A SURVEY OF PARASITOIDS ASSOCIATED WITH LEPIDOPTEROUS PESTS OF PEANUTS

By

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CHAPTER I

INTRODUCTION

Pest management, emphasizing the preservation of natural control agents, is a very desirable approach to insect control. Crops having a high cash value, such as peanuts, will benefit much from an efficient pest control program because of possible increased cash return and reduction in expensive insecticide applications. Parasitoids are an important constituent among natural control agents and can be a major factor in a pest management system. It is essential that these control agents be identified and their effect upon pest populations quantified before procedures for preservation or possible augmentation can be attempted.

The lesser cornstalk borer, *Elasmopalpus lignosellus* (Zeller), is a subterranean pest of peanuts. *E. lignosellus* feeds on the pegs and pods and tunnels in the stems (Walton et al., 1964) causing reductions in yield and grade of peanuts. In addition to suffering peg loss and nut destruction, individual plants may be stunted or killed from feeding damage of this insect. Economic damage levels were stated as 5% infestation on dryland and 10% on irrigated peanuts before pegging, and 10% (dryland) and 15% (irrigated) after pegging begins (Hammon et al., 1972). Control of E. lignosellus appears to be of greater importance in dryland situations where population levels are often high and plants may already be stressed due to insufficient moisture. The possibility that dryland peanuts are less capable of withstanding damage is indicated by the somewhat lower economic damage level.

Peanuts can withstand considerable loss of foliage without significant yield reductions resulting (Berberet[1]). Foliage feeding species such as the corn earworm, Heliothis zea (Boddie), the red-necked peanutworm, Stegasta bosqueella (Chambers), yellow-striped armyworm, Spodoptera ornithogalli (Guenee), fall armyworm, Spodoptera frugiperda (J.E. Smith), and the granulate cutworm, Feltia subterranea (F.) may cause peanut yield reductions when they produce extensive defoliation (Walton and Matlock, 1959) (Hammon et al., 1972) (King et al., 1961).

Applications for control of foliage feeding larvae are generally applied over the row, while control for the soil insect, E. lignosellus, is most effective with a directed spray at the base of the plants or granular insecticide banded over the row. Research conducted by J.W. Smith, Texas A and M University, has indicated that the directed spray can result in more effective control of E. lignosellus, however, it has deleterious effects upon non-target

[1]Berberet, R. C., Personal communication, Department of Entomology, Oklahoma State University, Stillwater, Oklahoma, 1975.

Arthropods similar to spray applications over the row (Smith[2]). According to Smith, granular insecticide formulations applied as a band over the row have less affect on the non-target Arthropods than liquid formulations.

Luginbill and Ainslie (1917) reported collecting only 2 parasitoid species from _E. lignosellus_, _Neopristomerus_ sp. and _Orgilus laeviventris_ Cresson, and they stated that populations of this pest in South Carolina are affected little by parasitoids. Muesbeck et al. (1951) listed an additional parasitoid species, _Pristomerous pacificus melleus_ Cushman. In contrast to the opinion of Luginbill and Ainslie (1917) Leuck and Dupree (1965) stated that parasitoids often greatly reduce _E. lignosellus_ populations in Georgia. In samples of borers collected between 1962 and 1963, they found that parasitism ranged between 34.8 and 61.2%. In their 10 year study, Leuck and Dupree (1965) reported collections of 7 parasitoid species: 2 egg parasitoids, _Telenomus_ (_Telenomus_) n. sp. and _Chelonus_ (_Microchelonus_) n. sp., and 5 larval parasitoids; _Pristomerus pacificus melleus_ Cushman, _Orgilus_ n. sp., _Bracon mellitor_ Say, _Stomatomyia floridensis_ (Townsend), and _Plagiprospherysa parvipalpis_ (Wulp). Leuck (1966) added _Pristomerus pacificus appalachianus_ Viereck as another parasitoid of _E. lignosellus_.

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[2]Smith, J. W., Personal communication, Department of Entomology, Texas A and M University, College Station, Texas, 1975.

Foliage feeding pests, with exception of the red-necked peanutworm, have been studied extensively on host plants other than peanuts and lists of their parasitoids are numerous. Bibby (1942) mentioned *Micropletis croceipes* (Cresson) as an important parasitoid of the corn earworm. Bottrell et al. (1968) reported that *Eucelatoria armigera* (Coquillett), *Archytas marmoratus* (Townsend), and several other parasitoids attack *Heliothis* sp. Luginbill (1928) listed numerous parasitoids of the fall armyworm, *S. frugiperda*, including *Euplectrus platyhypenae* Howard and *Apanteles marginiventris* (Cresson). Vickery (1929) added *Chelonus texanus* Cresson and *Zelle mellea* (Cresson) to the list of parasitoids of *S. frugiperda*. The yellow-striped armyworm, *S. ornithogalli*, is attacked by several parasitoids including *Lespesia archippivora* (Riley) and *E. platyhypenae* (Bottrell, 1968). Taylor (1954) recorded 13 parasitoid species of the salt-marsh caterpillar, *Estigmene acrea* (Drury). Included among the parasitoids of the cabbage looper, *Trichoplusia ni* (Hubner), are *Copidosoma truncatellum* (Dalman) and *E. armigera* (Oatman, 1966) (Clancy, 1969). Butler (1958) also listed several important tachinid parasitoids of foliage feeding pests.

The objectives of this study were: 1. to identify members of the peanut foliage feeding complex, 2. identify the parasitoids associated with foliage feeding larvae and the lesser cornstalk borer, 3. record the rate of parasitism produced by each parasitoid species in order to identify those that have the greatest impact on pest populations,

4. establish a reference collection of the peanut insect pests and related parasitoids to aid in future identification.

CHAPTER II

METHODS AND MATERIALS

Lepidopterous pests were collected from peanuts in 3 areas of Oklahoma (Figure 1). Area 1 consisted of Caddo and Grady counties, area 2, Marshall and Bryan counties, and Hughes county comprised area 3. The majority of peanut acreage in Oklahoma is located in these areas. Extensive collecting was done throughout the 1972, 1973, and 1974 growing seasons. Collections were made in these areas whenever pest populations were located in order to sample the diverse pest and parasitoid populations. The application of insecticides was not regulated in fields from which samples were taken, however, fields which had received recent applications were avoided.

Lesser cornstalk borer larvae were collected by carefully examining the inside of stems and subterranean portions of peanut plants. The soil several inches in depth around the base of the plants was sifted in order to recover larvae and pupae. Samples of 100-200 plant terminals were collected and examined in the laboratory for red-necked peanutworms. Other foliage feeding species were collected by lightly beating the plants and then inspecting the soil surface under the plants for larvae. Collections of at least 50 larvae of each pest species present were made whenever possible.

As pest larvae were collected in the field, low numbers (25-30) were placed in 1-liter paper cartons filled with peanut foliage to prevent overcrowding and cannibalism. Lesser cornstalk borers and red-necked peanutworms were placed in cartons separate from the larger foliage feeding larvae. Cartons were placed in coolers to restrict larval activity while they were transported to the laboratory.

