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# INSECT DENSITY AND DIVERSITY STUDIES ON TEST AREA C-52A, EGLIN AFB RESERVATION, FLORIDA

PYROTECHNICS BRANCH

FLAME, INCENDIARY, AND EXPLOSIVES DIVISION

Valder

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# Insect Density And Diversity Studies On Test Area C-52A, Eglin AFB Reservation, Florida

Stephen M. Valder, Captain, USAF

## FOREWORD

This technical note documents research supported by Air Force Armament Laboratory Development Project 5066, Aerial Dissemination Techniques. The study was conducted during the period September 1970 to June 1971.

The assistance of Captain John H. Hunter (DLIP) in preparing this document for publication is acknowledged.

This technical note has been reviewed and is approved.

Franklin C. Davies

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Chief, Flame, Incendiary, and Explosives Division

ABSTRACT

A sweep-net survey of the insects and other invertebrate animals found on a one-mile linear transect of Test Area C-52A, Eglin AFB Reservation, Florida, during the period 24 May to 2 June 1971, resulted in the collection of more than 1800 specimens belonging to 74 insect families and two non-insect Arthropod orders. An additional 28 insect families were noted on the test area during this period and during sporadic surveys in the fall and winter of 1970. Eighteen of the taxa collected accounted for 97 percent of the collection; six taxa accounted for 72 percent of the collection. These six taxa were Arthropod order Araneida (spiders), and the insect families Cicadellidae (leafhoppers), Elateridae (click beetles), Asilidae (robber flies), Lygaeidae (lygaeid plant bugs), and Pentatomidae (stink bugs). Spiders and robber flies are carnivores, stink bugs are carnivores or herbivores, and the other families are herbivores. Insect density and diversity could be correlated with plant density and diversity, which appeared to be functions of soil moisture and/or soil type as well as of previous defoliation. No direct adverse effects upon insects of high defoliant application levels were demonstrated, although as plants were eliminated by defoliation the insects which fed specifically upon these plants also disappeared.

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## SECTION I

## INTRODUCTION

Test Area C-52A on the Eglin AFB Reservation is a three-square-mile area. In the middle of this area is a one-square-mile plot divided into a 13 by 13 grid by permanent air sampling stations set at 400-foot intervals. The grid was used for aerial dispersal tests of military defoliants Purple, Orange, White and Blue from June 1962 to October 1970. During that period, approximately 1,211 pounds per acre of defoliant active ingredients as well as quantities of non-defoliant chemicals were deposited on the grid (Reference 1). The non-defoliant chemicals included malathion insecticide, 215 gallons of which were deposited over Test Area C-52A and the area north of C-52A between August and November 1970. The exact amount of malathion falling on the grid is unknown.

Several studies of the effects of these massive amounts of defoliants upon various aspects of grid flora are presented in References 1 to 6. The effects upon fish populations of defoliant washed into the streams draining the grid are reported in Reference 7 and upon species composition of vertebrate animals on the grid in Reference 8.

Insect life on the grid had not been examined previously except for one study on the effects of defoliant concentration, moisture, and vegetation upon ant hill density (Reference 8). Insects make ideal subjects for the determination of chemically induced environmental disruption, since they are highly sensitive to environmental alteration of any type through direct toxic effect and through unfavorable alteration of their ecological requirements.

The work described in this report was intended to be a preliminary effort to a comprehensive study of the effects of defoliation upon insects to be carried out during 1971 and 1972. However, due to transfer of the key personnel from the Air Force Armament Laboratory, the comprehensive study was not accomplished. The results of this pilot study are presented to suggest possible points of departure for similar studies. Insect families found on the grid are enumerated, and the relative abundance of these families is also presented. Simple correlations are made between insect diversity and abundance and the diversity and abundance of plants on the grid. No direct effects of defoliants upon insects were suggested by these initial studies. Malathion insecticide sprayed on the grid in 1970 almost certainly had no effect on grid insects in 1971 because it breaks down rapidly when exposed to the environment.

## SECTION II

## METHODS AND MATERIALS

The insect survey of Test Area C-52A can be divided roughly into two phases. During 1970, the grid was visited approximately twice monthly from September through December, and the insects noted were sight identified to family. On several occasions, a sweep net was used to make random catches in various areas of the grid, but no attempt was made to survey any area systematically.

During 1971, sweep net collections were made along a one-mile row of air samplers on 24, 26, and 27 May, and 1 and 2 June. The row chosen was air sampler row 8, the first sampler row east of the north-south sampler row dividing the grid into east and west halves (Figure 1). This particular row intercepted one east-west flight path, one northeast-southwest flight path, and one of the of the streams on the grid, thus affording the opportunity to sample every major ecosystem on the grid. Sampler row 8 was traversed (by walking) from north to south and then from south to north, so was sampled twice per day. The row is divided into thirteen 400 foot transects by impinger posts and east-west roads. Two hundred sweeps of a 15-inch diameter insect sweep net were made on each 400 foot transect. A line that was as straight as possible was walked between the impinger stations delineating the transect limits, with no deviations made for insects which flew out of the path of the sweep net. At the end of each transect, the net contents were emptied into a killing jar, and when all insects had expired, they were transferred into a polyethylene bag. This process was repeated for all transects. A total of 26 samples per day were obtained in this manner, two from each of the 13 transects. Insects observed on the grid but not captured in the sweep net which could be sight identified were logged into a field notebook. When the collections for the day were completed, the samples were taken back to the laboratory and the insects separated from plant debris and preserved in 70 percent isopropanol until identified. All insects were identified to family; all non-insect invertebrates were identified to order. Keys used for insect identification were those of Borrer and Delong in Reference 9. Common names used in tables and appendixes are from Blickenstaff in Reference 10.

The sweep net method was chosen as the easiest method of obtaining the greatest and most diversified number of insects with the lowest expenditure of money and manhours. It must be pointed out that certain biases are inherent in the sweep net method. These are discussed fully later.

