131	.5	1	1	COLECHRY	3	10	1	.0014	2
3010GRG21067131	.5	1	0	COLE	7	10	1	.0018	3
3010GRG21067131	.5	1	6	HYMEFORM	3	10	21	.0013	29
3010GRG21067131	.5	2	5	THY2PHLOOED		10	2		
3010GRG21067131	.5	2	5	COLECARA	4	10	3		
3010GRG21067131	.5	2	8	COLETENE	2	10	26		
3010GRG21067131	.5	2	1	COLEELAT	1	10	51		
3010GRG21067131	.5	2	6	HYMEFORMPOG		10	6		
3010GRG21067131	.5	2	0	HEMICORE	1	10	2	.0510	2
3010GRG21067131	.5	2	5	COLECOCC	4	10	2		
3010GRG21067131	.5	2	1	COLEANTH	1	10	1	.0017	8
3010GRG21067131	.5	2	5	ACAR		00	1		
3010GRG21067131	.5	3	5	THY2PHLOOED		10	6		
3010GRG21067131	.5	3	0	COLE	6	40	3	.0013	3
3010GRG21067131	.5	3	1	COLEELAT	1	10	9		
3010GRG21067131	.5	3	8	COLETENE	1	10	5		
3010GRG21067131	.5	3	8	COLETENE	2	10	82		
3010GRG21067131	.5	3	0	NEURMYRE	1	40	3	.0173	3
3010GRG21067131	.5	3	1	COLEELAT	2	10	2		
3010GRG21067131	.5	3	0	HEMICORE	1	40	3		
3010GRG21067131	.5	3	0	COLEMELY	1	40	1	.0079	3
3010GRG21067131	.5	3	2	HOMOCICA	5	10	1	.0025	1
3010GRG21067131	.5	3	6	HYMEFORMCRE		10	5		
3010GRG21067131	.5	4	0	COLEMELY	1	40	2		
3010GRG21067131	.5	4	5	THY2PHLOOED		10	3		
3010GRG21067131	.5	4	1	COLECHRY	3	10	1		
3010GRG21067131	.5	4	0	COLE	5	40	1	.0023	1
3010GRG21067131	.5	4	8	COLETENE	2	10	133		
3010GRG21067131	.5	4	5	COLECARA	4	10	1		
3010GRG21067131	.5	4	1	COLEELAT	2	10	1		
3010GRG21067131	.5	4	5	COLECOCC	4	10	1		
3010GRG21067131	.5	4	5	ACAR		00	1		
3010GRG21067131	.5	4	5	ARAN		00	2		
3010GRG21067131	.5	4	1	COLEELAT	1	10	51		
3010GRG21067131	.5	4	8	COLETENE	1	10	8		
3010GRG21067131	.5	4	0	COLECURCCRE	1	10	2		
3010GRG21067131	.5	4	6	HYMEFORMPOG		10	1		
3010GRG21067131	.5	4	0	COLESCAR	1	10	3		
3010GRG21067131	.5	4	1	COLEANTH	1	10	1		
3010GRG21067131	.5	4	6	HYMEFORM	3	10	8		
3010GRG21067131	.5	5	5	THY2PHLOOED		10	4		
3010GRG21067131	.5	5	1	COLECHRY	1	10	6	.0048	25
3010GRG21067131	.5	5	8	COLETENE	2	10	67		

3010GRG21067131	.5	5	1	COLEELAT	1	10	31		
3010GRG21067131	.5	5	8	COLETENE	1	10	1		
3010GRG21067131	.5	5	6	HYMEFORMCRE	1	10	94		
3010GRG21067131	.5	5	5	ARAN		00	3		
3010GRG21067131	.5	5	0	COLECURCGER		10	2		
3010GRG21067131	.5	6	5	THY2PHLOOED		10	6		
3010GRG21067131	.5	6	1	COLECHRY	1	10	5		
3010GRG21067131	.5	6	8	COLETENE	2	10	12		
3010GRG21067131	.5	6	1	COLEELAT	1	10	1		
3010GRG21067131	.5	6	6	HYMEFORM	2	10	4	.0031	25
3010GRG21067131	.5	6	5	ARAN		00	1		
3010GRG21067131	.5	6	8	COLETENE	1	10	1		
3010GRG21067131	.5	6	0	COLECURCGER		10	1		
3010GRG21067132	.5	1	5	THY2PHLOOED		10	8	.0017	42
3010GRG21067132	.5	1	8	COLETENE	2	10	19	.0944	222
3010GRG21067132	.5	1	1	COLEELAT	1	10	11	.0026	18