Larvae were reared in the laboratory on a modified Vanderzant-Adkisson medium (Vanderzant et al., 1961). Lesser cornstalk borers and red-necked peanutworms were reared individually in 17 X 63 mm (2-dram) plastic vials[1] plugged with cotton. Larger foliage feeding larvae were reared individually in 30 ml plastic cups with cardboard lids[2]. Larvae were reared at 22$\pm$3°C and observed at 2 day intervals to check for pupation and to collect parasitoids. Host and parasitoid adults were pinned and labeled for identification. Lepidopterous pests and parasitoids were identified using reference collections from the Oklahoma State University Museum and by B.D. Burks, R.W. Carlson, R.W. Hodges, P.M. Marsh, C.W. Sabrosky, and E.L. Todd, all of the USDA, Systematic Entomological Laboratory, Washing-

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[1]Celluplastics Inc., 55 North Street, Fitchburg, Massachusetts.

[2]Premium Plastics Inc., 465 West Cermak Rd., Chicago, Illinois.

ton, D.C.

Parasitism of the various pest species in this study was calculated by dividing the number of parasitized larvae by the number of pests that completed development. Larvae that died before parasitism could be determined were not considered in the reported percent parasitism, except in Figure 2, which shows the possible extremes in parasitism for each host. The reported percent parasitism also does not take into account the possibility that parasitized larvae may be more likely to die before completing development than unparasitized larvae. Because of this, rates of parasitism reported in this study may be somewhat conservative.

CHAPTER III

RESULTS AND DISCUSSION

A total of 22 species of lepidopterous larvae were collected from peanuts in Oklahoma (Table I). E. lignosellus was the most abundant and destructive pest collected. Populations of E. lignosellus appeared to be reduced by high soil moisture as was observed by Hammon et al. (1972) and Sanchez (1960). This species was most abundant in the sandy soils of dryland peanut fields in Oklahoma (Walton et al., 1964). High soil moisture may have been the reason that E. lignosellus was not abundant in Caddo county (area 1) where irrigation was extensive.

S. bosqueella and H. zea were the most common foliage feeders collected on peanuts during this study. Damaging populations of the remaining species collected from foliage (Table I) were not common, although S. frugiperda, E. acrea, and Anticarsia gemmatilis (Hubner) did become numerous in several areas in October.

Trichoplusia ni (Hubner), Strymon melinus (Hubner), Spodoptera exigua (Hubner), and Platynota nigrocervina Walsingham were not collected in large numbers. They are included in Table II because many were parasitized. With exception of S. bosqueella, the number of larvae collected

(Table II) reflects the relative abundance of these pests throughout the 3 years of this study. S. bosqueella were far more numerous than is indicated by the number collected. Sixty-three percent of the peanut terminals checked in 1973 were infested by S. bosqueella.

The number of host larvae that died before completing development or prior to parasitoid emergence is shown in Table II, Column 3. Mortality ranged from 24-88% with E. acrea being the lowest and P. nigrocervina registering the highest rate. Molds were the principle cause of high mortality rates in most species, although some died due to poor adaptation to the artificial medium. It was evident that P. nigrocervina and F. subterranea were not well adapted to the diet because very few of these larvae were able to complete development. Larvae also died from what appeared to be polyhedrosis viruses.

The high and low limits in parasitism are given in Figure 2 which shows the effect of high mortality rates on computations. The lower value is calculated based on the assumption that none of the larvae which died were parasitized. The upper limit is based on the assumption that all larvae which died were parasitized. The actual percent parasitism lies somewhere between these 2 limits, and is dependent upon the mortality rate of host larvae and the number of parasitoids that emerged. Higher mortality of host larvae caused more difficulty in determining accurately the rate of parasitism. I did not feel that discussion of percent parasitism was warranted for species in which less than 100 larvae were collected.

The low rate of parasitism for E. lignosellus, S. bosqueella, and E. acrea (Table II) may be due to habits or means of protection possessed by these larvae. E. lignosellus was the only subterranean insect collected in this study and was parasitized at a much lower rate than foliage feeders. Being subterranean, E. lignosellus may be somewhat more inaccessible to parasitoids. S. bosqueella remains inside the tightly folded leaves of the developing plant terminals and may escape many parasitoids. E. acrea feeds exposed on the leaves of the plant but may be afforded some protection by dense setae which cover its body. The habits and morphology of the remaining foliage feeding larvae do not appear to provide possible means of protection from parasitism.

Figure 3 shows the seasonal variation in parasitism of the 3 most commonly collected pest species. Parasitism of the soil pest, E. lignosellus, remained low throughout the season with maxima for any area or date from 20-25%. Parasitism of H. zea generally increased throughout the season and reached a high of 96% in early September (Figure 3). Seasonal incidence of parasitism of S. bosqueella was erratic but reached as high as 57% in early September.

The seasonal incidence of hymenopterous and dipterous parasitoids (Figure 4) indicates that the hymenopterous species were of major importance from July until late September. Diptera were not prevalent until late September and October. Although hymenopterous parasitoids were, in general, most abundant during this study, late season collections resulted in accumulation of large numbers of Diptera, particularly in 1974.

Tables III and IV and Figure 5 were assembled as cross-references for host and parasitoid species. Table III is constructed to show the relative importance of individual parasitoid species for each host. Unidentified parasitoid species in Table III include those parasitoids which could not be identified because of failure to complete development. It was determined from dissections of dead larvae that a portion of this parasitoid mortality was due to host mortality prior to completion of development by the parasitoids. Desiccation of parasitoid larvae and pupae in the laboratory was another factor responsible for mortality. Approximately 10% of the M. croceipes parasitizing H. zea died prior to completing development.

Table IV shows the host range and rates of parasitism of these hosts for each parasitoid species. The families Braconidae, Ichneumonidae, Chalcididae, Encyrtidae, Eulophidae, and Tachinidae were represented among the 39 parasitoid species identified in this study (Table IV). Most parasitoids exhibited some degree of host specificity. L. archippivora was the only parasitoid that exhibited significant parasitism of several host species (Table IV). Other parasitoids with host ranges of 4 or more species included E. armigera, C. texanus, Pristomerus spinator (F.), and E. platyhypenae. Figure 5 shows the seasonal incidence of important pests and the major parasitoids as they were associated with each of these pests. Also indicated in this figure is the seasonal incidence of each host (dotted vertical lines) and dates when the majority of that species was collected (75% host).

E. lignosellus is used as an example of how Tables III and IV may be utilized in conjunction with Figure 5 to explain range and seasonal incidence of parasitoids associated with a pest species. E. lignosellus was parasitized by 8 species of parasitoids (Table III). Orgilus elasmopalpi Muesebeck was host specific on E. lignosellus (Table IV) and was responsible for 33.3% of the parasitism of this pest (Tables III and IV, % parasitism of host species). O. elasmopalpi were active throughout the time that the majority of E. lignosellus were collected (Figure 5).