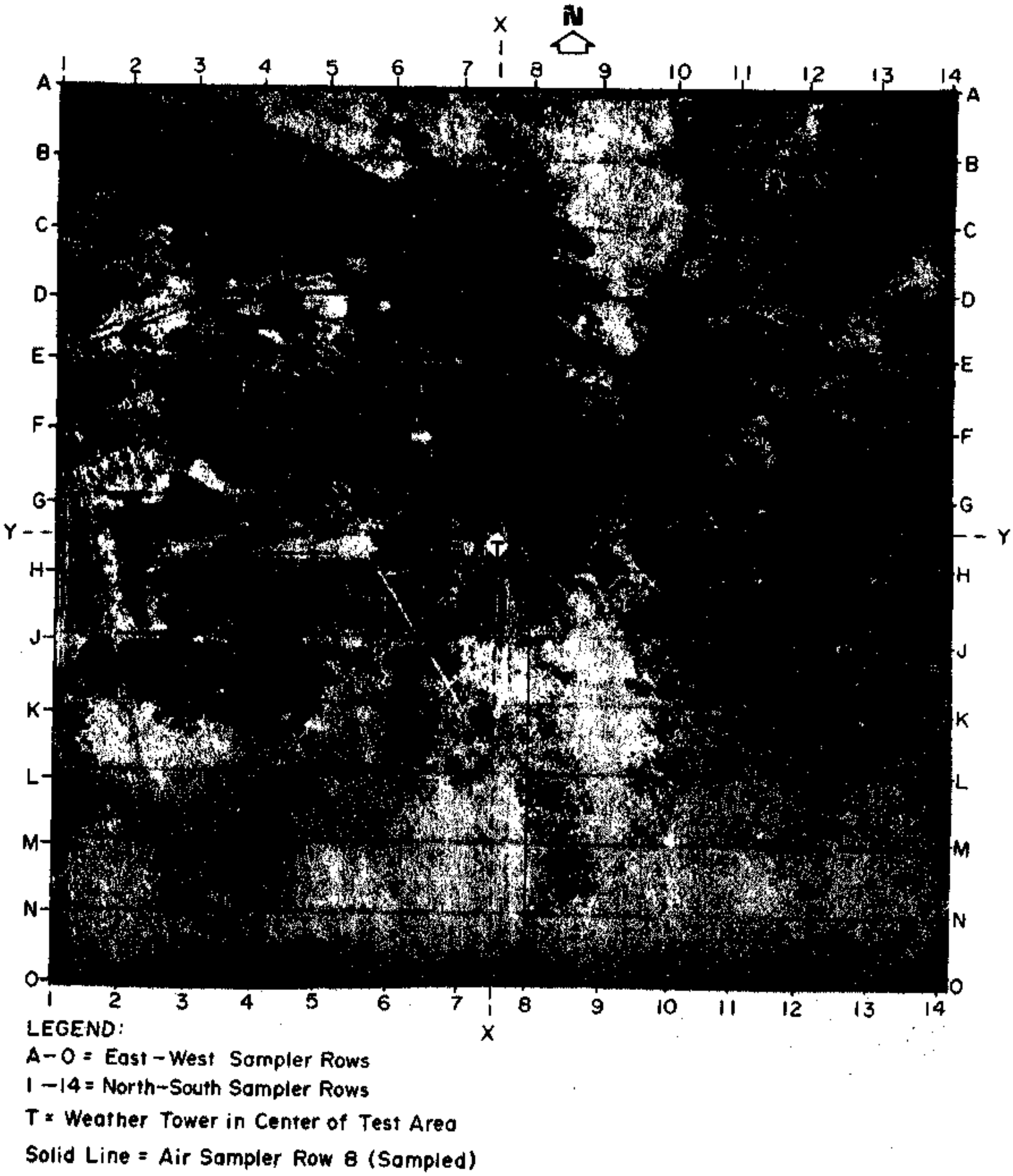


Figure 1. Aerial Photograph of Test Area C-52A

## SECTION III

## RESULTS

The results of all insect surveys of Test Area C-52A accomplished in 1970 and 1971 are summarized in Appendixes I and II. A total of 74 insect families and two orders of non-insect Arachnids were recovered during the 1971 sweep net survey. Twenty-eight additional insect families were observed and/or captured in 1970 or observed and not captured in 1971, for a total of 102 insect families and two Arachnid orders. At least six families of Arachnid order Araneida (spiders), and probably several more, were présent on the grid. The insects collected on each of the 13 transects studied are listed in the Appendix.

Although specimens representing 76 families (treating the non-insect orders as insect families for simplicity) were recovered in the sweep net survey, a comparatively small number of these families comprised the majority of the specimens collected. As summarized in Table I, only 18 families were present in numbers equal to or exceeding 1 percent of the total insects collected, yet these 18 dominant families comprised 96.9 percent of the 1,803 insects collected. The six families which exceeded 4 percent of the total insects comprised 71.4 percent of the collection.

| TABLE I. TAXA COLLECTED IN NUMBERS EXCEEDING ONE PERCENT OF THE TOTAL SPECIMENS COLLECTED[a] | | |
|---|---|---|
| FAMILY-COMMON NAME | PERCENT OF TOTAL | CUMULATIVE PERCENT OF TOTAL[b] |
| Cicadellidae - leafhoppers | 31.7 | 31.7 |
| Araneida - spiders (order) | 18.6 | 50.3 |
| Lygaeidae - lygaeid bugs | 7.7 | 58.0 |
| Elateridae - click beetles | 4.7 | 62.7 |
| Pentatomidae - stink bugs | 4.5 | 67.2 |
| Asilidae - robber flies | 4.2 | 71.4 |
| Nabidae - damsel bugs | 3.9 | 75.3 |
| Acrididae - grasshoppers | 3.2 | 78.5 |
| Reduviidae - assassin bugs | 2.7 | 81.2 |
| Sphecidae - sand wasps | 2.6 | 83.8 |
| Tenebrionidae - darkling beetles | 2.4 | 86.2 |
| Chrysomelidae - leaf beetles | 2.2 | 88.4 |
| Scutelleridae - scutellerid bugs | 2.1 | 90.5 |
| Coenagrionidae - dragonflies | 1.4 | 91.9 |
| Halictidae - sweat bees | 1.4 | 93.3 |
| Mydaidae - mydas flies | 1.3 | 94.6 |
| Tettigoniidae - katydids | 1.3 | 95.9 |
| Mycetophilidae - mycetophilid flies | 1.0 | 96.9 |

[a]Total equals 1803 specimens: 1 percent of the total equals 18 specimens

[b]Cumulated percent of total is derived by the progressive summation of the figures in the percent of total column

## SECTION IV

## EXPERIMENTAL BIASES

The sweep net was chosen for the preliminary grid survey because many diverse insect species can be collected by this method in a short time and at a low cost. However, certain experimental biases are introduced in the sweep net method and affect both the numbers and the species of insects collected in the net.

Among the factors which can affect the results of sweep net collections are: ecological (including behaviorial) factors and local weather. These factors are thoroughly discussed in Reference 11 but will be summarized here. The most obvious bias of the sweep net method is that the only insects collected are those which are, at the time of the survey, either in the vegetation or on the wing in the approximate area between 2 and 40 inches above the ground. Thus, specimens crawling on the ground (ground beetles and wolf spiders); those which have a subterranean habitat (ants and mole crickets); those with an aquatic habitat (diving beetles and backswimmers); those that are completely or partially protected by their environment (termites, crickets, and cockroaches); those which normally fly higher than the net can reach (larger butterflies); etc.; are seldom recovered.

Many insects fly so swiftly and evade the net so readily while in flight that they are seldom netted, even though they are often observed. It is almost impossible to capture the larger dragonflies with a sweep net due to their speed and ability to evade the net when they see it approaching. The sand wasps, common in the barren areas of the grid, were much more numerous than shown by the survey, but these flew less than one inch off the ground and could evade the net.

