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# INSECT POPULATION STUDIES

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## ABSTRACT

Insect populations on the Pantex Site, U.S. IBP, were quantitatively sampled by "quick trap--D-VAC" combination at two-week intervals from April 10, 1970 to October 23, 1970 inclusive. Qualitative samples were taken by pitfall traps, light traps, sweep net, and observation. Three treatment effects were tested--ungrazed, moderately grazed, and grazed 1969/ungrazed 1970. Each treatment sample consisted of two replications of six randomly selected quadrats. A circular area of 0.5 $m^2$ was covered by the "quick trap" in each quadrat. Plant litter and insects collected in the "D-VAC" bags were placed in Berlese funnels and left for 48 hours under a 60-watt light bulb. The insects were collected in alcohol. Insects were sorted to easily recognized taxa--family level or below. A bimodal trend in insect numbers was detected during the season. The first maximum occurred in August and was caused by false chinch bug adults and nymphs of these and other Lygaeidae. The maximum number of insects collected per square meter was 5350. Insect biomass was at a maximum in August with 0.20 $g/m^2$. The percentages of piercing-sucking phytophagous insects tended to exceed the percentages of biting-chewing phytophagous insects in both numbers and biomass. Total insect biomass is expected to exceed 2.0 $g/m^2$. The lower figures this season were due to imperfection in sampling and extraction of the insects and less than normal rainfall during the season.

## DESCRIPTION OF SAMPLED AREAS

Three treatments were used: treatment 1, ungrazed; treatment 3, moderately grazed; and treatment 5, grazed 1969/ungrazed 1970. Physical description of treatment areas is found in IBP Grassland Biome Technical Report #45.

Sampling grids (Fig. 1) are 360 x 360 feet (108 x 108 m) giving 900 one hundred fourty four square feet (13 $m^2$) quadrats. One hundred quadrats per replicate were randomly selected for sampling. Each treatment consists of one grid each. Six quadrats are sampled per replicate each sampling date.

## METHODS OF SAMPLING

The principal sampling method in use at the Pantex Comprehensive Network Site for qualitative and quantitative samples of aboveground insect populations is the "quick trap" and "D-VAC" combination. On the evening before sampling, traps are suspended from tripods situated over the designated sampling station. On the following day, each trap is dropped immediately before the sample is taken. This system samples 1/2 square meter in circular format. Once the sample has been taken, it is placed in a Berlese funnel constructed from a 30 pound lard can and extracted under a 60-watt light bulb for 48 hours. The extracted insects are collected in alcohol, then counted and sorted to easily recognized taxa. Generally this is to family level or below. These sorted insects are dried for 48 hours at 70°C and weighed on a Mettler balance to determine biomass.

Pitfall traps partially filled with glycerine have been tested as a qualitative method of evaluating the efficiency of the "quick trap" for insects active on the soil surface. Two patterns of pitfalls are used:

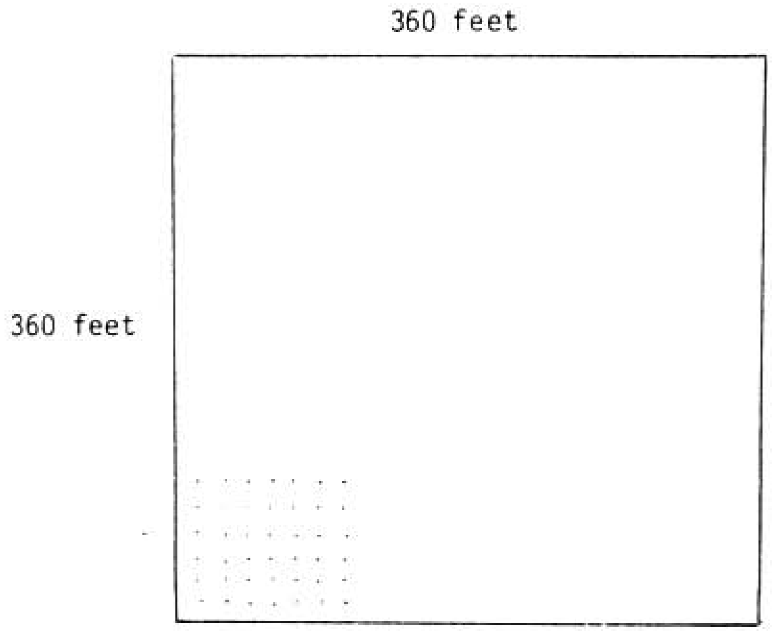


Fig. 1. Sampling replicate with grid

two transects of 10 traps per line on each of three treatments, and two grids of 144 pitfalls each on treatment 5 only. Pitfalls in the transects are 3 m apart and the pitfalls in the 12 x 12 grids are 2 m apart. The grids have been used for population studies with limited success. One grid is fenced to eliminate immigration and emigration, the other grid is unfenced. Several "capture-recapture" studies have been run on Tenebrionidae and Carabidae. Data have not been analyzed.

Comparisons between the "quick trap" and sweep net have been made in 1969 and 1970. Observations by investigators of nocturnal cactiphagous weevils have recorded a State record for one species and host data and type locality for another species. Attempts at qualitative and quantitative comparisons between light traps using white light and black light as their source of attraction for insects were unrewarding due to cool temperatures and high surface winds.

Expansion and refinement of the above studies plus new sampling methods for above- and belowground arthropods will be used in the 1971 season.

## STATUS OF 1970 SAMPLES

Beginning 10 April 1970, samples were taken by "quick trap" at approximately two-week intervals. Beginning 23 October 1970, samples will be taken at one month intervals until April 1971. The status of 1970 samples as of early December is shown in Table 1. Data from these samples are summarized in Appendix 1.

## INTERPRETATION OF DATA

Insect populations showed a bimodal trend during the season (Fig. 2, 3, 4, and 5). In May, the first maximum occurred for all treatments; the

Table 1. Status of quick trap samples, Pantex Site, 1970.

| Date | Counted | Weighed | Data Analyzed |
|---|---|---|---|
| 10 April 70 | x | * | x |
| 2 May 70 | x | * | x |
| 15 May 70 | x | * | x |
| 1 June 70 | x | * | x |
| 14 June 70 | x | x | x |
| 30 June 70 | x | x | x |
| 15 July 70 | x | x | x |
| 30 July 70 | x | x | x |
| 8 August 70 | x | x | x |
| 25 August 70 | x | x | x |
| 9 Sept. 70 | x | x | x |
| 19 Sept. 70 | x | x | x |
| 3 Oct. 70 | | | |
| 23 Oct. 70 | | | |
| 20 Nov. 70 | | | |

*Weighing not begun until 14 June 70 sample.