P. spinator and Invreia mirabilis Boucek were also important parasitoids of E. lignosellus, each was responsible for 16.1% parasitism. Neither of these parasitoids were host specific (Table IV). Additional parasitoids of E. lignosellus identified in this study were Spilochalris sanguinivantris (Cresson), Spilochalris flavopicta (Cresson), S. floridensis, C. texanus, and M. croceipes (Table III). E. lignosellus is a new host record for all parasitoid species collected from it except S. floridensis (Table III). Perilampus fulvicornis Ashmead, a hyperparasite according to

Burks[1], was collected from parasitoids of this pest. Positive identification of the host of this hyperparasite was not possible. It emerged from what appeared to be normal, unparasitized pupae of E. lignosellus.

The majority of parasitism of H. zea in this study was due to M. croceipes and E. armigera, neither of which were host specific (Table IV). However, M. croceipes was most important as a parasitoid of H. zea (Table IV). I observed that many of the M. croceipes which were collected from H. zea in late September of 1973 did not emerge until the following spring. This parasitoid possibly survives the winter in Oklahoma as diapausing larvae or pupae in cocoons. In relation to H. zea, the hyperparasite P. fulvicornis exclusively parasitized M. croceipes and may be an important factor in limiting populations of this important parasitoid. Hyperparasitism of M. croceipes reached approximately 10% for a short time in 1973.

No references to the parasitoids of S. bosqueella were located. Eight species of hymenopterous parasitoids were reared and identified from S. bosqueella during this study. Orgilus modicus Muesebeck and Chelonus sp., both of which were host specific, were responsible for 67.8% of the parasitism of this species (Table III). Both of these parasitoids were active throughout the time when populations of S. bosqueella were high (Figure 5). Diadegma compressum

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[1]Burks, B. D., Personal communication, USDA, Systematic Entomological Laboratory, Washington, D.C., 1974.

(Cresson), Macrocentrus amylivorus Rohwer, Apanteles epinotiae Viereck, Orgilus walleyi Muesebeck, M. croceipes, and I. mirabilis also parasitized this peanut pest. The hyperparasite P. fulvicornis was also found to attack parasitoids of S. bosqueella, and again, positive identification of its host was not possible.

S. ornithogalli were never collected in large numbers, possibly due to the consistently high rate of parasitism primarily by L. archippivora (Table III). Campoletis flavicincta (Ashmead) and E. platyhypenae were each responsible for 6% parasitism, however, the activity of these parasitoids was restricted to early season (Figure 5). We found S. frugiperda to be parasitized by 13 species of parasitoids. L. archippivora, E. platyhypenae, and Winthemia rufopicta (Bigot) caused the highest rates of parasitism. All of these parasitoids were active in late September and October when S. frugiperda was most prevalent (Figure 5). The life cycle of E. platyhypenae, a gregarious external parasitoid, has been described by Wall and Berberet (1974). The beet armyworm, Spodoptera exigua (Hubner), was never collected in high numbers. It was parasitized by L. archippivora, P. spinator, and C. texanus.

E. acrea appeared to be somewhat less susceptible to parasitism than the other foliage feeders included in this study. Hyposoter pilosulus (Provancher), Lespesia aletiae (Riley), and Exorista mella (Walker) collectively parasitized 9.5% of this species. Both H. pilosulus and L. aletiae occurred late in the season and remained active for less than 2 weeks during the period when peak populations of E. acrea were present (Figure 5).

F. subterranea was parasitized largely by an unidentified species of Apanteles and by Micropletis feltia Muesebeck. Parasitoids of F. subterranea were difficult to collect because of the high rate of mortality for this species on artificial medium. Parasitism of T. ni was almost exclusively by C. truncatellum. This parasitoid appears to be polyembryonic in that over 1000 adults emerged from an individual T. ni in some cases.

A. gemmatilis was collected late in the season only and was parasitized by E. armigera and W. rufopicta. This pest had the lowest rate of parasitism of any species. It is felt that this figure is not a true representation of the actual seasonal parasitism because the majority of this species were collected in a single location on a single collection date in 1974. Had it been collected earlier, it is possible that additional parasitoids would also have been found. The common hairstreak, Strymon melinus (Hubner), was heavily parasitized by Apanteles thecelae Riley.

CHAPTER IV

SUMMARY

Parasitism appears to have a definite impact on limiting populations of peanut foliage feeders. Most of the foliage feeding larvae were parasitized by one or more important parasitoid species throughout the season. If, through conservation and augmentation, several of these parasitoid species could be maintained at high population levels, it may be possible to achieve successful biological control of these pests.

Control of the subterranean pest, *E. lignosellus*, through conservation or augmentation of natural agents would be much less feasible than the same approach for foliage feeders because of the relative ineffectiveness of native parasitoids and detrimental effects of insecticides on parasitoid populations. In addition, the low economic damage level associated with this pest necessitates highly effective control measures. An integrated system of control is needed for this insect in order to obtain satisfactory control yet preserve populations of beneficial insects.

TABLE I

LEPIDOPTEROUS PESTS COLLECTED ON PEANUTS IN OKLAHOMA, 1972-4

Common name	Scientific name
Arge moth	Apantesis arge (Drury)
Armyworm	Pseudaletia unipuncta (Haworth)
Beet armyworm	Spodoptera exigua (Hubner)
Budworm	Heliothis virescens (Fabricius)
Cabbage looper	Trichoplusia ni (Hubner)
Common hairstreak	Strymon melinus (Hubner)
Corn earworm	Heliothis zea (Boddie)
Fall armyworm	Spodoptera frugiperda (J.E. Smith)
Geometridae	Macano pompinaria (Semiothisa)
Granulate cutworm	Feltia subterranea (Fabricius)
Green cloverworm	Plathypenae scabra (Fabricius)
Lesser cornstalk borer	Elasmopalpus lignosellus (Zeller)
Noctuidae	Amyna octo (Guenee)
Noctuidae	Elaphria chalcedonia (Hubner)
Noctuidae	Tetanolita mynesalis (Walker)
Red-necked peanutworm	Stegasta bosqueella (Chambers)
Salt-marsh caterpillar	Estigmene acrea (Drury)
Scythridae	Scythris sp.
Tortricidae	Platynota nigrocervina Walsingham
Variegated cutworm	Peridroma saucia (Hubner)
Velvet bean caterpillar	Anticarsia gemmatilis (Hubner)
Yellow-striped armyworm	Spodoptera ornithogalli (Guenee)

TABLE II

PARASITISM OF LEPIDOPTEROUS PESTS COLLECTED ON PEANUTS IN OKLAHOMA, 1972-4

Larvae	Number collected	Number[a] died	Number[b] parasitized	Percent[c] parasitism
E. lignosellus	5344	1598	179	4.8
S. bosqueella	2739	971	340	21.4
S. frugiperda	1864	1072	331	41.8
H. zea	1636	958	391	57.7
E. acrea	773	185	92	15.6
A. gemmatilis	567	157	6	1.5
F. subterranea	393	341	28	53.8
S. ornithogalli	167	88	50	63.3
T. ni	127	52	29	38.7
P. nigrocervina	69	61	2	25.0
S. exigua	33	12	9	42.9
S. melinus	12	4	5	62.5

[a]Total number that died before completing development or before a parasitoid emerged.