Many insects with habitats which are within the area conveniently sampled by the sweep net may evade the net when warned of the presence of the collector by visual or other stimuli. These insects either fly from the area or evade capture by dropping to the ground out of the reach of the net. The larger of these insects may be sighted, but it is probable that many of the smaller insects escaping the net in this manner are not.

Local weather conditions can profoundly influence the results of sweep net surveys. Generally speaking, optimum weather conditions for a sweep net survey are temperature in excess of 70°F, no precipitation, no dew, and no air movement. If the temperature is low, insects become inactive and difficult to collect. Precipitation drives the insects into cover near the ground or in the middle of vegetation clumps. Winds will also drive many insects to sheltered locations and allow others, particularly larger butterflies, dragonflies, and grasshoppers, to soar at altitudes higher than the net can reach.

Even with the drawbacks described, the sweep net survey was successful in identifying several species which could have been used in more detailed studies of the effects of defoliants upon insects.

## SECTION V

## FACTORS AFFECTING PLANT DISTRIBUTION

Both natural and introduced factors influence plant density and diversity on the grid. The only natural factors considered here are soil type and soil moisture (Reference 1) which are closely related. Most of the grid is covered by Lakeland Sand, which is excessively drained and remains very dry at all times, even though the grid receives an average of 60 inches of rain annually. There are areas of Chipley Sand and Rutledge Sand crossing the middle third of the grid, and these sands are not as well drained as the Lakeland Sand, and they hold water for a longer time. The water tables under the latter two sands are much higher, and two permanent ponds are found in this area, one close to transect FG of air sampler row 8. These areas support a dense and diverse flora, while the north and south ends of the grid are barren. The number and diversity of insects collected in the middle third of the grid are correspondingly high as compared to the number of insects collected on the north and south thirds of the grid.

The defoliant applied to the grid also affected the pattern of plant life on the grid, as would be expected. The grid is crossed by several flight paths used in the aerial dissemination of defoliants, two of which influenced the vegetation of several transects on sampler row 8. The major north-south flight path parallels air sampler row 8, approximately 400 feet to the east. This path is apparent in Figure 1 because of the reduced vegetation compared with surrounding terrain that was not directly under the flight path. The two southern transects (MN, NO) are almost devoid of vegetation due primarily to a flight path crossing the area, although wind erosion, excessive soil dryness, and perhaps mechanical disturbance may also be factors.

It is difficult to determine whether the distribution of plants upon the grid is affected more by moisture level or by defoliant application. Defoliants obviously caused plant death; however, plant populations quickly returned to their previous levels if there was sufficient soil moisture to support them. This is easily seen by examination of the main north-south flight path in Figure 1. This flight path appears as a broad barren area on the north and south thirds of the grid, which are excessively drained, but appears much more heavily vegetated in the middle third of the grid, which has a higher water table and therefore more soil moisture. Defoliant residues in grid soil appeared to dissipate rapidly to a non-phytotoxic level by leaching, photodegradation, or other mechanisms. Both defoliation operations and soil moisture are thus seen to influence plant growth of the grid.

## SECTION VI

## PLANT-INSECT INTERRELATIONSHIPS

Much of the insect fauna of an area is directly related to the plants found in that area. Many herbivorous insects feed specifically on a single plant species, or on a group of closely related species, or on plants of a single family, although a large number of insect herbivores are more general feeders. Insectivorous or parasitic insects are also often quite specific, as has been known since it was demonstrated over 80 years ago that certain wasps provision their nests with only a single species of grasshopper. Many other cases of prey specificity have since been documented. Thus, the presence of two, or perhaps even more insect trophic levels may be dependent on the presence of a plant species in the area. Plant density also directly influences insect populations. As an oversimplified example, if one plant will support 10 insects, than 10 plants will support 100 insects. Since insect density and diversity are influenced by plant density and diversity, it would be expected that in an area (such as Test Area C-52A) where plant density and diversity are varied, insect density and diversity would also vary. The grid studies generally supported these facts; although much more work is necessary to determine the extent that the presence of a particular insect species on the grid is dependent upon a specific plant.

The plant density on the grid was previously determined (Reference 1) and it was also shown that the diversity of dicotyledonous plants (dicots) was closely correlated with plant density over the grid. Dicot diversity is used here as an index of plant diversity. Table II shows this relationship.

TABLE II. NUMBER OF DICOTYLEDONOUS PLANT SPECIES OCCURRING IN 400 BY 400 FOOT SECTIONS HAVING VEGETATION COVER OF CLASS 0 TO V [From Reference 1]

| VEGETATION CLASS[a] | PERCENTAGE COVER | NUMBER OF DICOTYLEDONS | NUMBER OF SHRUBS |
|---|---|---|---|
| 0 | 0 to 5 | 5 | 0 |
| I | 5 to 20 | 6 | 0 |
| II | 20 to 40 | 13 | 1 |
| III | 40 to 60 | 17 | 2 |
| IV | 60 to 80 | 19 | 5 |
| V | 80 to 100 | 24 | 4 |

[a]Vegetation class is based on percentage of area covered by vegetation

Table III presents dicot number, used as the plant diversity index; percent plant cover, used as the plant density index; number of insect families, used as the insect diversity index; and number of insects, used as the insect density index. Most families of insects collected were represented by several to many species which were not further identified. Dicot number and percent plant cover were adjusted from the figures given in Table II, as these were originally determined on the basis of the 400 foot square area enclosed by each four impinger stations on the grid. Adjustments were calculated by averaging the dicot numbers and mean vegetation densities of the two 400 foot square areas interfacing at each transect.

The relationship of the data shown in Table III is shown in Figures 2 to 5. These figures compare insect density with plant density, insect density with plant diversity, insect diversity with plant density, and insect diversity with plant diversity. The figures are remarkably similar due to the interdependence of vegetative cover and dicot number, and of insect numbers and numbers of insect families.