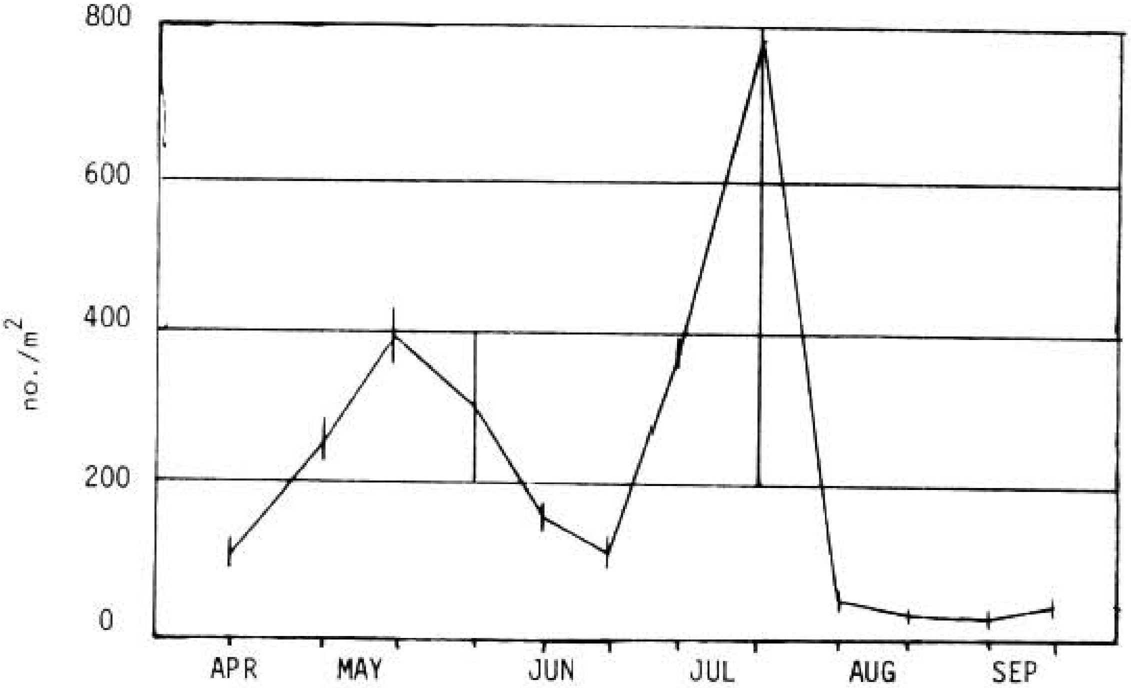


Fig. 2. Insect numbers per $m^2$, Pantex Site, 1970
Ungrazed

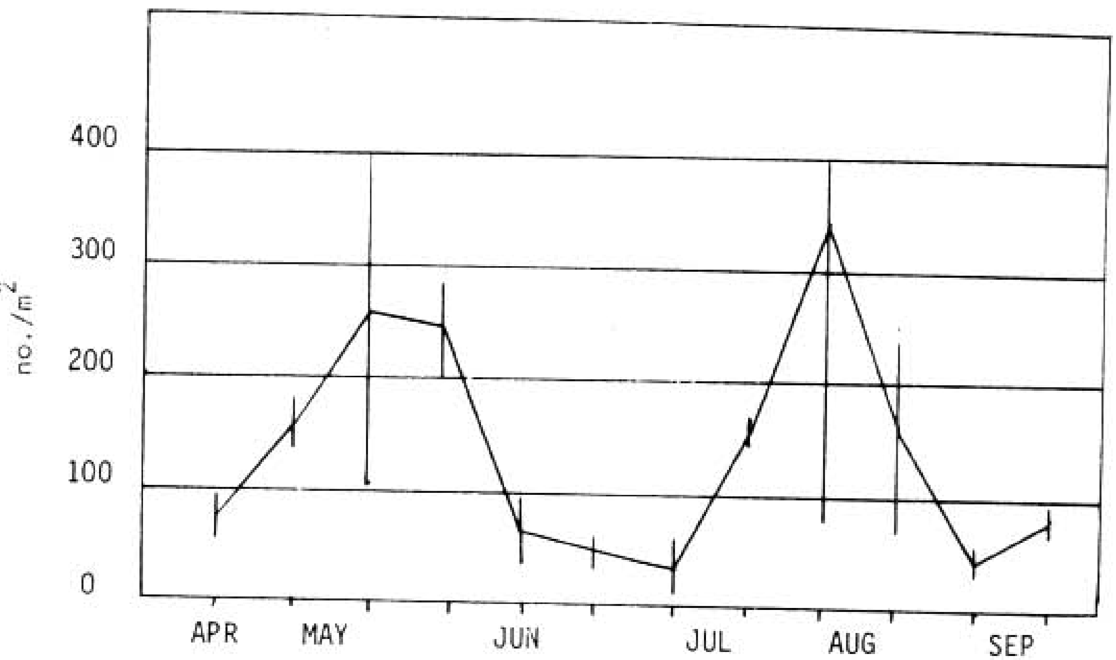


Fig. 3. Insect numbers per $m^2$, Pantex Site, 1970
Moderately Grazed

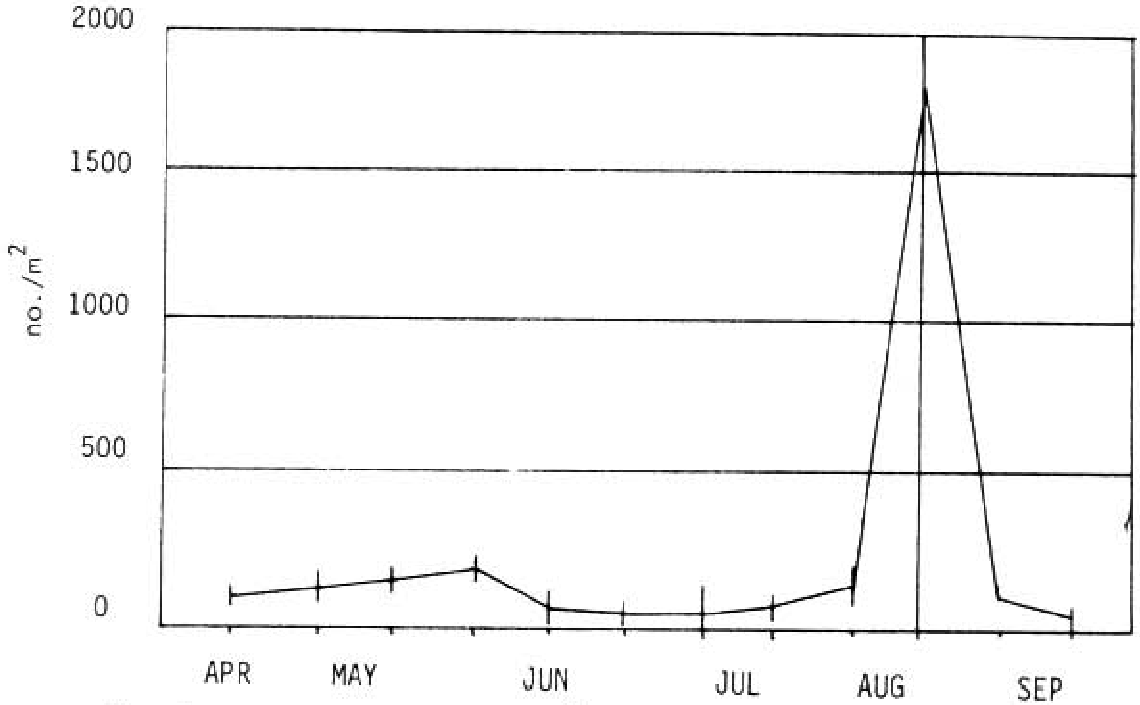


Fig. 4. Insect numbers per $m^2$, Pantex Site, 1970
Grazed '69/Ungrazed '70

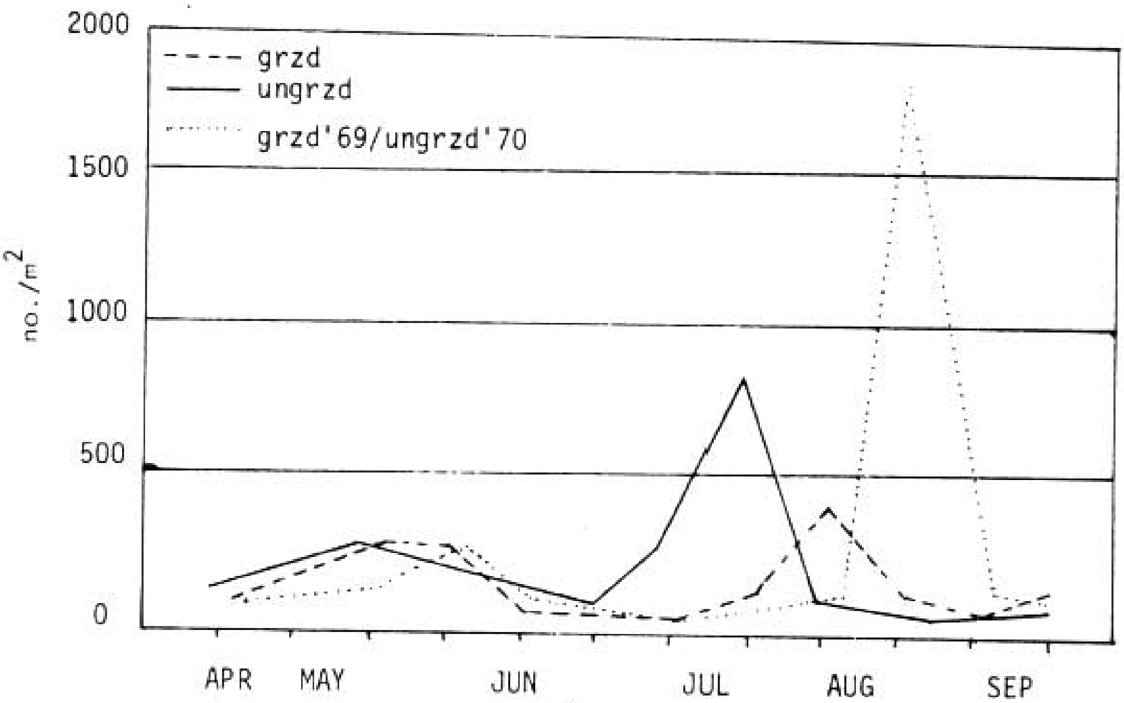


Fig. 5. Insect numbers per $m^2$, Pantex Site, 1970
All Treatments

second maximum occurred in July for treatment 1 and in August for treatments 3 and 5. Mean maximum numbers in May were $403/m^2$ for treatment 1, $264/m^2$ for treatment 3, and $403/m^2$ for treatment 5. In July, the mean maximum for treatment 1 was $800/m^2$. The mean maxima for treatment 3 and for treatment 5 in August were $400/m^2$ and $1783/m^2$ respectively. The greatest number of insects obtained from a single quick trap ($\frac{1}{2}$ $m^2$) was 3200 or 6400 per $m^2$.