[b]Total number that were determined to be parasitized.

[c]Number of pests that completed development divided by the number parasitized.

TABLE III

RELATIVE IMPORTANCE OF PARASITOID SPECIES ASSOCIATED WITH LEPIDOPTEROUS PESTS ON PEANUTS IN OKLAHOMA, 1972-4

Host species	Parasitoid species	% of total parasitism of host species
E. lignosellus		
	Orgilus elasmopalpi Muesebeck	33.3
	Pristomeris spinator (Fabricius)	16.1
	Invreia mirabilis Boucek	16.1
	Apanteles sp.	5.6
	Stomatomyia floridensis (Townsend)	2.8
	Orgilus sp.	1.1
	Spilochalris flavopicta (Cresson)	0.6
	Spilochalris sanguinivantris (Cresson)	0.6
	Chelonus texanus Cresson	0.1
	Micropletis croceipes Cresson	0.1
	Unidentified Hymenoptera	18.8
	Unidentified parasitoids	4.9
	*Perilampus fulvicornis Ashmead	-
H. zea		
	Micropletis croceipes Cresson	36.1
	Eucelatoria armigera (Coquillett)	17.4
	Archytas marmoratus (Townsend)	3.6
	Campoletis sonorinsis (Cameron)	3.3
	Pristomerus spinator (Fabricius)	2.6
	Lespesia archippivora (Riley)	1.5
	Chelonus texanus Cresson	1.0

TABLE III (Continued)

Host species	Parasitoid species	% of total parasitism of host species
	Winthemia sinuata Reinhard	0.8
	Euplectrus platyhypenae Howard	0.5
	Euphorocera floridensis Townsend	0.3
	Apanteles marginiventris (Cresson)	0.3
	Euphorocera tachinomonides Townsend	0.1
	Lespesia aletiae (Riley)	0.1
	Unidentified Diptera	17.0
	Unidentified parasitoids	15.0
	**Perilampus fulvicornis* Ashmead	-
S. bosqueella		
	Orgilus medicus Muesebeck	51.8
	Chelonus (*Microchelonus*) sp.	16.0
	Diadegma compressum (Cresson)	4.9
	Orgilus sp.	2.6
	Pristomerus spinator (Fabricius)	2.1
	Macrocentrus ancylivorus Rohwer	0.8
	Apanteles epinotiae Viereck	0.5
	Microplitis croceipes Cresson	0.3
	Orgilus walleyi Muesebeck	0.3
	Invreia mirabilis Boucek	0.3
	Unidentified Hymenoptera	15.9
	Unidentified parasitoids	4.6
	**Perilampus fulvicornis* Ashmead	-

TABLE III (Continued)

Host species	Parasitoid species	% of total parasitism of host species
S. ornithogalli		
	Lespesia archippivora (Riley)	42.0
	Campoletis flavicincta (Ashmead)	6.0
	Euplectrus platyhypenae Howard	6.0
	Apanteles marginiventris (Cresson)	2.0
	Chelonus texanus Cresson	2.0
	Winthemia rufopicta (Bigot)	2.0
	Winthemia sinuata Reinhard	2.0
	Archytas apicifer (Walker)	0.1
	Unidentified Hymenoptera	6.0
	Unidentified Diptera	28.0
	Unidentified parasitoids	4.0
S. frugiperda		
	Lespesia archippivora (Riley)	29.7
	Euplectrus platyhypenae Howard	13.3
	Winthemia rufopicta (Bigot)	12.4
	Chelonus texanus Cresson	2.4
	Winthemia sinuata Reinhard	0.9
	Lespesia aletiae (Riley)	0.9
	Zele mellea (Cresson)	0.9
	Campoletis flavicincta (Ashmead)	0.6
	Winthemia sp.	0.6
	Pristomerus spinator (Fabricius)	0.3

TABLE III (Continued)

Host species	Parasitoid species	% of total parasitism of host species
	Apanteles marginiventris (Cresson)	0.3
	Euphorocera tachinomoides Townsend	0.3
	Eucelatoria armigera (Coquillett)	0.3
	Exorista mella (Walker)	0.3
	Unidentified Hymenoptera	0.3
	Unidentified Diptera	27.3
	Unidentified parasitoids	8.8
S. exigua		
	Lespesia archippivora (Riley)	33.3
	Pristomerus spinator (Fabricius)	11.1
	Chelonus texanus Cresson	11.1
	Unidentified Hymenoptera	44.4
E. acrea		
	Hyposoter pilosulus (Provancher)	27.2
	Lespesia aletiae (Riley)	22.8
	Exorista mella (Walker)	10.9
	Lespesia archippivora (Riley)	6.5
	Enicospilus glabratus (Say)	4.3
	Apanteles diacrisiae Gahan	3.3
	Euphorocera claripennis (Macquart)	2.2
	Winthemia rufopicta (Bigot)	0.1
	Unidentified Hymenoptera	1.1
	Unidentified Diptera	16.2

TABLE III (Continued)

Host species	Parasitoid species	% of total parasitism of host species
	Unidentified parasitoids	5.4
T. ni		
	Copidosoma truncatellum (Dalman)	72.4
	Euplectrus platyhypenae Howard	6.9
	Voria aurifrons (Townsend)	6.9
	Lespesia archippivora (Riley)	3.4
	Eucelatoria armigera (Coquillett)	3.4
	Rogas sp.	3.4
	Unidentified parasitoids	3.4
A. gemmatilis		
	Eucelatoria armigera (Coquillett)	33.3
	Winthemia rufopicta (Bigot)	16.7
	Unidentified parasitoids	50.0
S. melinus		
	Apanteles theclae Riley	100.0
P. nigrocervina		
	Unidentified Diptera	50.0
	Unidentified parasitoids	50.0

*a hyperparasite

TABLE IV

RELATIVE IMPORTANCE AND HOST RANGE OF PARASITOID SPECIES OF LEPIDOPTEROUS PESTS ON PEANUTS IN OKLAHOMA, 1972-4

Parasitoid species	Host species	% of total parasitism of host species
Braconidae		
Apanteles diacrisiae	E. acrea	3.3
Apanteles epinotiae	S. bosqueella	0.5
Apanteles griffini	F. subterranea	3.6
Apanteles marginiventris	H. zea	0.3
	S. frugiperda	0.3
	S. ornithogalli	2.0
Apanteles theclae	S. melinus	100.0
Apanteles spp.	E. lignosellus	5.6
	F. subterranea	21.4
Chelonus texanus	E. lignosellus	0.1
	H. zea	1.0
	S. exigua	11.1
	S. frugiperda	2.4
	S. ornithogalli	2.0
Chelonus (Microchelonus) sp.	S. bosqueella	16.0
Macrocentrus ancylivorus	S. bosqueella	0.8
Micropletis croceipes	E. lignosellus	0.1
	H. zea	35.6

TABLE IV (Continued)