It is apparent that insect density and diversity vary with plant density and diversity. Insect diversity, in particular, is closely correlated with plant density and diversity. Insect density also shows a general correlation with plant density and diversity, although this correlation was not always quantitative. For example, transect FG showed an enormous increase in number of insects collected (Appendixes I and II) compared with the adjacent transect GH (524 compared with 183), even though transects FG and GH have the same percent of vegetative cover, the same dicot index, and essentially the same number of insect families present (44 as compared with 43). When the numbers of some of the families collected are compared however, significant differences appear. There were 80 leafhoppers collected on FG contrasted to 21 collected on GH. There were 188 spiders collected on FG contrasted to only 26 on GH. The majority of spiders collected on FG appeared to be a single species (possible of Family Tetragnathidae), and this species appeared nowhere else on air sampler row 8. These spiders might be associated with water or depend upon it in some way, as FG is crossed by a small stream, and there is not water on any other transect studied. Other families show transect-to-transect variation of this type, as is shown in the appendixes. This transect-to-transect variation is the type of phenomenon that could almost certainly be exploited to find specific plant-insect relationships. These relationships could be used as an index of plant succession through insect succession.

| TABLE III. PLANT AND INSECT DENSITY AND DIVERSITY ON TEST AREA C-52A | | | | |
|---|---|---|---|---|
| TRANSECT | ADJUSTED DICOT NUMBER[a] | ADJUSTED PERCENT PLANT COVER[b] | NUMBER OF INSECT FAMILIES[c] | NUMBER OF INSECTS[d] |
| AB | 12 | 30 | 18 | 50 |
| BC | 12 | 30 | 20 | 92 |
| CD | 21 | 70 | 26 | 219 |
| DE | 21 | 70 | 23 | 147 |
| EF | 22 | 80 | 27 | 196 |
| FG | 24 | 90 | 44 | 524 |
| GH | 24 | 90 | 43 | 183 |
| HJ | 21 | 70 | 31 | 166 |
| JK | 13 | 30 | 14 | 32 |
| KL | 15 | 40 | 17 | 35 |
| LM | 15 | 40 | 17 | 75 |
| MN | 12 | 30 | 16 | 38 |
| NO | 6 | 10 | 13 | 46 |

[a]Adjusted dicot number is used as the measure of plant diversity.

[b]Adjusted percent plant cover is used as the measure of plant density.

[c]Number of insect families is used as the measure of insect diversity.

[d]Number of insects is used as the measure of insect density.

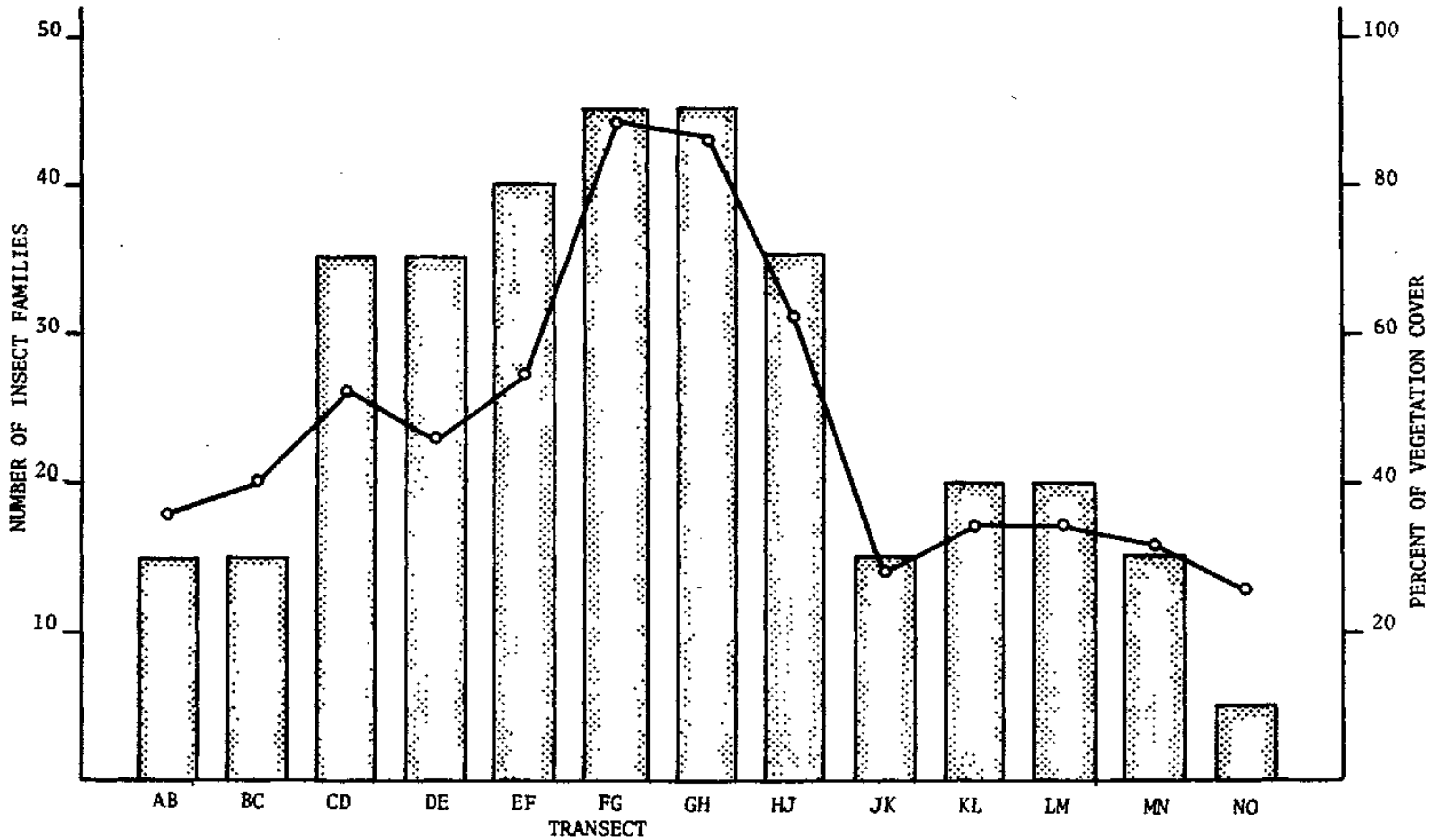


Figure 2. Number of Insect Families per Transect Compared with Percentage of Vegetation Cover of the Transects (Vegetation Cover is Represented by Bar Graphs. Number of Insect Families is Represented by Line Graphs)