Large numbers of leafhoppers (Cicadellidae), adults and nymphs, were the most numerous insects during the period in May when the first population peaks were detected. Later in the season, peaks were due to large populations of adult false chinch bugs and nymphs of these and other Lygaeidae. Populations always peaked earlier on the ungrazed treatment than on the other two treatments; it has not been determined whether this effect was due to the grazing treatment or due to other environmental factors.

As seen in the above graphs, there appears to be a significant correlation between rainfall and size of insect populations. Although rainfall was much below normal (Fig. 6), when there was precipitation, insect numbers increased. At the Pantex Site, mean annual rainfall is 18.1 inches (46 cm). Rainfall for the period of January to October was 3.8 inches (9.65 cm). This was an atypical year, with respect to rainfall, for Pantex. Since this was a very dry year, some insect populations apparently never appeared in an active stage and were never represented in the samples. This fact must be considered when comparing insect numbers and biomass with other consumer numbers and biomass.

Insect biomass showed a single peak (Fig. 7). This peak was due to large populations of false chinch bugs in July and August. No biomass figures are available for dates prior to 14 June 1970 as of the present.

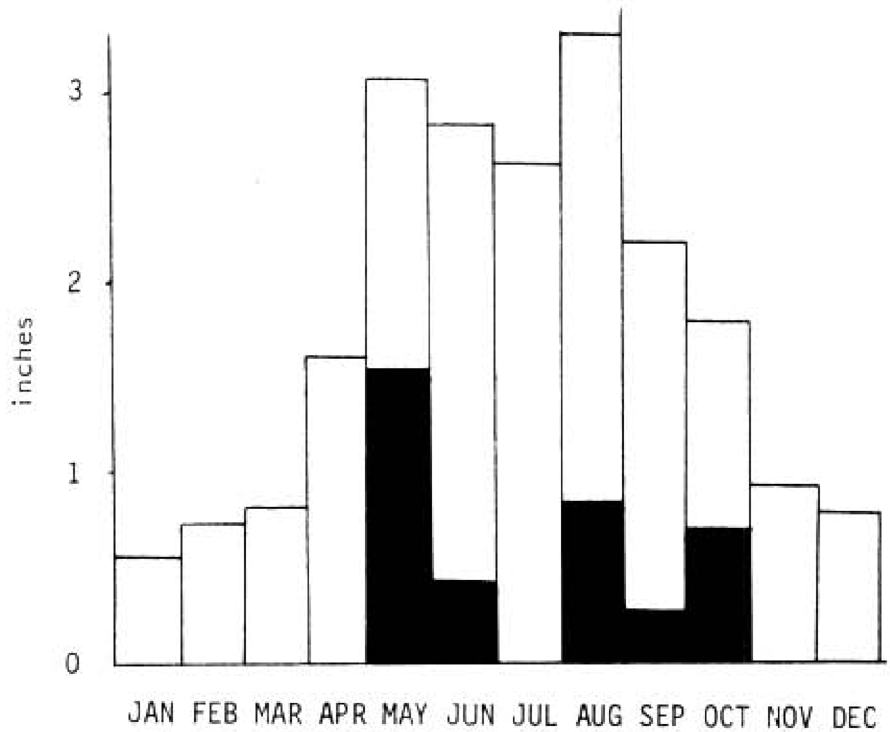


Fig. 6. Average rainfall vs. actual rainfall (shaded). Pantex Site, 1970

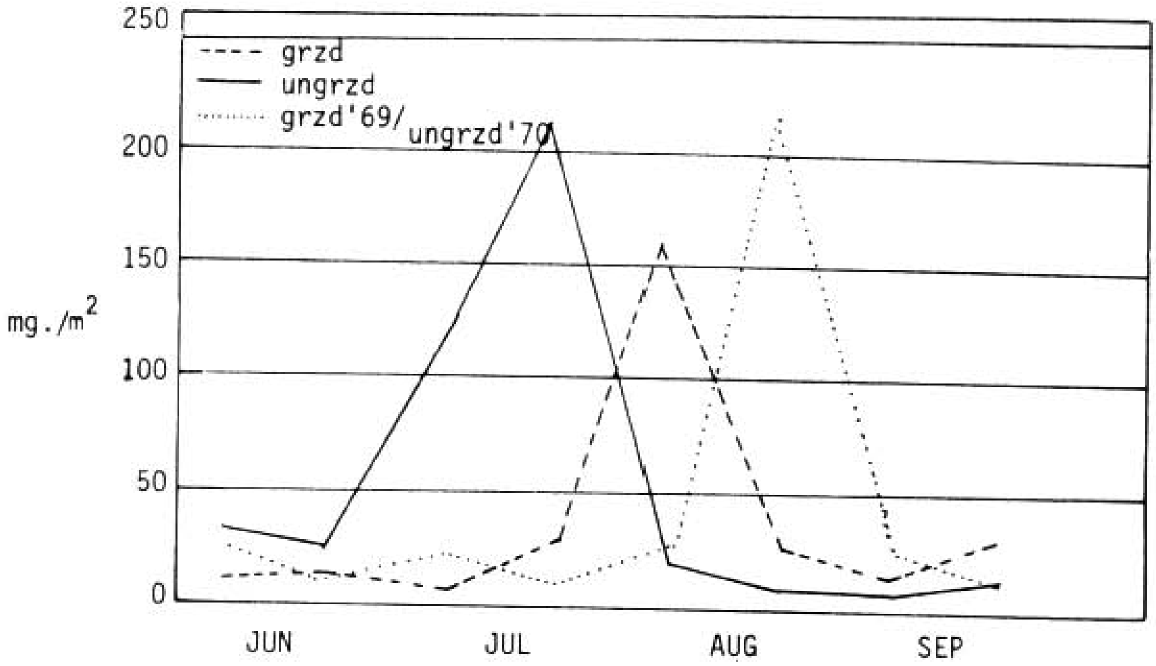


Fig. 7. Insect biomass-Pantex Site, 1970
All Treatments

The mean maximum and mean minimum for treatment 1 were 0.21 $g/m^2$ and 0.004 $g/m^2$. The mean maximum and mean minimum for treatment 3 were 0.161 $g/m^2$ and 0.010 $g/m^2$. The mean maximum and mean minimum for treatment 5 were 0.219 $g/m^2$ and 0.006 $g/m^2$. Aboveground insect biomass had a maximum above 0.20 $g/m^2$ for two treatments. When this figure is coupled with the estimated belowground arthropod biomass (based on a range of 0.20 to 0.80 $g/m^2$ at the intensive site) a total arthropod biomass in excess of 1.0 $g/m^2$ can be expected. This is a conservative figure due to low rainfall this season, and because it is known that the "quick trap" does not collect all the insects in its $\frac{1}{2}$ $m^2$, and the Berlese funnel does not extract all the insects from the litter. The total arthropod biomass could be in excess of 2.00 $g/m^2$ or in the same order of magnitude as the large domestic herbivore biomass on managed grasslands. In addition, the rate of energy flow through small organisms can be expected to be much greater than through large organisms. Another factor to be considered is that biomass accumulation in a large domestic herbivore is measured on a single organism while the point measurements of insect biomass include many organisms that have short life cycles and were not present at earlier or later sampling dates. Because of these factors, total insect biomass produced in a season is cumulative and may be two or more times the value represented by the peak of the seasonal curve and thus may even be in the range of 4.0 to 6.0 $g/m^2$ or 60 kg/ha.

Insect herbivores fall into two major classes based on type of mouthparts, piercing-sucking and biting-chewing. A comparison of the numbers and biomass of each type was made to gain information on the manner in which energy is transferred into the insect compartment. Based on analysis of the data for 1970, there appears to be significantly greater numbers and biomass in the piercing-sucking subcompartment (Fig. 8 & 9). The major insects in this category are leafhoppers early in the season and false chinch bugs later in the growing season (Fig. 8).

Proportion of piercing-sucking herbivores ranged from 40% of the total on the early dates to 99% of the total on the later dates. Biomass estimates for the two classes of phytophagous insects were in the same order of magnitude relationships; values for piercing-sucking insects ranged from 32% to 91% of the total (Fig. 9). Early in the season when biting-chewing insects produced slightly over 60% of the numbers, the major groups present were grasshopper nymphs and Elateridae adults.