Parasitoid species	Host species	% of total parasitism of host species
	S. bosqueella	0.8
Microplitis feltiae	F. subterranea	10.7
Orgilus elasmopalpi	E. lignosellus	33.3
Orgilus medicus	S. bosqueella	51.8
Orgilus walleyi	S. bosqueella	0.3
Orgilus sp.	E. lignosellus	1.1
	S. bosqueella	2.6
Rogas sp.	T. ni	3.4
Zele mellea	S. frugiperda	0.9
Ichneumonidae		
Campoletis flavicincta	S. frugiperda	0.6
	S. ornithogalli	6.0
Campoletis sonorensis	H. zea	3.3
Diadegma compressum	S. bosqueella	4.9
Enicospilus glabratus	E. acrea	4.3
Hyposoter pilosulus	E. acrea	27.2
Pristomerus spinator	E. lignosellus	16.1
	F. subterranea	3.6
	H. zea	2.6
	S. bosqueella	2.1

TABLE IV (Continued)

Parasitoid species	Host species	% of total parasitism of host species
	S. exigua	11.1
	S. frugiperda	0.3
Chalcididae		
Invreia mirabilis	E. lignosellus	16.1
	S. bosqueella	0.3
Spilochalris flavopicta	E. lignosellus	0.6
Spilochalris sanguinivantris	E. lignosellus	0.6
Encyrtidae		
Copidosoma truncatellum	T. ni	72.4
Eulophidae		
Euplectrus platyhypenae	H. zea	0.5
	S. frugiperda	13.3
	S. ornithogalli	6.0
	T. ni	6.9
Perilampidae		
*Perilampus fulvicornis	E. lignosellus	-
	H. zea	-
	S. bosqueella	-
Unidentified Hymenoptera	E. acrea	1.1
	E. lignosellus	17.8

TABLE IV (Continued)

Parasitoid species	Host species	% of total parasitism of host species
	F. subterranea	32.1
	S. bosqueella	14.4
	S. exigua	44.4
	S. frugiperda	0.6
	S. ornithogalli	6.0
Tachinidae		
Archytas apicifer	S. ornithogalli	0.1
Archytas marmoratus	H. zea	3.6
Eucelatoria armigera	A. gemmatilis	33.3
	H. zea	17.4
	S. frugiperda	0.3
	T. ni	3.4
Euphorocera claripennis	E. acrea	2.2
Euphorocera floridensis	H. zea	0.3
Euphorocera tachinomoides	H. zea	0.1
	S. frugiperda	0.3
Euphorocera sp.	H. zea	0.5
Exorista mella	E. acrea	10.9
	S. frugiperda	0.3
Lespesia aletiae	E. acrea	22.8
	H. zea	0.1

TABLE IV (Continued)

Parasitoid species	Host species	% of total parasitism of host species
	S. frugiperda	0.9
Lespesia archippivora	*E. acrea*	6.5
	H. zea	1.5
	S. exigua	33.3
	S. frugiperda	29.7
	S. ornithogalli	42.0
	T. ni	3.4
Stomatomyia floridensis	*E. lignosellus*	2.8
Voria aurifrons	*T. ni*	6.9
Winthemia rufopicta	*A. gemmatilis*	16.7
	E. acrea	0.1
	S. frugiperda	12.4
	S. ornithogalli	2.0
Winthemia sinuata	*H. zea*	0.8
	S. frugiperda	0.9
	S. ornithogalli	2.0
Winthemia sp.	*S. frugiperda*	0.6
Unidentified Diptera	*E. acrea*	16.3
	H. zea	17.1
	P. nigrocervina	50.0
	S. frugiperda	27.3

TABLE IV (Continued)

Parasitoid species	Host species	% of total parasitism of host species
	S. ornithogalli	28.0
Unidentified parasitoids	*A. gemmatilis*	50.0
	E. acrea	4.3
	E. lignosellus	5.0
	F. subterranea	28.6
	H. zea	15.1
	P. nigrocervina	50.0
	S. bosqueella	4.6
	S. frugiperda	8.8
	S. ornithogalli	4.0
	T. ni	3.4