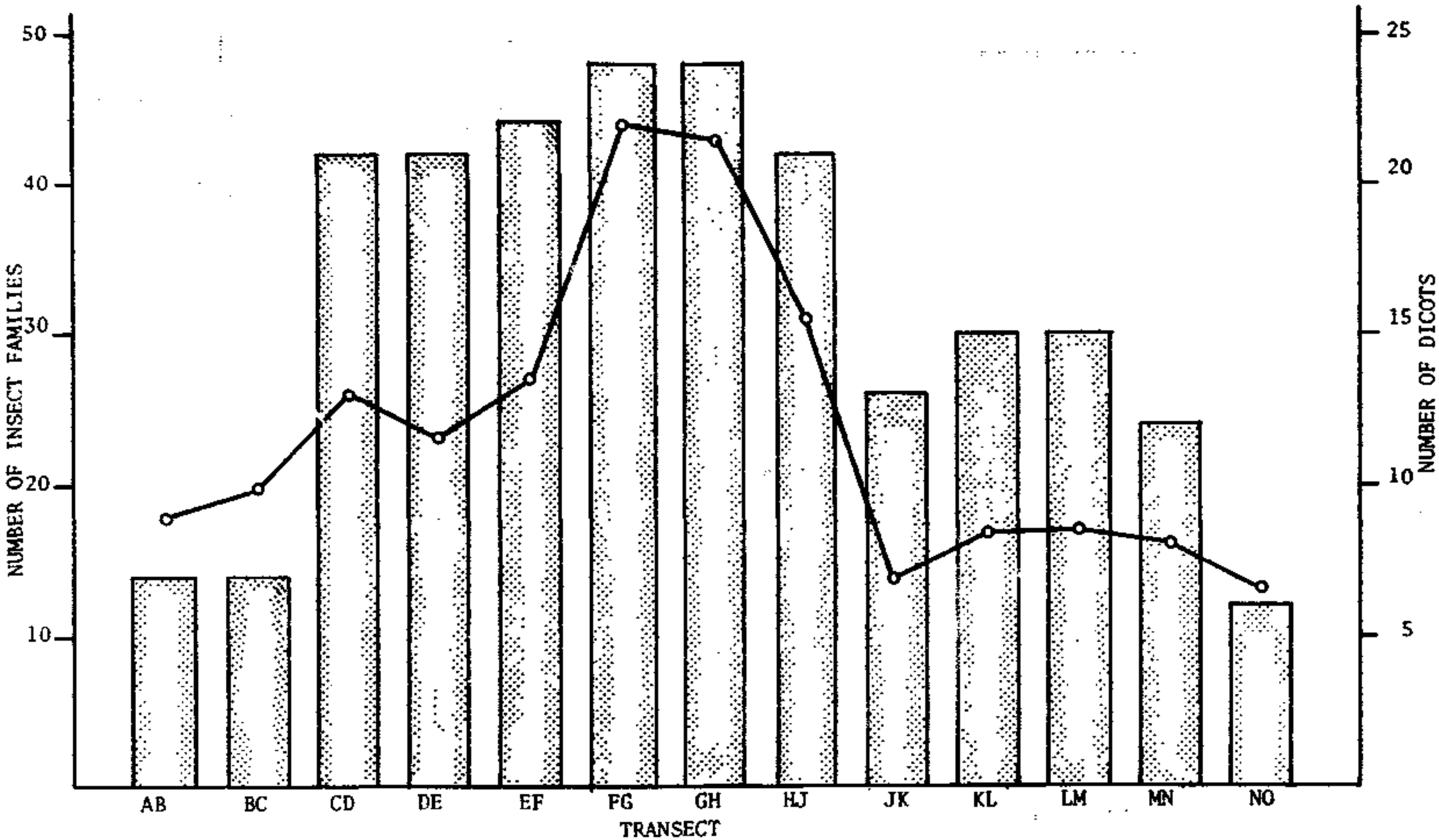


Figure 3. Number of Insect Families per Transect Compared to Number of Dicots per Transect. Dicot Number is Represented by the Bar Graph. Number of Insect Families is Represented by the Line

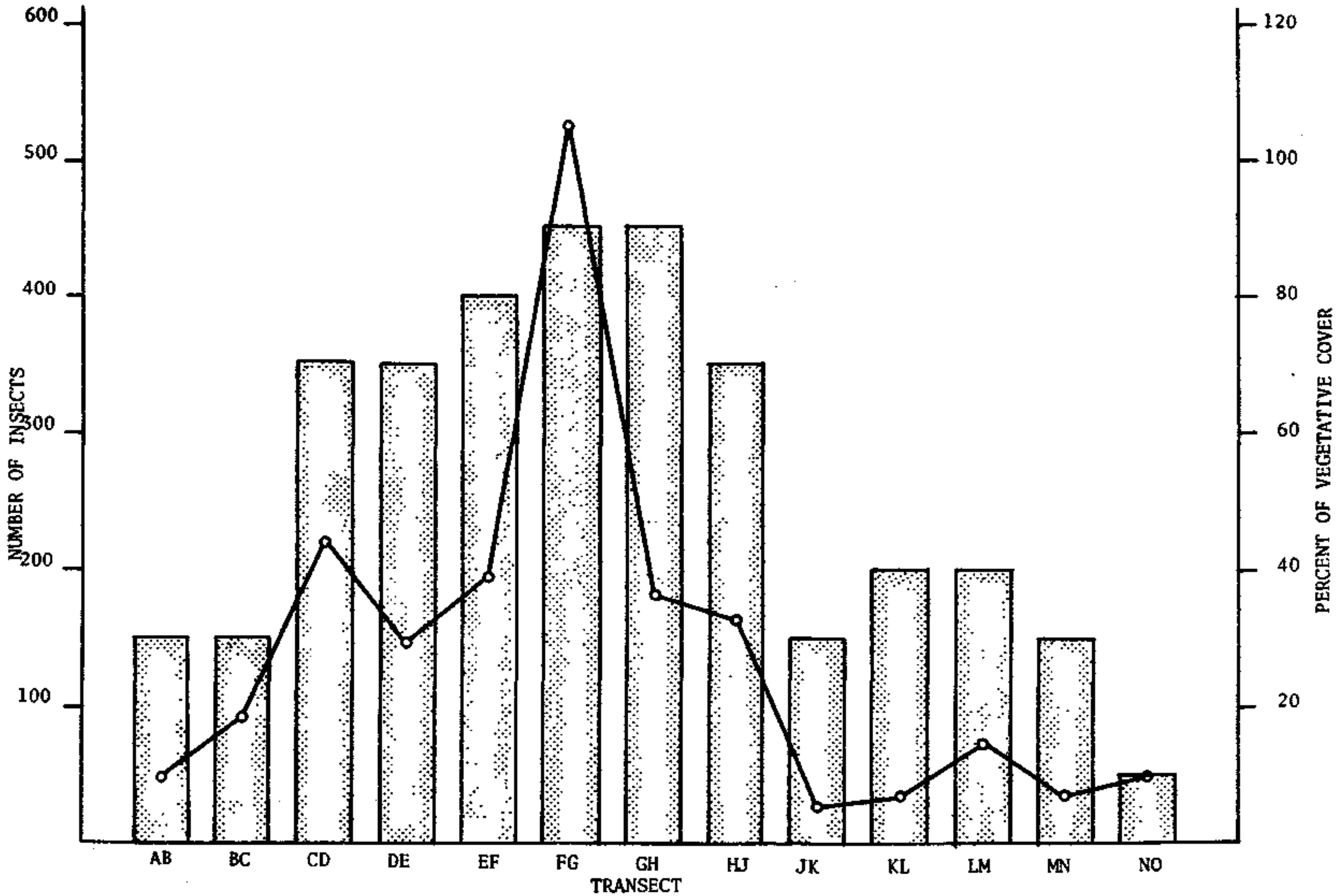


Figure 4. Number of Insects per Transect Compared with Percentage of Vegetation Cover of the Transects. Vegetation Cover is Represented by Bar Graphs. Number of Insect Families is Represented by Line Graphs