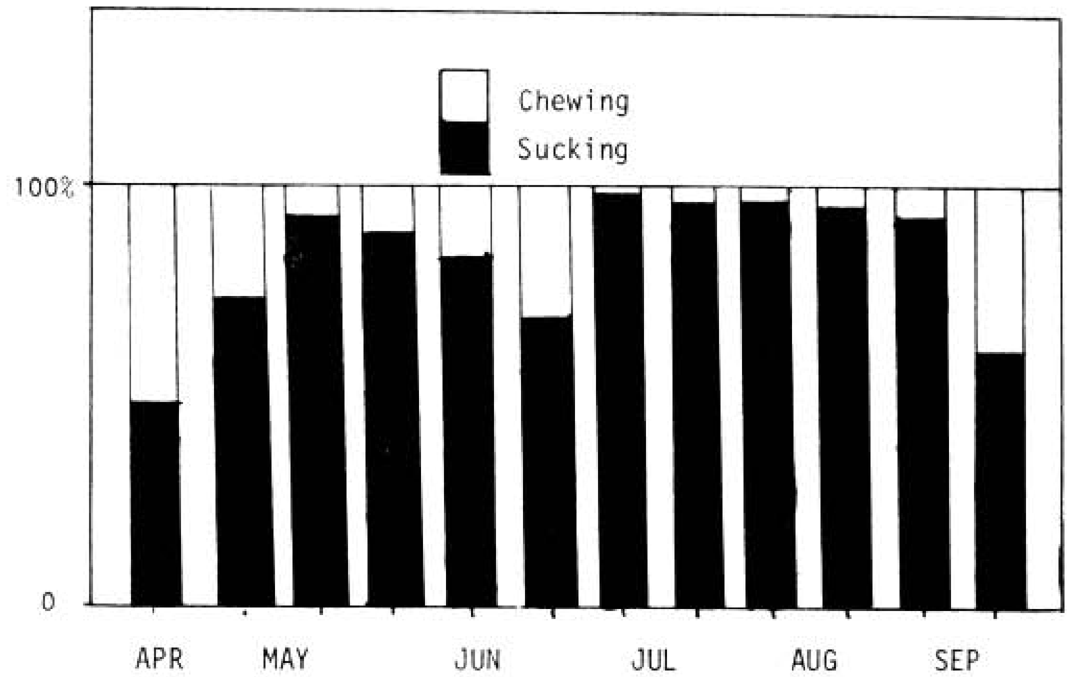


Fig. 8. Insect proportions-Pantex Site, 1970
Sucking vs. Chewing

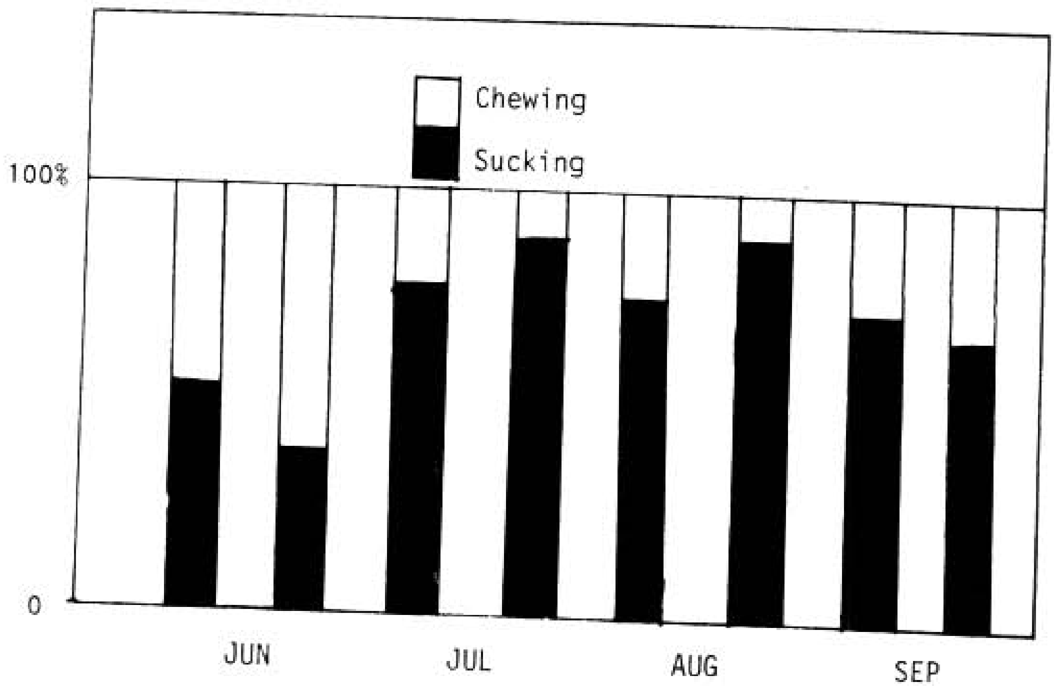


Fig. 9. Insect proportionate biomass - Pantex Site, 1970
Sucking vs. Chewing

# APPENDIX I

## Summary of Insect Numbers and Biomass per $m^2$ Pantex Site, U.S. IBP, 1970

| Date (1970) | TRT | REP | Quadrat (total no./$m^2$) 1 | 2 | 3 | 4 | 5 | 6 | Biomass $m^2$ |
|---|---|---|---|---|---|---|---|---|---|
| 10 April | 1 | 1 | - | 96 | 64 | - | - | 176 | - |
| | | 2 | 82 | - | - | 42 | 102 | 134 | - |
| | 3 | 1 | 30 | 40 | 46 | 74 | 34 | 114 | - |
| | | 2 | - | 102 | - | - | - | 72 | - |
| | 5 | 1 | - | - | 42 | 76 | 104 | 66 | - |
| | | 2 | 62 | - | - | 44 | 102 | 68 | - |
| 2 May | 1 | 1 | 318 | 198 | 164 | 242 | 400 | - | - |
| | | 2 | 336 | 154 | 362 | - | - | - | - |
| | 3 | 1 | 226 | 168 | - | 148 | 150 | 180 | - |
| | | 2 | 102 | 100 | 186 | - | 112 | 82 | - |
| | 5 | 1 | 126 | 342 | 98 | 86 | - | 80 | - |
| | | 2 | 132 | - | 70 | 102 | 60 | 112 | - |
| 15 May | 1 | 1 | 244 | 404 | 400 | 364 | 558 | - | - |
| | | 2 | 402 | 544 | 486 | - | 286 | 344 | - |
| | 3 | 1 | 202 | 500 | - | 396 | 296 | 130 | - |
| | | 2 | 190 | 380 | 92 | - | 128 | 330 | - |
| | 5 | 1 | 34 | 132 | 214 | - | 30 | 112 | - |
| | | 2 | 280 | - | 86 | 104 | 176 | 358 | - |
| 1 June | 1 | 1 | 530 | 274 | 116 | 204 | 262 | 192 | - |
| | | 2 | 846 | 158 | - | - | 96 | - | - |
| | 3 | 1 | 390 | 214 | 220 | 202 | 342 | 492 | - |
| | | 2 | 156 | 208 | 122 | 192 | 138 | 242 | - |
| | 5 | 1 | 126 | 150 | 272 | 240 | 218 | 114 | - |
| | | 2 | 606 | 224 | 124 | 104 | 130 | 86 | - |
| 14 June | 1 | 1 | 116 | - | 154 | 162 | 140 | 208 | 0.0308 g |
| | | 2 | 172 | 184 | 164 | 156 | 146 | 170 | 0.0293 g |
| | 3 | 1 | 24 | 118 | 54 | 92 | - | 62 | 0.0104 g |
| | | 2 | 26 | 22 | 62 | 50 | 24 | 150 | 0.0072 g |
| | 5 | 1 | - | 82 | 148 | 104 | 82 | 18 | 0.0280 g |
| | | 2 | 26 | 130 | - | 72 | 22 | 94 | 0.0381 g |
| 30 June | 1 | 1 | 30 | 104 | 96 | 76 | 126 | 86 | 0.0232 g |
| | | 2 | 76 | 108 | 150 | 126 | 112 | 124 | 0.0243 g |
| | 3 | 1 | 36 | 48 | 54 | 18 | 50 | 56 | 0.0198 g |
| | | 2 | 82 | 26 | 32 | 34 | 28 | 42 | 0.0025 g |
| | 5 | 1 | 36 | 44 | 28 | 48 | 24 | 26 | - |
| | | 2 | 18 | 74 | - | 68 | 16 | 52 | 0.0161 g |