*a hyperparasite

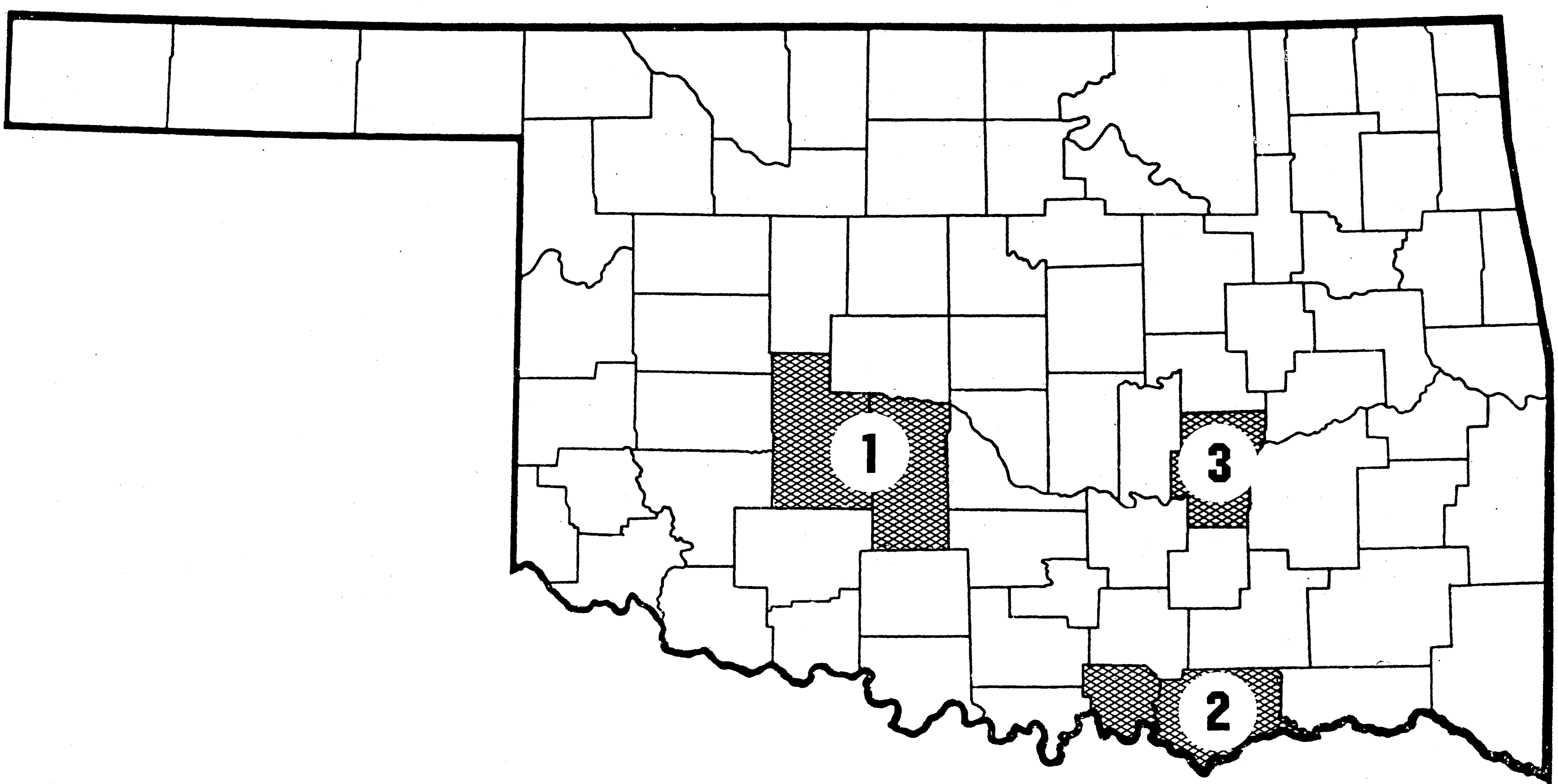
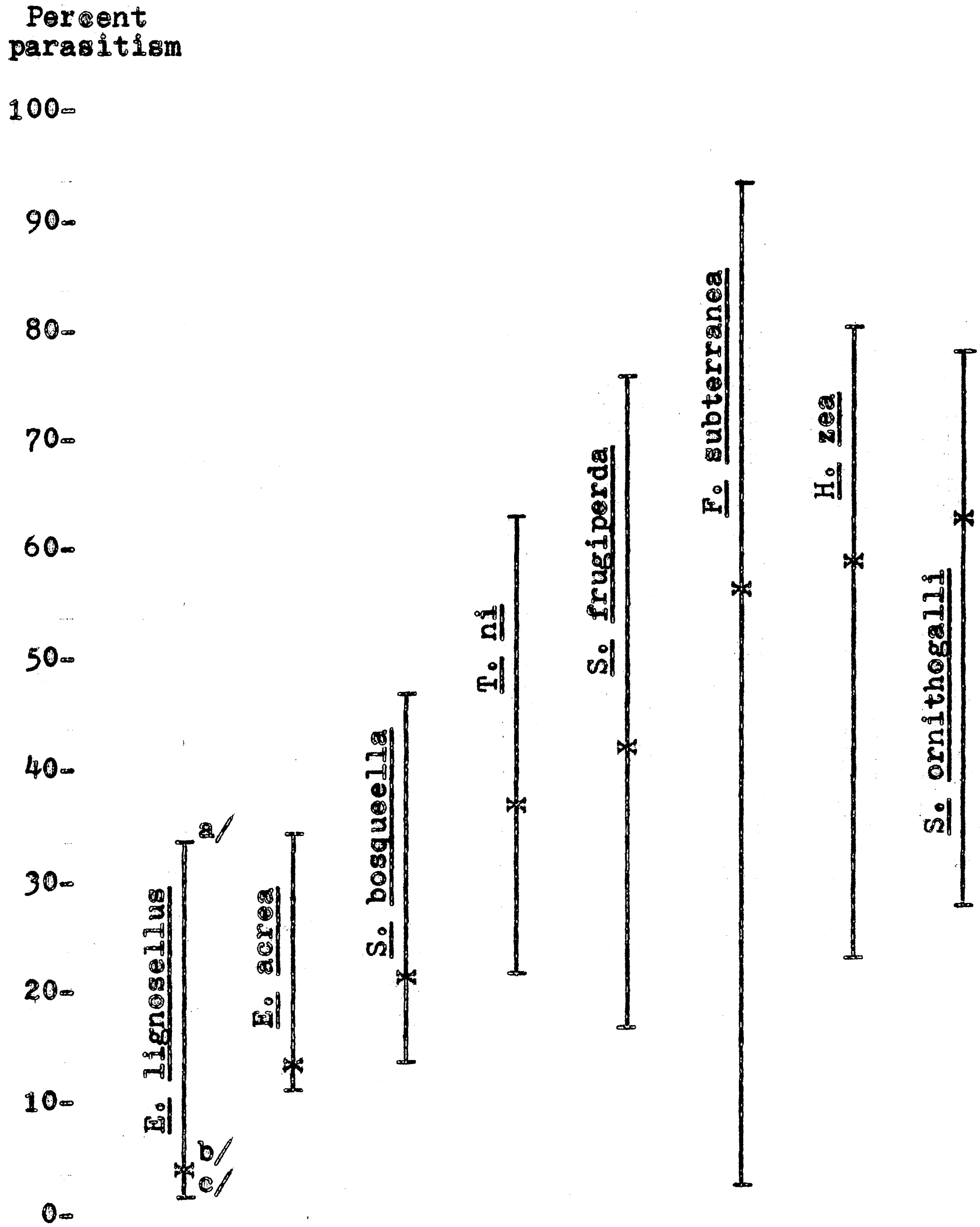


Figure 1. Areas of Oklahoma in Which Peanut Pests were Collected in 1972-4



a/Calculated on the assumption that all larvae which died were parasitized.

b/Calculated using only those larvae which completed development.

c/Calculated on the assumption that none of the larvae which died were parasitized.

Figure 2. Percent Parasitism of Lepidopterous Pests on Peanuts in Oklahoma, 1972-4