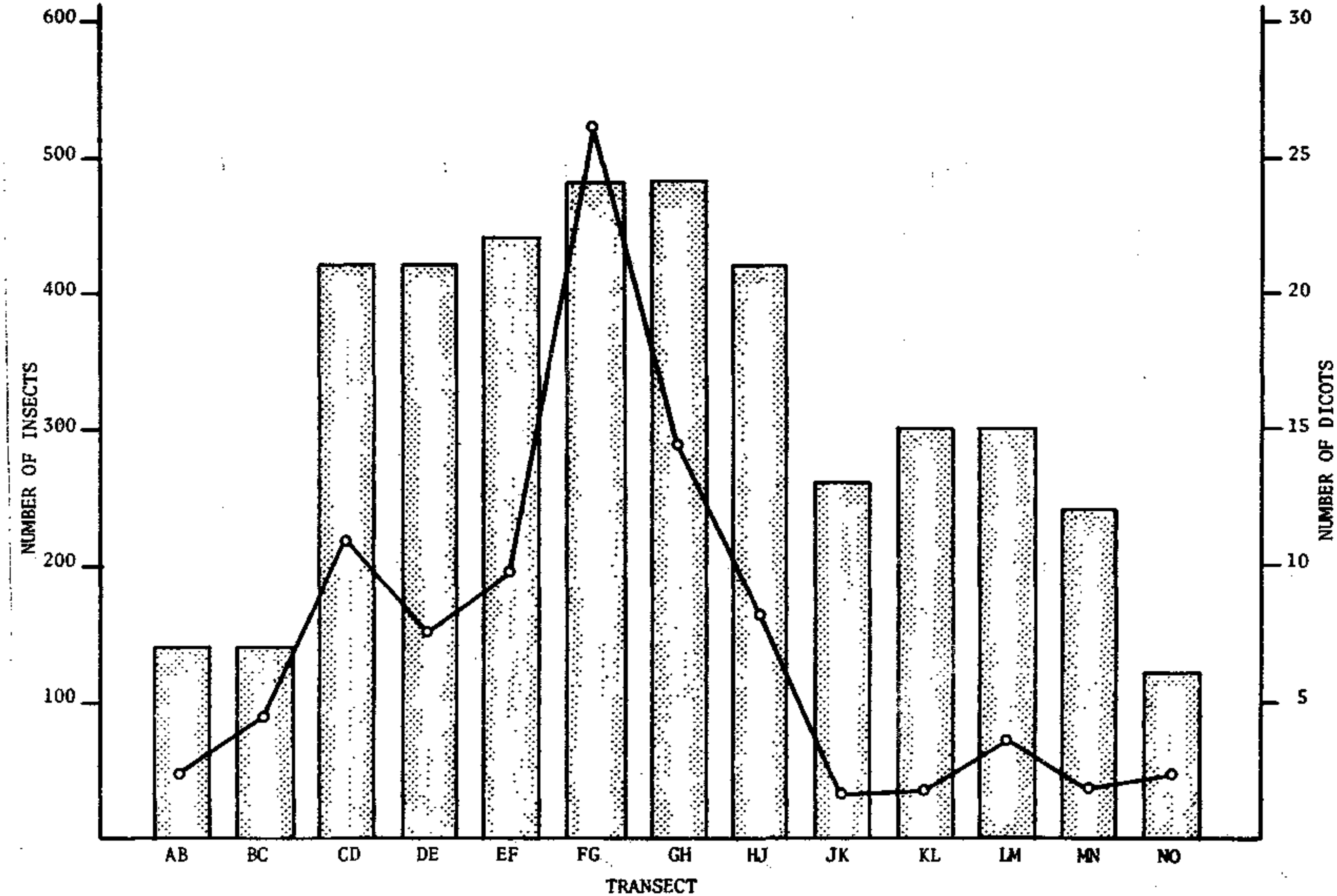


Figure 5. Number of Insects per Transect Compared with Number of Dicots per Transects. Dicot Number is Represented by Bar Graphs. Number of Insect Families is Represented by Line Graphs.

## SECTION VII

## SUMMARY AND CONCLUSIONS

A five-day sweep net insect survey of Test Area C-52A on the Eglin Air Force Base Reservation used for testing aerial application methods for military defoliants, resulted in the collection of over 1800 specimens belonging to 74 insect families and two non-insect Arthropod orders. Twenty-eight additional insect families were noted on the grid but not collected during the survey. Only 18 of the 74 families were collected in numbers exceeding 1 percent of the total insects collected, and specimens from these 18 families constituted 97 percent of the total collection.

A positive correlation was demonstrated between plant density and diversity and insect density and diversity; however, plant succession on Test Area C-52A (after defoliation) was influenced by soil moisture as well as by the actual defoliation operation. Plants in moist areas of the grid came back much more rapidly than did plants in areas of low soil moisture.

No direct adverse effects of previous heavy defoliant applications upon grid insects could be demonstrated nor were any suspected. The only apparent effect that the defoliation had upon insects was that elimination of plants used as food or shelter by certain insects resulted in elimination of the insect from the area. More specialized studies could identify insect-plant relationships such that the insect could be used as an index for the determination of the rate of plant succession in defoliated areas.

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APPENDIX I. ARACHNIDS COLLECTED OR OBSERVED ON TEST AREA C-52A, EGLIN AFB RESERVATION, FLORIDA

| ORDER | COMMON NAME | TOTAL SPECIMENS | NUMBER OF SPECIMENS COLLECTED ON TRANSECT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AB | BC | CD | DE | EF | FG | GH | HJ | JK | KL | LM | MN | NO |
| Araneida | Spiders | 355 | 4 | 3 | 25 | 8 | 30 | 188 | 26 | 28 | 7 | 4 | 8 | 2 | 2 |
| Phalagida | Harvestmen | 1 | | | | | | | | | | | | | |