Appendix I (continued)

| Date (1970) | TRT | REP | Quadrat (total no./m$^2$) 1 | 2 | 3 | 4 | 5 | 6 | Biomass m$^2$ |
|---|---|---|---|---|---|---|---|---|---|
| 13 July | 1 | 1 | 20 | 78 | 36 | 66 | 66 | 3678 | 0.2245 g |
| | | 2 | 34 | 112 | 170 | 34 | 72 | 52 | 0.0275 g |
| | 3 | 1 | 22 | 30 | 68 | 6 | 30 | 22 | 0.0073 g |
| | | 2 | 20 | 42 | 44 | 10 | 18 | 56 | 0.0135 g |
| | 5 | 1 | 16 | 28 | 28 | 54 | 40 | 58 | 0.0100 g |
| | | 2 | 48 | 20 | 16 | 30 | 12 | 28 | 0.0664 g |
| 30 July | 1 | 1 | 3280 | 374 | 60 | 780 | 282 | 122 | 0.2099 g |
| | | 2 | 2132 | 1690 | 534 | 790 | 302 | 254 | - |
| | 3 | 1 | 154 | 142 | 874 | - | 62 | 210 | - |
| | | 2 | 26 | 8 | 16 | 20 | 70 | 44 | - |
| | 5 | 1 | 48 | 40 | 20 | 30 | 26 | 84 | - |
| | | 2 | - | - | - | 66 | 104 | 38 | - |
| 8 Aug. | 1 | 1 | 36 | 42 | 174 | 40 | 16 | 40 | 0.0097 g |
| | | 2 | - | 76 | - | 140 | 64 | 106 | 0.0166 g |
| | 3 | 1 | 66 | 598 | 150 | 44 | 52 | 2166 | 0.1871 g |
| | | 2 | 64 | 960 | 48 | 54 | 36 | 6 | 0.1362 g |
| | 5 | 1 | 76 | 34 | 488 | 38 | 372 | 56 | 0.0692 g |
| | | 2 | 56 | 42 | 54 | 32 | 44 | 80 | 0.0469 g |
| 25 Aug. | 1 | 1 | 42 | 14 | 10 | 34 | 44 | 12 | 0.0057 g |
| | | 2 | 8 | 30 | 18 | 18 | 42 | 26 | 0.0136 g |
| | 3 | 1 | 54 | 64 | 124 | 94 | 62 | 482 | 0.0265 g |
| | | 2 | 92 | 114 | 182 | 486 | 82 | 62 | 0.0223 g |
| | 5 | 1 | 122 | 106 | 172 | 340 | 90 | 50 | 0.0155 g |
| | | 2 | 44 | 1362 | 912 | 7258 | 5516 | 5350 | 0.2577 g |
| 5 Sept. | 1 | 1 | 20 | 12 | 4 | 22 | 2 | 10 | 0.0047 g |
| | | 2 | 22 | 18 | 2 | 20 | 12 | 28 | 0.0043 g |
| | 3 | 1 | 18 | 30 | 20 | 14 | 12 | 22 | 0.0076 g |
| | | 2 | 190 | 10 | 30 | 42 | 34 | 72 | 0.0159 g |
| | 5 | 1 | 170 | 36 | 574 | 62 | 48 | 50 | 0.0392 g |
| | | 2 | 20 | 64 | 16 | 72 | 82 | 38 | 0.0311 g |
| 19 Sept. | 1 | 1 | 14 | 24 | 20 | 8 | 40 | 8 | 0.0062 g |
| | | 2 | 10 | 14 | 8 | 72 | 32 | 14 | 0.0137 g |
| | 3 | 1 | 182 | 30 | 4 | 78 | 66 | 358 | 0.0493 g |
| | | 2 | 74 | 44 | 40 | 14 | 58 | 42 | 0.0223 g |
| | 5 | 1 | 28 | 94 | 24 | 42 | 10 | 16 | 0.0040 g |
| | | 2 | 66 | 30 | 46 | 30 | 28 | 44 | 0.0114 g |

# APPENDIX II

Summary of Taxa Collected with Corresponding Abbreviations
Pantex Site, U.S. IBP, 1970

| TAXON | ABBREVIATION |
|---|---|
| Collembola | COLL |
| Sminthuridea | SMIN |
| sp 01 (adult) | |
| Entomobriidea | ENTO |
| sp 01 (adult) | |
| Orthoptera | ORTH |
| Acrididae | ACRI |
| sp 01 (adult) | |
| sp 01 (nymph) | |
| Thysanoptera | THY2 |
| Thripidae | THRI |
| *Bregmatothrips* | BRE |
| sp 01 (adult) | |
| sp 01 (nymph) | |
| Aeolothripidae | AEOL |
| *Aeolothrips* | AEO |
| sp 01 (adult) | |
| Phloeothripidae | PHLO |
| *Oedolothrips* | OED |
| sp 01 (adult) | |
| sp 01 (nymph) | |
| Homoptera | HOMO |
| Cicadellidae | CICA |
| 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) | |
| sp 11 (adult) | |
| Dactylopiidae | DACT |
| sp 01 (adult) | |
| Pseudococcidae | PSEU |
| sp 01 (adult) | |
| sp 02 (adult) | |
| Aphidae | APHI |
| sp 01 (adult) | |

Appendix II (continued)

| TAXON | ABBREVIATION |
|---|---|
| Hemiptera | HEMI |
| sp 01 (adult) | |
| sp 02 (adult) | |
| sp 03 (adult) | |
| sp 04 (adult) | |
| sp 05 (adult) | |
| sp 06 (adult) | |
| sp 01 (nymph) | |
| Lygaeidae | LYGA |
| sp 01 (adult) | |
| sp 02 (adult) | |
| sp 03 (adult) | |
| sp 04 (adult) | |
| sp 01 (nymph) | |
| | EMB |
| sp 01 (adult) | |
| *Geocoris* | GEO |
| sp 01 (adult) | |
| sp 01 (nymph) | |
| Nabidae | NABI |
| sp 01 (adult) | |
| Coreidae | CORE |
| sp 01 (adult) | |
| sp 02 (adult) | |
| sp 01 (nymph) | |
| Scutelleridae | SCUT |
| sp 01 (adult) | |
| Pentatomidae | PENT |
| sp 01 (adult) | |
| Anthocoridae | ANTH |
| Coleoptera | COLE |
| sp 03 (adult) | |
| sp 07 (adult) | |
| sp 09 (adult) | |
| sp 12 (adult) | |
| Lathridiidae | LATH |
| sp 01 (adult)[1] | |
| Cleridae | CLER |
| sp 01 (adult)[2] | |
| Curculionidae | CURC |
| *Gerstaeckeria* | GER |
| *lacontei* (Lec.) | lec |
| *porosa* O'Brien | por |
| *indistinca* O'Brien | ind |
| *Ophryastes* | OPH |
| *vittatus* (Say) | vit |
| *Centorhynchus* | CEN |
| *convexicollis* (Lec.) | con |
| *Sephenophorus* | SEP |
| *compressirostris* (Say) | com |

Appendix II (continued)

| TAXON | ABBREVIATION |
|---|---|
| Malachiidae | MALA |
| sp 01 (adult) | |
| Phalacridae | PHAL |
| Carabidae | CARA |
| sp 01 (adult) | |
| sp 02 (adult) | |
| sp 03 (adult) | |
| sp 04 (adult)[3] | |
| sp 05 (adult) | |
| Meloidae | MELO |
| sp 01 (larva) | |
| Coccinellidae | COCC |
| sp 01 (adult) | |
| sp 02 (adult)[4] | |
| sp 03 (adult) | |
| *Scyrimmus* | SCY |
| sp 01 (adult) | |
| Tenebrionidae | TENE |
| sp 01 (adult) | |
| sp 02 (adult) | |
| sp 03 (adult)[5] | |
| sp 04 (adult) | |
| Elateridae | ELAT |
| sp 01 (adult) | |
| Staphylinidae | STAP |
| sp 01 (adult) | |
| sp 02 (adult) | |
| Chrysomelidae | CHRY |
| sp 01 (adult) | |
| sp 02 (adult)[6] | |
| sp 03 (adult) | |
| Scaphidiidae | SCAP |
| sp 01 (adult)[7] | |
| Anthicidae | ANTH |
| sp 01 (adult) | |
| sp 02 (adult)[8] | |
| sp 03 (adult)[9] | |
| sp 04 (adult)[10] | |
| sp 05 (adult)[11] | |
| sp 06 (adult)[12] | |
| sp 07 (adult) | |
| Lepidoptera | LEPI |
| sp 01 (adult) | |
| sp 02 (adult) | |
| sp 03 (adult) | |
| sp 04 (adult) | |
| sp 05 (larva) | |