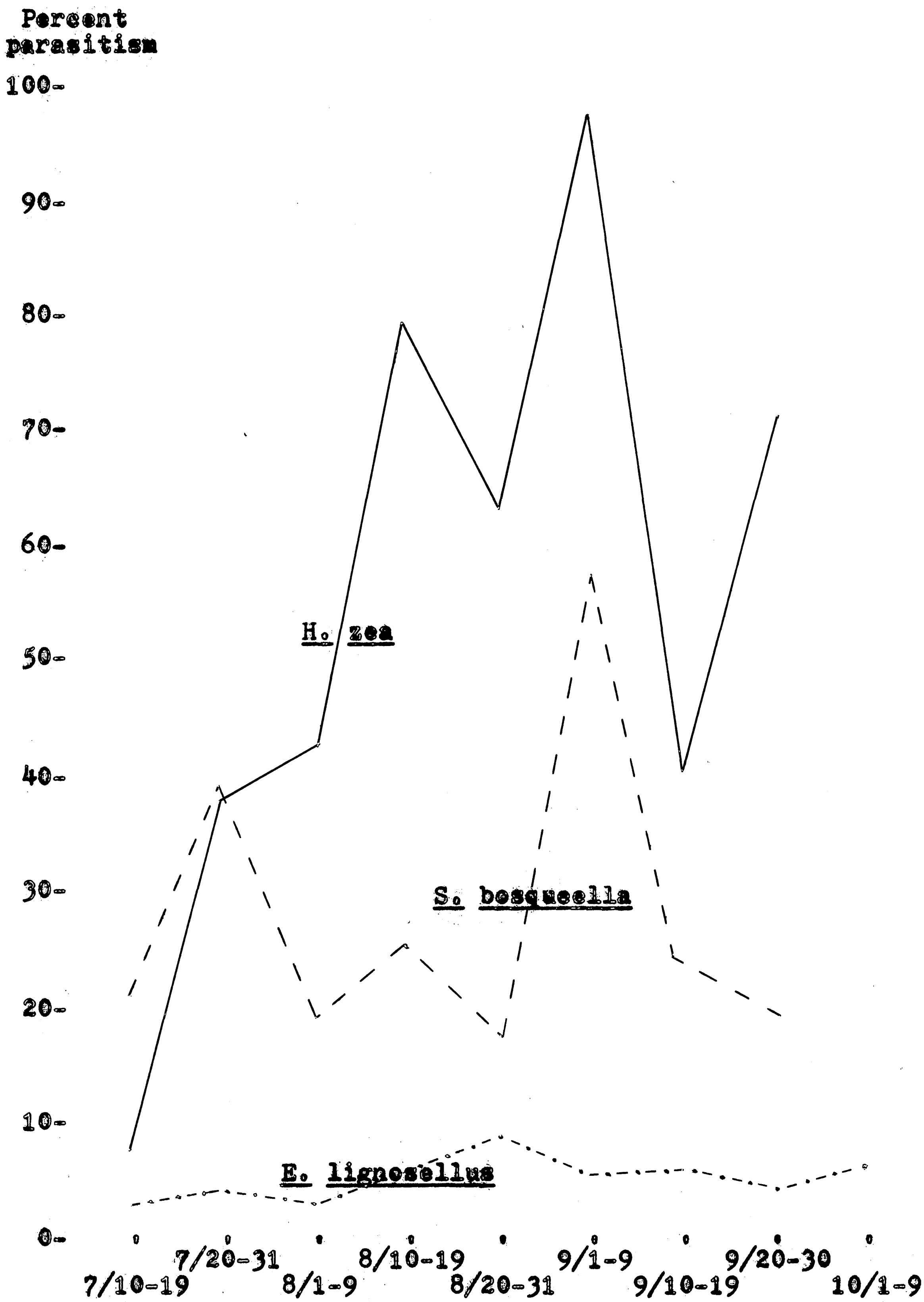


Figure 3. Parasitism of E. lignosellus, H. zea, and S. bosqueella Collected on Peanuts in Oklahoma, 1972-4

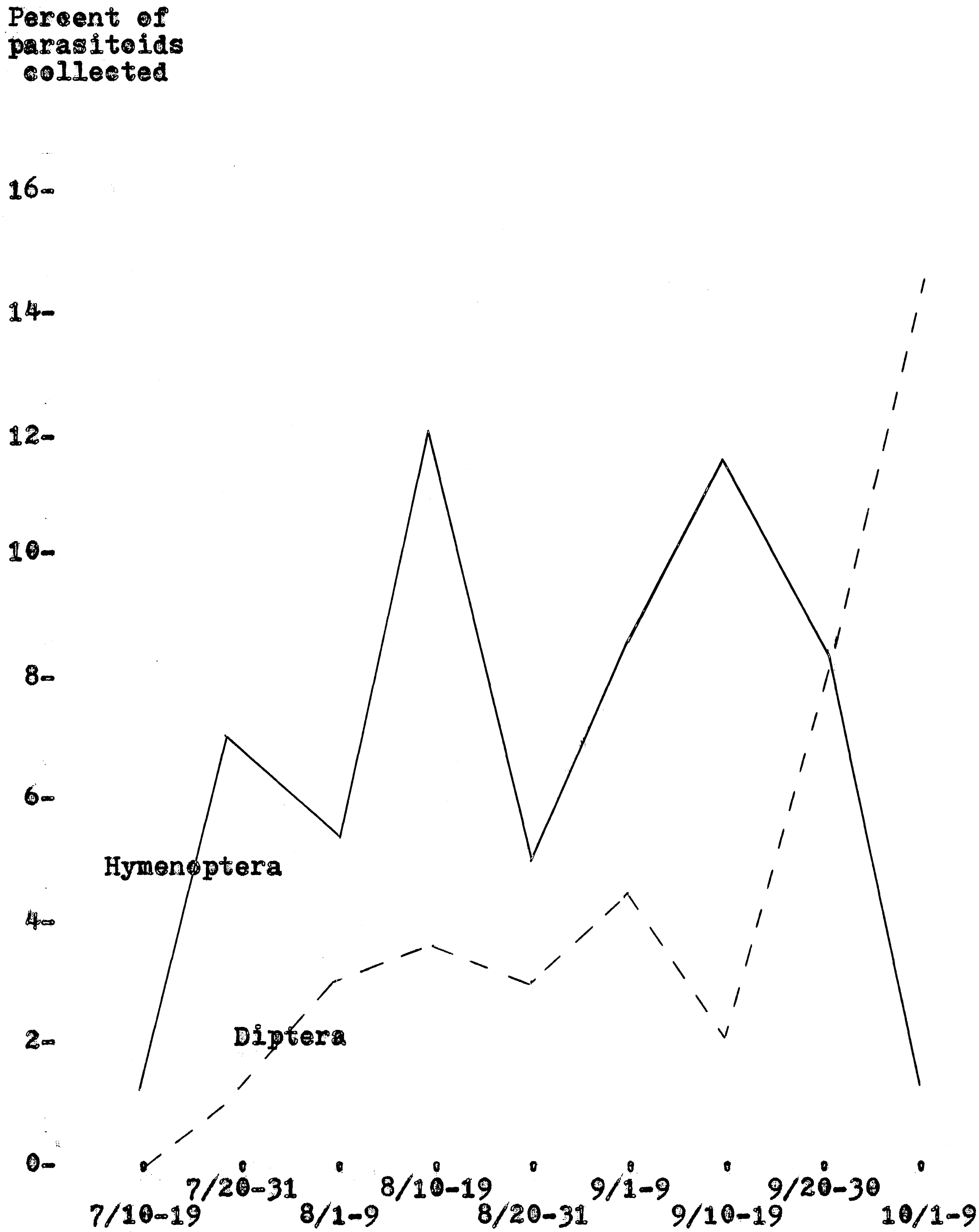


Figure 4. Seasonal Incidence of Hymenopterous and Dipterous Parasitoids Collected from Peanut Pests in Oklahoma, 1972-4