APPENDIX II. INSECTS COLLECTED OR OBSERVED ON TEST AREA C-52A, EGLIN AFB RESERVATION, FLORIDA

| FAMILY | COMMON NAME | TOTAL SPECIMENS | NUMBER OF SPECIMENS COLLECTED ON TRANSECT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AB | BC | CD | DE | EF | FG | GH | HJ | JK | KL | LM | MN | NO |
| ORDER: COLEOPTERA (BEETLES) 206 Specimens Collected | | | | | | | | | | | | | | | |
| Anthicidae | Antlike Flower Beetles | 1 | | | | | | | | | | | 1 | | |
| Bruchidae | Seed Beetles | 1 | | | | | 1 | | | | | | | | |
| Buprestidae[a] | Metallic Wood Borers | | | | | | | | | | | | | | |
| Carabidae | Ground Beetles | 4 | | | | | | 2 | 1 | 1 | | | | | |
| Cerambycidae | Long horned Beetles | 1 | | | 1 | | | | | | | | | | |
| Chrysomelidae | Leaf Beetles | 43 | 4 | 4 | 1 | 1 | 6 | 5 | 6 | 4 | 2 | 4 | 2 | 4 | |
| Cicindellidae | Tiger Beetles | 2 | | | | 1 | | 1 | | | | | | | |
| Coccinellidae | Lady Beetles | 8 | | | 1 | | 1 | | 4 | | 2 | | | | |
| Curculionidae | Snout Beetles | 10 | | | | | | 10 | | | | | | | |
| Dytiscidae[b] | Predacious Diving Beetles | | | | | | | | | | | | | | |
| Elateridae | Click Beetles | 84 | 12 | 10 | 15 | 5 | 13 | 10 | 2 | 5 | 1 | 1 | | 7 | 3 |
| Gyrinidae[a] | Whirligig Beetles | | | | | | | | | | | | | | |
| Meloidae | Blister Beetles | 3 | | | | | | | 2 | 1 | | | | | |
| Mordellidae | Tumbling Flower Beetles | 6 | | | | | | 2 | 4 | | | | | | |
| Passalidae[b] | Passalid Beetles | | | | | | | | | | | | | | |

[a]Sighted but not collected in 1971

[b]Sighted or collected in 1970

| FAMILY | COMMON NAME | TOTAL SPECIMENS | NUMBER OF SPECIMENS COLLECTED ON TRANSECT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AB | BC | CD | DE | EF | FG | GH | HJ | JK | KL | LM | MN | NO |
| ORDER: COLEOPTERA (Continued) | | | | | | | | | | | | | | | |
| Scarabaeidae | Scarab Beetles | 2 | | 1 | | | | | 1 | | | | | | |
| Staphylinidae | Rove Beetles | 1 | | | | | | | | | | 1 | | | |
| Tenebrionidae | Darkling Beetles | 43 | 2 | 2 | 10 | | 2 | 3 | 3 | 4 | | 1 | 7 | 3 | 6 |
| ORDER: DERMAPTERA (EARWIGS) 1 Specimen Collected | | | | | | | | | | | | | | | |
| Forficulidae | Forficulid Earwigs | 1 | | | | | | | | | | | | | |
| ORDER: DIPTERA (FLIES) 211 Specimens Collected | | | | | | | | | | | | | | | |
| Anthomyiidae | Anthomyiidid Flies | 14 | | | | | | 9 | 1 | 2 | 1 | 1 | | | |
| Asilidae | Robber Flies | 76 | 1 | 4 | 4 | 8 | 11 | 10 | 14 | 7 | | 3 | 9 | 3 | 2 |
| Bibionidae | March Flies | 4 | | | | | | 4 | | | | | | | |
| Bombiliidae[a,b] | Bee Flies | | | | | | | | | | | | | | |
| Calliphoridae | Blow Flies | 2 | | | | | | 2 | | | | | | | |
| Chironomidae | Midges | 8 | | | | | 4 | | 4 | | | | | | |
| Chloropidae[b] | Chloropid Flies | | | | | | | | | | | | | | |
| Culicidae[a,b] | Mosquitoes | | | | | | | | | | | | | | |
| Dolichopodidae | Long-Footed Flies | 3 | | | | | | 2 | 1 | | | | | | |
| Drosophilidae | Vinegar Flies | 16 | 1 | | 2 | 2 | | 2 | 1 | | | | 6 | 1 | 1 |
| Mycetophilidae | Fungus Gnats | 18 | | | | | | 16 | 2 | | | | | | |
| Mycaidae | Mydas Flies | 23 | 1 | 4 | 3 | 1 | 3 | 2 | | 1 | 1 | 4 | 2 | 1 | |
| Muscidae | Muscid Flies | 17 | | 1 | | | 2 | 9 | 3 | | | | 1 | | 1 |
| Pipunculidae | Bigheaded Flies | 3 | | | | | 1 | | 2 | | | | | | |

| FAMILY | COMMON NAME | TOTAL SPECIMENS | NUMBER OF SPECIMENS COLLECTED ON TRANSECT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AB | BC | CD | DE | EF | FG | GH | HJ | JK | KL | LM | MN | NO |
| ORDER: DIPTERA (FLIES) (Continued) | | | | | | | | | | | | | | | |
| Sepsidae | Sepsid Flies | 11 | | | | | | 3 | 7 | 1 | | | | | |
| Syrphidae | Flower Flies | 9 | | | | | | 9 | | | | | | | |
| Tabanidae | Horse Flies, Deer Flies | 1 | | | | | | | 1 | | | | | | |
| Tachinidae | Tachina Flies | 1 | | | | | | | 1 | | | | | | |
| Tipulidae | Crane Flies | 1 | | | | 1 | | | | | | | | | |
| Tripetidae | Trypetid Flies | 4 | | | | | | 3 | 1 | | | | | | |
| ORDER: HEMIPTERA (TRUE BUGS) 390 Specimens Collected | | | | | | | | | | | | | | | |
| Belastomatidae[b] | Giant Water Bugs | | | | | | | | | | | | | | |
| Coreidae | Coreid Bugs | 3 | | | 2 | | | | | | | | | | |
| Corimelaenidae | Corimelaenid Bugs | 5 | | | 5 | | | | | | | | | | |
| Cydnidae | Cydnid Bugs | 2 | | | | | | | 1 | 1 | | | | | |
| Gerridae[a] | Water Striders | | | | | | | | | | | | | | |
| Lygaeidae | Lygaeid Bugs | 138 | | 4 | 38 | 10 | 19 | 40 | 6 | 19 | 1 | | 5 | 1 | 2 |
| Miridae | Plant Bugs | 2 | 1 | | | | | | | 1 | | | | | |
| Nabidae | Damsel Bugs | 71 | 2 | 7 | 8 | 15 | 3 | 5 | 9 | 14 | 2 | 2 | 4 | | |
| Neididae | Neidid Bugs | 1 | | 1 | | | | | | | | | | | |
| Nepidae[b] | Water Scorpions | | | | | | | | | | | | | | |
| Notonectidae[b] | Backswimmers | | | | | | | | | | | | | | |
| Pentatomidae | Stink Bugs | 82 | 2 | 7 | 22 | 13 | 7 | 5 | 4 | 18 | | | 4 | | |
| Reduviidae | Assassin Bugs | 49 | 1 | 1 | 11 | | 14 | | 6 | 6 | 1 | 1 | 7 | 1 | |
| Scutelleridae | Scutellerid Bugs | 37 | | 2 | 3 | 1 | 12 | 1 | 13 | 2 | | | 2 | | |