Appendix II (continued)

| TAXON | ABBREVIATION |
|---|---|
| Neuroptera | NEUR |
| Myrmeliontidae | MYRM |
| sp 01 (larva) | |
| Diptera | DIPT |
| 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) | |
| sp 11 (adult) | |
| sp 12 (adult) | |
| sp 13 (adult) | |
| sp 14 (adult) | |
| sp 15 (adult) | |
| sp 16 (adult) | |
| Hymenoptera | HYME |
| 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) | |
| sp 11 (adult) | |
| sp 12 (adult) | |
| sp 13 (adult) | |
| Chalcidae | CHAL |
| sp 01 (adult) | |
| sp 02 (adult) | |
| sp 03 (adult) | |
| sp 04 (adult) | |
| sp 05 (adult) | |
| sp 06 (adult) | |
| sp 07 (adult) | |
| sp 08 (adult) | |
| Dryinidae | DRYI |
| sp 01 (adult) | |

Appendix II (continued)

| TAXON | ABBREVIATION |
|---|---|
| Formicidae | FORM |
| sp 01 (adult) | |
| sp 02 (adult) | |
| sp 03 (adult) | |
| sp 04 (adult) | |
| sp 06 (adult) | |
| sp 07 (adult) | |
| sp 08 (adult) | |
| sp 09 (adult) | |
| *Crematogaster* | CRE |
| sp 01 (adult) | |
| *Pogonomyrmex* | POG |
| sp 01 (adult)[13] | |
| Aranaeda | ARAN |
| sp 01 (adult) | |
| Lycosidae | LYCO |
| sp 01 (adult) | |
| sp 02 (adult) | |
| Salticidae | SALT |
| sp 01 (adult) | |
| Microaranaeda | MICR |
| sp 01 (adult) | |
| sp 02 (adult) | |
| Solpugida | SOLP |
| sp 01 (adult) | |

## Footnotes to Appendix II

[1] Formerly COLE 01

[2] Formerly COLE 12

[3] Formerly COLE 10

[4] Formerly COLE 13

[5] Formerly COLE 05

[6] Formerly COLE 06

[7] Formerly COLE 11

[8] Formerly COLE 02

[9] Formerly COLE 04

[10] Formerly COLE MELO 03

[11] Formerly COLE MELO 01

[12] Formerly COLE MELO 02

[13] Formerly HYME FORM 05

# APPENDIX III

# FIELD DATA

## Invertebrate Data

Invertebrate data collected in 1970 on the Pantex Site is Grassland Biome data set A2U300A. Data were collected on form NREL-30. A sample data form and a sample of the data follow.

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 | 12-13 | 14 | 15 | 16-19 | 20-21 | 23 | 25-29 | 31-33 | 35-37 | 39-40 | 42-43 | 45 | 47-48 | 50-55 | 57-62 | 64-66 |
| | | | | | | | | | | | | | | | | | | | | |

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
- [illegible] 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         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