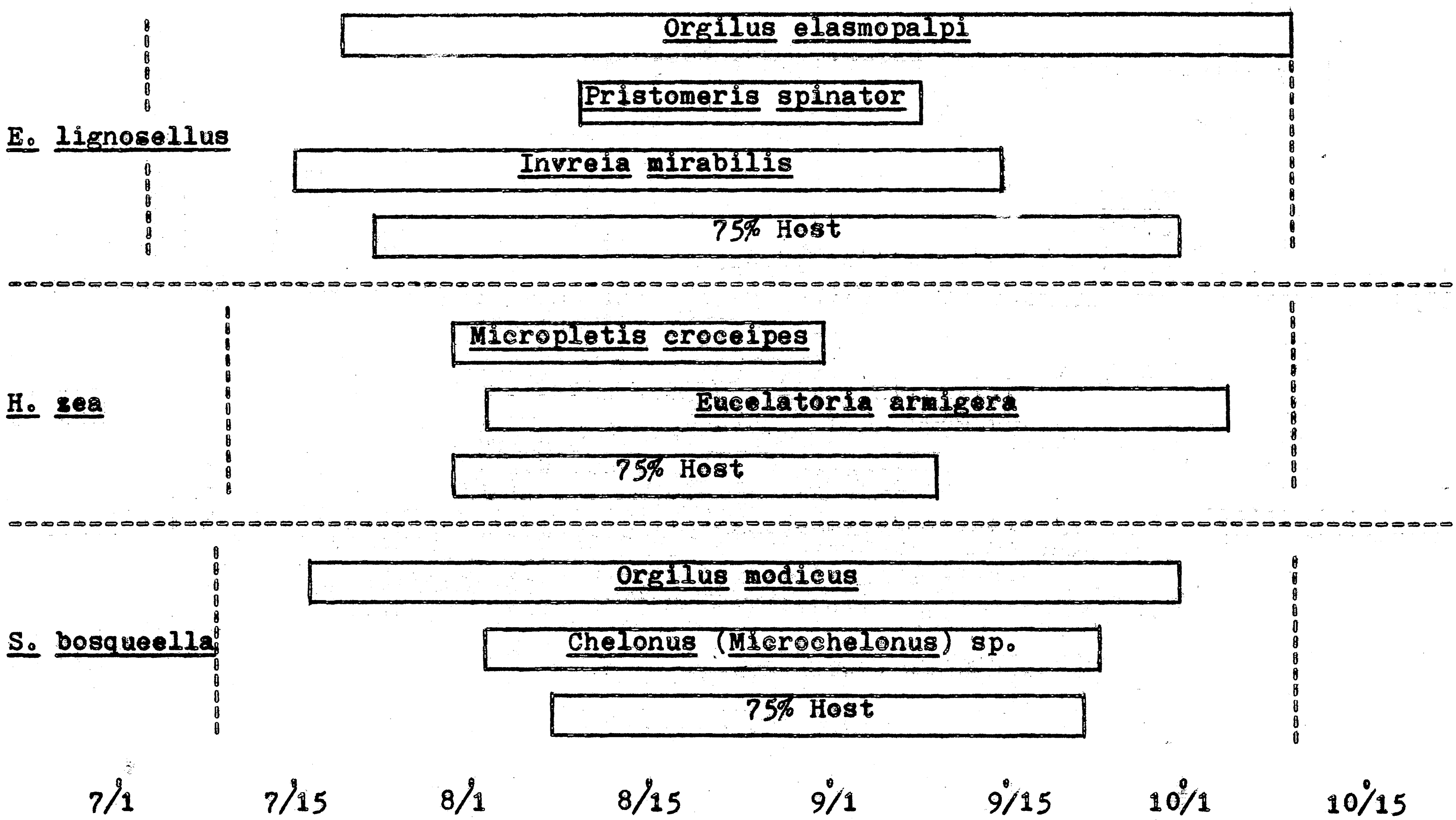


Figure 5. Seasonal Incidence of Important Pest and Parasitoid Species Collected on Peanuts in Oklahoma, 1972-4

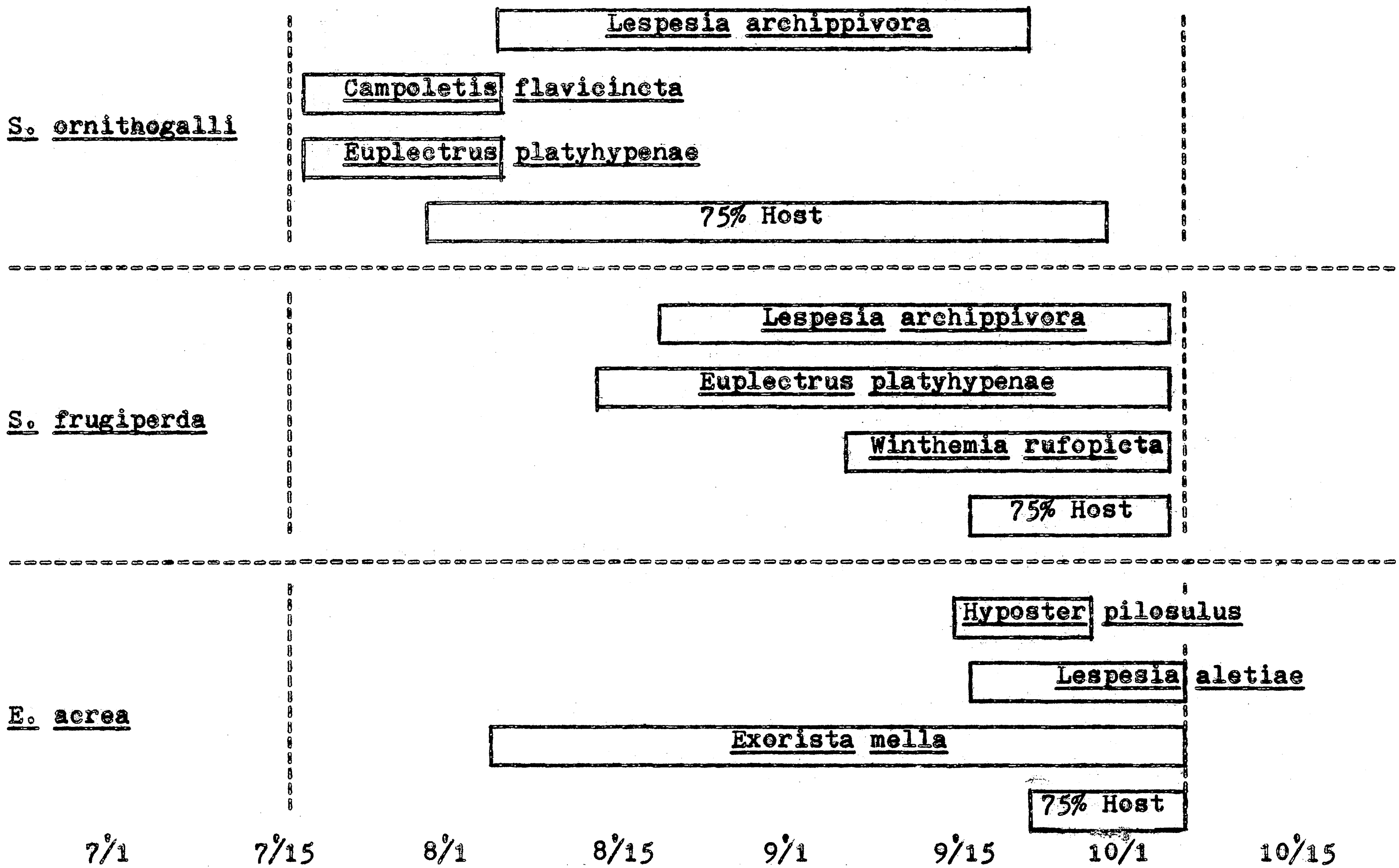


Figure 5. (Continued)

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