| FAMILY | COMMON NAME | TOTAL SPECIMENS | NUMBER OF SPECIMENS COLLECTED ON TRANSECT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AB | BC | CD | DE | EF | FG | GH | HJ | JK | KL | LM | MN | NO |
| ORDER: HOMOPTERA (TRUE BUGS) 360 Specimens Collected | | | | | | | | | | | | | | | |
| Aphidae | Plantlice | 4 | | | | 1 | | 1 | | 1 | 1 | | | | |
| Cercopidae | Spittlebugs | 9 | | | 1 | 2 | 1 | 1 | 1 | 3 | | | | | |
| Cicadellidae | Leafhoppers | 343 | 10 | 30 | 46 | 54 | 41 | 80 | 21 | 29 | 10 | 10 | 10 | 2 | 2 |
| Coccidae[a,b] | Scale Insects | | | | | | | | | | | | | | |
| Fulgoridae | Fulgorid Planthoppers | 1 | | | | | | | 1 | | | | | | |
| Membracidae | Treehoppers | 3 | | | | | | 2 | 1 | | | | | | |
| ORDER: HYMENOPTERA (BEES, WASPS, ANTS) 125 Specimens Collected | | | | | | | | | | | | | | | |
| Apidae | Apid Bees | 1 | | | | | | | | 1 | | | | | |
| Bombidae[b] | Bumble Bees | | | | | | | | | | | | | | |
| Braconidae | Braconid Wasps | 11 | | 1 | 1 | 1 | 2 | 1 | 3 | 2 | | | | | |
| Chalcididae | Chalcids | 2 | | | | | | 1 | 1 | | | | | | |
| Chrysididae | Cuckoo Wasps | 1 | | | | | | 1 | | | | | | | |
| Cynipidae | Gall Wasps | 2 | | | | | | | | 2 | | | | | |
| Formicidae | Ants | 12 | | | 1 | 2 | | 6 | 2 | | | 1 | | | |
| Halictidae | Sweat Bees | 25 | 3 | 1 | 2 | 1 | | 12 | 5 | 1 | | | | | |
| Ichneumonidae | Ichneumon Wasps | 3 | | | | | | | | 1 | | | | 2 | |
| Megachilidae | Leafcutting Bees | 2 | 1 | | | | | 1 | | | | | | | |
| Mutillidae | Velvet Ants | 4 | | 3 | | | | | | | | | | 1 | |
| Pamphiliidae | Webspinning Sawflies | 5 | 1 | | 1 | | | | | | | | | 1 | 2 |
| Pompilidae | Spider Wasps | 6 | | | | | | 1 | | 1 | | 1 | | 2 | 1 |

| FAMILY | COMMON NAME | TOTAL SPECIMENS | NUMBER OF SPECIMENS COLLECTED ON TRANSECT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AB | BC | CD | DE | EF | FG | GH | HJ | JK | KL | LM | MN | NO |
| ORDER: HYMENOPTERA (BEES, WASPS, ANTS) (Continued) | | | | | | | | | | | | | | | |
| Scoliidae | Scoliid Wasps | 1 | | | | | | 1 | | | | | | | |
| Sphecidae | Sand Wasps | 46 | 2 | 2 | | 1 | 2 | 4 | 6 | 2 | | 1 | | 6 | 20 |
| Tiphiidae | Tiphiid Wasps | 4 | | | | | | 4 | | | | | | | |
| Xylocopidae[a] | Carpenter Bees | | | | | | | | | | | | | | |
| ORDER: ISOPTERA (TERMITES) Observed Only | | | | | | | | | | | | | | | |
| Rhinotermitidae[b] | Subterranean Termites | | | | | | | | | | | | | | |
| ORDER: LEPIDOPTERA (BUTTERFLIES AND MOTHS) 38 Specimens Collected | | | | | | | | | | | | | | | |
| Danaidae[b] | Milkweed Butterflies | | | | | | | | | | | | | | |
| Geometridae[a,b] | Geometrid Moths | | | | | | | | | | | | | | |
| Lycaenidae[a,b] | Blues and Coppers | | | | | | | | | | | | | | |
| Hesperiidae[a,b] | Skippers | | | | | | | | | | | | | | |
| Microlepidoptera[c] | Several Families | 23 | | | | 5 | 3 | | | | | | | | |
| Noctuidae | Owl Moths | 1 | | | | | | | | | | | 1 | | |
| Nymphalidae[a,b] | Brushfooted Butterflies | | | | | | | | | | | | | | |
| Papilionidae[a,b] | Swallowtail Butterflies | | | | | | | | | | | | | | |
| Pieridae[a,b] | Sulfurs | | | | | | | | | | | | | | |
| Psychidae[b] | Bagworm Moths | | | | | | | | | | | | | | |
| Pyralidae | Pyralid Moths | 14 | | | | | | 3 | 1 | 2 | 1 | | | | |

[c]Several families in this group, but identified no further

| FAMILY | COMMON NAME | TOTAL SPECIMENS | NUMBER OF SPECIMENS COLLECTED ON TRANSECT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AB | BC | CD | DE | EF | FG | GH | HJ | JK | KL | LM | MN | NO |
| ORDER: NEUROPTERA (NERVE WINGED INSECTS) 9 Specimens Collected | | | | | | | | | | | | | | | |
| Chrysopidae[a] | Green Lacewings | | | | | | | | | | | | | | |
| Hemerobaeidae | Brown Lacewings | 1 | | | | | 1 | | | | | | | | |
| Myrmeleonidae | Antlions | 8 | | 1 | | | | | | | | 1 | 5 | | 1 |
| ORDER: ODONATA (DRAGONFLIES AND DAMSELFLIES) 40 Specimens Collected | | | | | | | | | | | | | | | |
| Aeshnidae[b] | Dragonflies | | | | | | | | | | | | | | |
| Coenagrionidae | Damselflies | 25 | | | | | 2 | 21 | 1 | | 1 | | | | |
| Corduliidae[b] | Dragonflies | | | | | | | | | | | | | | |
| Lestidae[b] | Damselflies | | | | | | | | | | | | | | |
| Libellulidae | Dragonflies | 15 | | | | | 1 | 14 | | | | | | | |
| ORDER: ORTHOPTERA (GRASSHOPPERS AND CRICKETS) 74 Specimens Collected | | | | | | | | | | | | | | | |
| Acrididae | Grasshoppers | 58 | 1 | 6 | 6 | 6 | 8 | 16 | 7 | 4 | 1 | 1 | | 1 | 1 |
| Gryllidae | Crickets | 3 | | | 1 | | | | 1 | 1 | | | | | |
| Gryllotalpidae[a,b] | Mole Crickets | | | | | | | | | | | | | | |
| Mantidae | Mantids | 4 | | | | 1 | 3 | | | | | | | | |
| Tettigoniidae | Katykids | 23 | 1 | | 6 | 4 | 2 | 4 | 5 | 1 | | | | | |
| Trydactylidae | Pygmy Mole Crickets | 7 | | | | | | 7 | | | | | | | |
| ORDER: TRICHOPTERA (CADDISFLIES) Observed Only | | | | | | | | | | | | | | | |
| Family not determined | | | | | | | | | | | | | | | |

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