3010HNH10047011 0.5 2 2       HOMOCICA        10       5
                    2 2       HOMOCICA        40      20
                    2 2       HOMOAPHI        00       3
                    2 1       COLESTAP        10       1
                    2 1       COLEELAT        10      13
                    2 6       HYMEFORM        10       5
                    2 5       ARAE00          00       1
                    3 2       HOMOCICA        10       1
                    3 2       HOMOCICA        40      15
                    3 2       HOMOAPHI        00       1
                    3 1       COLEELAT        10      11
                    3 0       HYME00          10       1
                    3 6       HYMEFORM        10       3
                    4 2       HOMOCICA        10       1
                    4 2       HOMOCICA        40      12
                    4 0       THYS00          00       1
                    4 1       COLEELAT        10      20
                    4 1       COLEMELO        10       1
                    4 1       COLECHRY        10       1
                    4 6       AYMEFORM        10       1
                    4 0       HYME00          10       1
                    4 5       ARAE00          00       2
                    6 2       HOMOCICA        40       2
                    6 0       COLE00          40       1
                    6 1       COLEELAT        10      18
                    6 6       HYMEFORM        10      66
                    6 5       ARAE00          00       1
3010HNH10047012 0.5 1 1       COLEELAT        10      36
                    1 1       COLECHRY        10       1
                    1 0       COLE00          10       3
                    1 9       LEPI00          40       1
                    4 2       HOMOCICA        40       3
                    4 2       HOMOPSEU        40       1
                    4 1       COLEELAT        10      13
                    4 1       COLECHRY        10       3
                    4 5       ARAE00          00       1
                    5 2       HOMOCICA        40       1
                    5 1       COLEELAT        10      46
                    5 1       COLECHRY        10       1
                    5 1       COLEANTH        10       2
                    5 1       COLESTAP        10       1
                    6 2       HOMOCICA        40       3
                    6 1       COLEELAT        10      59
                    6 1       COLECHRY        10       1
                    6 1       COLEANTH        10       2
                    6 6       HYMEFORM        10       2
```

| | | | | | |
|---|---|---|---|---|---|
| 3010HNH10047031 0.5 | 1 | 2 | HOMOCICA | 40 | 4 |
| | 1 | 2 | HOMOPSEU | 40 | 2 |
| | 1 | 0 | HEMI00 | 40 | 1 |
| | 1 | 1 | COLEELAT | 10 | 7 |
| | 1 | 6 | HYMEFORM | 10 | 1 |
| | 2 | 0 | THYS00 | 00 | 1 |
| | 2 | 5 | HEMILYGAGEO | 40 | 1 |
| | 2 | 2 | HOMOCICA | 10 | 1 |
| | 2 | 2 | HOMOCICA | 40 | 4 |
| | 2 | 2 | HOMOPSEU | 40 | 3 |
| | 2 | 1 | COLEELAT | 10 | 9 |
| | 2 | 6 | HYMEFORM | 10 | 1 |
| | 3 | 5 | HEMILYGAGEO | 40 | 1 |
| | 3 | 2 | HOMOCICA | 40 | 9 |
| | 3 | 1 | COLEELAT | 10 | 9 |
| | 3 | 6 | HYMEFORM | 10 | 3 |
| | 3 | 9 | LEPI00 | 40 | 3 |
| | 4 | 5 | HEMILYGAGEO | 40 | 1 |
| | 4 | 2 | HOMOCICA | 40 | 16 |
| | 4 | 2 | HOMOPSEU | 40 | 1 |
| | 4 | 0 | COLE00 | 10 | 1 |
| | 4 | 1 | COLEELAT | 10 | 16 |
| | 4 | 1 | COLECHRY | 10 | 1 |
| | 4 | 5 | ARAE00 | 00 | 1 |
| | 5 | 0 | THYS00 | 00 | 1 |
| | 5 | 2 | HOMOCICA | 40 | 5 |
| | 5 | 1 | COLEELAT | 10 | 10 |
| | 5 | 5 | ARAE00 | 00 | 1 |
| | 6 | 2 | HOMOCICA | 10 | 2 |
| | 6 | 2 | HOMOCICA | 40 | 32 |
| | 6 | 0 | COLE00 | 10 | 1 |
| | 6 | 1 | COLEELAT | 10 | 11 |
| | 6 | 6 | HYMEFORM | 10 | 10 |
| | 6 | 5 | ARAE00 | 00 | 1 |
| 3010HNH10047032 0.5 | 1 | 2 | HOMOCICA | 00 | 1 |
| | 1 | 0 | LEPINOCT | 00 | 1 |
| | 1 | 6 | HYMEFORM | 10 | 9 |
| | 1 | 5 | ARAE00 | 00 | 1 |
| | 2 | 1 | ORTHACRI | 40 | 1 |
| | 2 | 0 | HEMI00 | 10 | 1 |
| | 2 | 2 | HOMOCICA | 40 | 26 |
| | 2 | 2 | HOMOCICA | 10 | 2 |
| | 2 | 2 | HOMOFULG | 40 | 1 |
| | 2 | 2 | HOMOAPHI | 10 | 1 |
| | 2 | 0 | COLE00 | 10 | 3 |
| | 2 | 1 | COLEELAT | 10 | 13 |
| | 2 | 6 | HYMEFORM | 10 | 1 |
| | 2 | 5 | ARAE00 | 00 | 2 |
| | 3 | 0 | COLL00 | 00 | 2 |
| | 3 | 2 | HOMOCICA | 10 | 1 |
| | 3 | 2 | HOMOCICA | 40 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | 3 2 | HOMOPSFU | 40 | 13 |
| | | 3 0 | THYS00 | 00 | 31 |
| | | 3 5 | COLECARA | 10 | 1 |
| | | 3 1 | COLECHRY | 10 | 1 |
| | | 3 1 | COLEELAT | 10 | 13 |
| | | 3 1 | COLEMELO | 10 | 2 |
| | | 3 0 | COLE00 | 40 | 1 |
| | | 3 0 | LEPI00 | 20 | 1 |
| | | 3 6 | HYMEFORM | 10 | 9 |
| | | 3 0 | DIPT00 | 10 | 1 |
| | | 3 5 | ARAE00 | 00 | 1 |
| | | 4 0 | COLL00 | 00 | 2 |
| | | 4 2 | HOMOCICA | 10 | 1 |
| | | 4 2 | HOMOCICA | 40 | 9 |
| | | 4 2 | HOMOPSFU | 40 | 2 |
| | | 4 0 | THYS00 | 00 | 12 |
| | | 4 1 | COLEELAT | 10 | 8 |
| | | 4 5 | COLECARA | 10 | 3 |
| | | 4 1 | COLECHRY | 10 | 5 |
| | | 4 0 | COLE00 | 40 | 5 |
| | | 4 0 | LEPI00 | 40 | 1 |
| | | 4 0 | DIPT00 | 10 | 1 |
| | | 4 6 | HYMEFORM | 10 | 3 |
| | | 4 5 | ARAE00 | 00 | 4 |
| | | 6 0 | THYS00 | 00 | 1 |
| | | 6 2 | HOMOCICA | 40 | 1 |
| | | 6 0 | COLE00 | 10 | 2 |
| | | 6 1 | COLEELAT | 10 | 28 |
| | | 6 1 | COLECHRY | 10 | 1 |
| | | 6 6 | HYMEFORM | 10 | 1 |
| | | 6 5 | ARAE00 | 00 | 2 |
| 3010HNH10047051 | 0.5 | 3 2 | THYS | 00 | 1 |
| | | 3 5 | HEMILYGAGEO | 40 | 1 |
| | | 3 2 | HOMOCICA | 40 | 1 |
| | | 3 0 | COLE | 10 | 1 |
| | | 3 1 | COLEELAT | 10 | 15 |
| | | 3 1 | COLECHRY | 10 | 1 |
| | | 3 7 | HYMEFORM | 10 | 1 |
| | | 4 0 | COLLENTO | 00 | 2 |
| | | 4 8 | COLLSMIN | 00 | 1 |
| | | 4 0 | THYS | 00 | 1 |
| | | 4 5 | HEMILYGAGEO | 40 | 2 |
| | | 4 2 | HOMOCICA | 10 | 2 |
| | | 4 2 | HOMOCICA | 40 | 14 |
| | | 4 2 | HOMOPSFU | 40 | 7 |
| | | 4 0 | COLE | 10 | 1 |
| | | 4 1 | COLEELAT | 10 | 6 |
| | | 4 6 | HYMEFORM | 10 | 2 |
| | | 5 0 | THYS | 00 | 1 |
| | | 5 2 | HOMOCICA | 40 | 14 |
| | | 5 2 | HOMOAPHI | 10 | 2 |
| | | 5 1 | COLEELAT | 10 | 33 |
| | | 5 0 | HYME | 10 | 1 |
| | | 5 5 | ARAN | 00 | 1 |
| | | 6 1 | ORTHACRI | 00 | 1 |
| | | 6 0 | THYS | 00 | 1 |
| | | 6 2 | HOMOCICA | 40 | 3 |
| | | 6 1 | COLEELAT | 10 | 26 |
| | | 6 6 | HYMEFORM | 10 | 1 |
| | | 6 5 | ARAN | 00 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| 3010HNH10047052 0.5 | 1 | 0 | THYS | 00 | 1 |
| | 1 | 2 | HOMOCICA | 40 | 9 |
| | 1 | 0 | COLE | 10 | 2 |
| | 1 | 1 | COLEELAT | 10 | 20 |
| | 1 | 1 | COLEANTH | 10 | 1 |
| | 4 | 0 | HEMI | 10 | 1 |
| | 4 | 5 | HEMILYGAGEO | 40 | 1 |
| | 4 | 2 | HOMOPSEU | 40 | 1 |
| | 4 | 0 | COLE | 10 | 1 |
| | 4 | 1 | COLEELAT | 10 | 16 |
| | 4 | 6 | HYMEFORM | 10 | 1 |
| | 4 | 5 | ARAN | 00 | 1 |
| | 5 | 1 | ORTHACRI | 40 | 1 |
| | 5 | 2 | HOMOCICA | 40 | 10 |
| | 5 | 0 | COLE | 10 | 1 |
| | 5 | 1 | COLEELAT | 10 | 36 |
| | 5 | 6 | HYMEFORM | 10 | 1 |
| | 5 | 5 | ARAN | 00 | 2 |
| | 6 | 0 | THYS | 00 | 1 |
| | 6 | 0 | HEMI | 10 | 1 |
| | 6 | 2 | HOMOCICA | 40 | 6 |
| | 6 | 2 | HOMOPSEU | 40 | 3 |
| | 6 | 1 | COLEELAT | 10 | 19 |
| | 6 | 1 | COLECHRY | 10 | 2 |
| | 6 | 1 | COLESTAP | 10 | 1 |
| | 6 | 5 | ARAN | 00 | 1 |

## SUPPLEMENT

This analysis is presented as a supplement to the taxa designated in Technical Report No. 79, dealing with the analysis of structure and function of grassland ecosystems in the southern Great Plains; population studies.

Many of the taxa designated in the report were, of necessity, rather broadly defined, i.e., family or super-family. The problems encountered in trying to place each individual in a definitive category such as plant feeder, predator, etc., becomes obvious when many specimens have not been identified satisfactorily. Therefore, characteristics of a family will be applied to individuals until further information is available.

The organisms described are presented in the order in which they appear in the above mentioned report.

### Collembola

Only two of the five known families have been reported from Pantex, these being Entomobryidae and Sminthuridae.

These insects are usually found in the soil or debris, are vegetarian, and normally feed on decayed organic matter although they are known to sometimes attack seeds and young plants. They are also reported as distributors of fungus diseases, as predators and/or as being cannabalistic (MacNamara 1924). It has also been reported (McDaniel 1970) that moisture is an important factor, in that low moisture results in dramatic reductions of numbers of Collembola. The Sminthurids (some species) seem to prefer feeding on delicate plant tissue rather than decaying organic matter and may be important in energy flow.

Orthoptera

Very few grasshoppers were collected at Pantex; the few that were are in the family Acrididae, with two very distinct types recognized. The low numbers may have been due to the very low amount of precipitation during the sampling period, but it has been suggested that grasshoppers are not good indicators of energy flow through the grasslands due to their sporadic occurrence at any given area.

All members of this family utilize plant tissue as their main source of food, although they may become carnivorous and cannabalistic (Metcalf, Flint, and Metcalf 1962).

Thysanoptera

These insects have rasping-sucking mouthparts and feed almost entirely on plant juices, causing considerable damage or death to the plant. Some species may feed on fungi or decayed vegetable matter or may be predacious on mites or other small insects. Many of the species which normally feed on grasses or weeds migrate to cultivated crops when native vegetation dries up. Eggs are laid on bark, surfaces of leaves, or are inserted in plant tissue.

The generalized feeding habits of the three families collected at Pantex are as follows: Thripidae--plant feeders, containing many economically important species; Aeolothripidae--some forms are phytophagous, others are predacious; Phloeothriptidae--some phytophagous, some predacious (Metcalf et al. 1962).

Homoptera

The order Homoptera seems to be best represented by the family Cicadellidae. Some eleven species have been collected but have been identified only to family at this time.

The Cicadellids are probably one of the most important groups on the Pantex Site due to the fact that all of this group are plant-feeders, sucking juices from the plants and causing the drying up and/or wilting of plant tissue. Most of the species in this group feed on wild grasses, weeds or shrubs, but some will move to cultivated crops (Metcalf et al. 1962).

Other members of this order are represented by Dactylopiidae, which are fairly abundant on the prickly pear (*Opuntia*) and seem to be causing considerable damage to the prickly pear (Smithsonian Institute 1969).

Pseudococcidae, which feed on all parts of the plant, both above- and belowground, were not abundant enough in the 1970 samples to cause any appreciable damage to the grassland.