3010GRG21067132	.5	1	6	HYMEFORMCRE	1	10	3	.0646	294
3010GRG21067132	.5	1	5	ARAN		00	1	.0094	11
3010GRG21067132	.5	1	6	HYMEFORMPOG		10	1	.0278	8
3010GRG21067132	.5	2	5	THY2PHLOOED		10	2		
3010GRG21067132	.5	2	1	COLECHRY	3	10	9	.0010	10
3010GRG21067132	.5	2	8	COLETENE	1	10	2	.7525	12
3010GRG21067132	.5	2	8	COLETENE	2	10	1		
3010GRG21067132	.5	2	1	COLEANTH	1	10	2	.0003	2
3010GRG21067132	.5	2	6	HYMEFORMCRE		10	69		
3010GRG21067132	.5	2	0	HEMICORE	1	40	1	.0203	3
3010GRG21067132	.5	2	0	COLEMELY	1	40	1	.0036	2
3010GRG21067132	.5	3	5	THY2PHLOOED		10	2		
3010GRG21067132	.5	3	8	COLETENE	2	10	75		
3010GRG21067132	.5	3	0	COLESCAR	1	10	2	.0019	2
3010GRG21067132	.5	3	1	COLEELAT	1	10	4		
3010GRG21067132	.5	3	8	COLETENE	1	10	5		
3010GRG21067132	.5	3	6	HYMEFORMCRE	1	10	114		
3010GRG21067132	.5	3	5	ARAN		00	1		
3010GRG21067132	.5	3	5	COLECARA	4	10	1	.0866	8
3010GRG21067132	.5	3	0	NEURMYRM	1	40	2	.0103	4
3010GRG21067132	.5	3	0	COLECURCGER		10	1	.0979	6
3010GRG21067132	.5	3	0	HEMICORE	1	40	1		
3010GRG21067132	.5	3	1	COLEELAT	2	10	1	.0234	3
3010GRG21067132	.5	3	5	COLECOCC	4	10	1	.0002	1
3010GRG21067132	.5	4	8	COLETENE	1	10	4		
3010GRG21067132	.5	4	8	COLETENE	2	10	60		
3010GRG21067132	.5	4	1	COLEELAT	1	10	3		
3010GRG21067132	.5	4	1	COLEANTH	2	10	3	.0003	3
3010GRG21067132	.5	4	6	HYMEFORMCRE	1	10	53		
3010GRG21067132	.5	4	5	ARAN		00	2		
3010GRG21067132	.5	4	0	COLE	7	10	1		
3010GRG21067132	.5	4	5	COLECARA	4	10	4		
3010GRG21067132	.5	4	0	COLECURCGER		10	2		
3010GRG21067132	.5	4	6	HYMEFORMPOG		10	2		
3010GRG21067132	.5	4	0	HEMICORE	1	40	1		
3010GRG21067132	.5	4	0	COLEMELY	1	40	1		
3010GRG21067132	.5	5	1	ORTHACRT	1	40	1	.0012	1
3010GRG21067132	.5	5	5	THY2PHLOOED		10	24		

3010GRG21067132	.5	5	8	COLETENE	2	10	53		
3010GRG21067132	.5	5	5	COLECARA	4	10	3		
3010GRG21067132	.5	5	8	COLETENE	1	10	1		
3010GRG21067132	.5	5	1	COLEELAT	2	10	1		
3010GRG21067132	.5	5	6	HYMEFORMCRE		10	45		
3010GRG21067132	.5	5	0	NEURMYRM	1	40	1		
3010GRG21067132	.5	5	5	ARAN		00	6		
3010GRG21067132	.5	5	6	HYMEFORMPOG		10	2		
3010GRG21067132	.5	5	0	COLECURCGER		10	2		
3010GRG21067132	.5	5	1	COLECHRY	3	10	1		
3010GRG21067132	.5	6	5	THY2PHLOOED		10	6		
3010GRG21067132	.5	6	8	COLETENE	2	10	11		
3010GRG21067132	.5	6	0	COLEMYRM	1	40	1		
3010GRG21067132	.5	6	6	HYMEFORMCRE	1	10	11		
3010GRG21067132	.5	6	5	ARAN		00	1		
3010GRG21067132	.5	6	0	COLECURCGER		10	1		
3010GRG21067132	.5	6	5	COLECARA	10	01	0	1	
3010GRG21067132	.5	6	1	COLEELAT	2	10	1		
3010GRG21067132	.5	6	6	HYMEFORMPOG	1	10	3		
3010GRG21067132	.5	6	0	NEURMYRM	1	40	1		
3010GRG21067132	.5	6	6	HYMEFORM	6	10	88	.0192	88