Aphids, which have not been collected in substantial numbers, feed by extracting juices from plant tissue, which may result in various abnormalities, wilting and weakening the entire plant. Many aphids disseminate fungus and other plant diseases (Imms 1964).

Hemiptera

The order Hemiptera is represented best at Pantex by the "false chinch bug" (Lygaeidae). These insects are often destructive, occurring in large numbers. Eggs are laid in cracks in the soil or on grasses during the entire summer from May to October, with four to several broods a year. Winter is passed in all stages, but the nymphal stage dominates in the west. Breeding and feeding occurs in native grasslands (Imms 1964).

The generalized feeding habits of other members of the Hemiptera collected at Pantex are as follows:

i. Lygaeidae: *Geocoris* sp.--generally predacious, sometimes common about the roots of grasses and weeds (Borror and DeLong 1964).

ii. Nabidae--inhabit fields and prey extensively on aphids, leafhoppers, treehoppers, and small caterpillars. The small number of the nabids collected at Pantex would indicate they are not important at this time.

iii. Coreidae--plant feeders, at times very destructive. Most of the speciments collected at Pantex were associated with prickly pear and were found in substantial numbers.

iv. Scutelleridae--reported as commonly occurring in dry grasses, but not commonly found at Pantex.

v. Pentatomidae--a few species of this group are reported as harmful, but most of this harm is associated with cultivated crops (Swain 1948). Other species are beneficial as predators. Again, these insects are not common at Pantex and are not important at this time.

vi. Anthocoridae--reported as a beneficial insect, preying on mites, thrips, aphids, young scales, and other small insects. These insects are not found in numbers which are considered significant.

Coleoptera

Representatives of the order Coleoptera are fairly diverse, but with a few exceptions, such as Chrysomelidae and Elateridae, do not appear to be present in significant numbers. The families collected are as follows:

i. Cleridae--reported as mostly predacious as adults and larvae. Very few speciments have been collected at Pantex.

ii. Curculionidae--the majority of the representatives of this family that have been collected at Pantex seem to be associated with various cacti in the area. Some six species have been identified from Pantex by Dr. Charles O'Brien.

iii. Malachiidae--adults and larvae have been reported as predacious on various immature stages of the alfalfa caterpillar in Arizona. Although fairly abundant at Pantex, no observations have been made concerning its feeding habits.

iv. Meloidae--larvae are reported as living in the nests of wild bees or in the soil where they eat the eggs of grasshoppers. The adults feed on foliage and flowers and usually emerge in June or July. Adults of these insects have not been collected at Pantex in significant numbers to be considered important. Several specimens of the triungulin, the active first instar, stage have been collected.

v. Coccinellidae--with one exception, the larvae and adults are predacious on scale-insects, aphids and other small, soft-bodied insects or insect eggs. Few members of this family have been collected at Pantex, and are not considered important at this time.

vi. Tenebrionidae--both larvae and adult stages are phytophagous, and although the family is not well represented in the D-vac samples, pitfall traps have indicated a fairly large population present at Pantex. Further studies, employing various collecting methods, will be conducted at Pantex to determine the role of this family in the ecosystem.

vii. Staphylinidae--adults and larvae are scavengers or predacious on insects found in filth or litter. Few members of this family have been collected at Pantex, and are not considered important at this time.

viii. Elateridae--this is one of the well represented families at Pantex. The larvae feed on planted seeds and roots, and the adults are plant feeders (Swain 1948) but not important.

Members of this family were abundant throughout the period from mid-April through mid-December 1970, and are at this time considered to be one of the more important groups found at Pantex.

ix. Chrysomelidae--larvae feed on either leaves, roots, or bore through roots and stems. Most adults feed on plant leaves, stems or flowers. Several species have been collected in sufficient numbers at Pantex to be considered as important.

x. Carabidae--mostly predacious as adult and larvae. Collection with the D-vac does not indicate a significant population. However, other collection methods indicate that the carabids are plentiful at Pantex. More studies will be necessary to determine the role of Carabidae at Pantex.

xi. Anthicidae--this family is not well represented at Pantex. Some adults are predacious on larval forms of other insects, while other adults feed on injured fruits.

Lepidoptera

Several families have been collected at Pantex, mostly larval forms collected during the fall. Numbers have not been high enough to consider this group important. However, in 1969 the fall armyworm caused extensive damage in the area around treatment 1, the ungrazed site.

Neuroptera

The only representative of this group collected at Pantex is the family Myrmeliontidae. Few specimens have been collected and are not considered as important. Most of the Myrmeliontidae are predacious on aphids, ants, and other small insects (Imms 1964).

Diptera

Many representatives of various families have been collected, but not in sufficient numbers to be designated as important. However, observations by collectors using the D-vac method indicate that many more species are present, but are not being efficiently collected. Methods of collecting this group will have to be modified in order to obtain reliable population estimates.

The majority of Diptera probably feed on nectar and pollen from flowers, while others may require decaying organic matter. Many of the Diptera are either predacious or parasitic.

Hymenoptera

This is another group which we feel is not efficiently sampled by the D-vac method. Although a substantial number of species has been collected, it is felt by the investigators at Pantex that other methods of collection are necessary to determine population density and diversity. The hymenopterous groups that were collected are represented by the following:

i. Chalcidoidea--this group contains many parasitic groups and may prove to be important at Pantex.

ii. Dryinidae--at Pantex, this group is fairly common and might be important. The adults and larvae destroy considerable numbers of leaf-hoppers (as parasitoids).

iii. Formicidae--this group is well represented at Pantex, chiefly by *Crematogaster*, which displays various feeding habits such as attending aphids and other honey dew producing insects. They commonly attend scale-insects in arid regions.

The following is a list of the various taxa collected at Pantex, including abundance, species collected, and species identified.

HOMOPTERA

Cicadellidae--abundant; 11 species collected--not identified.

Dactylopiidae--abundant, one species collected--not identified.

Pseudacoccidae--not common; two species collected--not identified.

Aphidae--not common; one species collected--not identified.

HEMIPTERA

Lygaeidae--abundant; five species collected--four not identified, one identified to genus.

Nabidae--not common, one species collected--not identified.

Coreidae--common; two species--not identified.

Scutelleridae--not common; one species collected--not identified.

Pentatomidae--not common; one species collected--not identified.

Anthocoridae--not common; one species collected--not identified.

COLLEOPTERA

Latheridiidae--not common; one species collected--not identified.

Cleridae--not common; one species collected--not identified.

Curculionidae--common; six species collected--all identified.

*Gerstaeckeria lecontei*
  G. *porosa*
  G. *indistincta*

*Ophryastes vittatus*

*Ceutorhynchus convexicollis*

*Sphenophorus compressirostris*

Malachiidae--not common; one species collected--not identified.

Phalacridae--not common; one species collected--not identified.

Carabidae--common; five species collected--not identified.

Meloidae--common; one species collected--not identified.

Coccinellidae--not common; four species collected--three not identified, one identified to genus.

Tenebrionidae--common; four species--not identified.

Elateridae--abundant; one species collected--not identified.

Staphylinidae--not common; two species collected--not identified.

Chrysomelidae--abundant; three species collected--not identified.

Scaphidiidae--not common; one species collected--not identified.

Anthicidae--common; seven species collected--not identified.

LEPIDOPTERA

Common; five species collected--not identified.

NEUROPTERA

Not common; one species collected--identified to family Myrmeliontidae.

DIPTERA

Abundant; 16 species collected--not identified.

HYMENOPTERA

Chalcidoidea--abundant; eight species collected--not identified.

Dryinidae--common; one species collected--not identified.

Formicidae--abundant; 10 species collected--two identified to genus, eight not identified.

*Crematogaster* sp.

*Pogonomyrmex* sp.

ARANEIDA--Common

Lycosidae--two species collected--not identified.

Salticidae--one species collected--not identified.

Microaraneida--two species collected--not identified.

Solpugida--one species collected--not identified.

ORTHOPTERA

Acrididae--not common; two species collected--identified to family.

THYSANOPTERA--Abundant

Three species collected--identified to genus.

Thripidae

*Bregmatothrips* sp.

Aeolothripidae

*Aelothrips* sp.

Phloeothripidae

*Oedaolothrips* sp.

COLLEMBOLA

Sminthuridae--common; one species collected--not identified.

Entomobryidae--common; one species collected--not identified.

## Summary

The data collected at the Pantex Site seems to indicate that possibly as little as 10-20% of the groups present can be considered as "important" at this time. However, due to the large number of organisms unidentified, it is impossible to say with any certainty just how each individual group fits into the grassland ecosystem.

The word "important" is certainly ambiguous at this point in the study, and is based solely on frequency of occurrence in the D-vac samples.

When identification of these organisms has been confirmed by specialists and literature concerning the various habits of these organisms has been surveyed, it will then be possible to attempt a meaningful word model of the various interactions taking place among insects within the grassland ecosystem.

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