ILLINOIS

Natural History Survey

BULLETIN

Larvae of the Sericothripini (Thysanoptera: Thripidae), with Reference to Other Larvae of the Terebrantia, of Illinois

mas C. Vance

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URAL HISTORY SURVEY DIVISION
ANA, ILLINOIS

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CONTENTS

This report is printed by authority of the State of Illinois, IRS Ch. 127, Par. 58.12. It is a contribution from the Section of Faunistic Surveys and Insect Identification of the Illinois Natural History Survey.

Thomas C. Vance is employed by the Illinois Department of Conservation as a Site Interpretive Specialist at Lincoln Log Cabin State Park, Lerna, Illinois.

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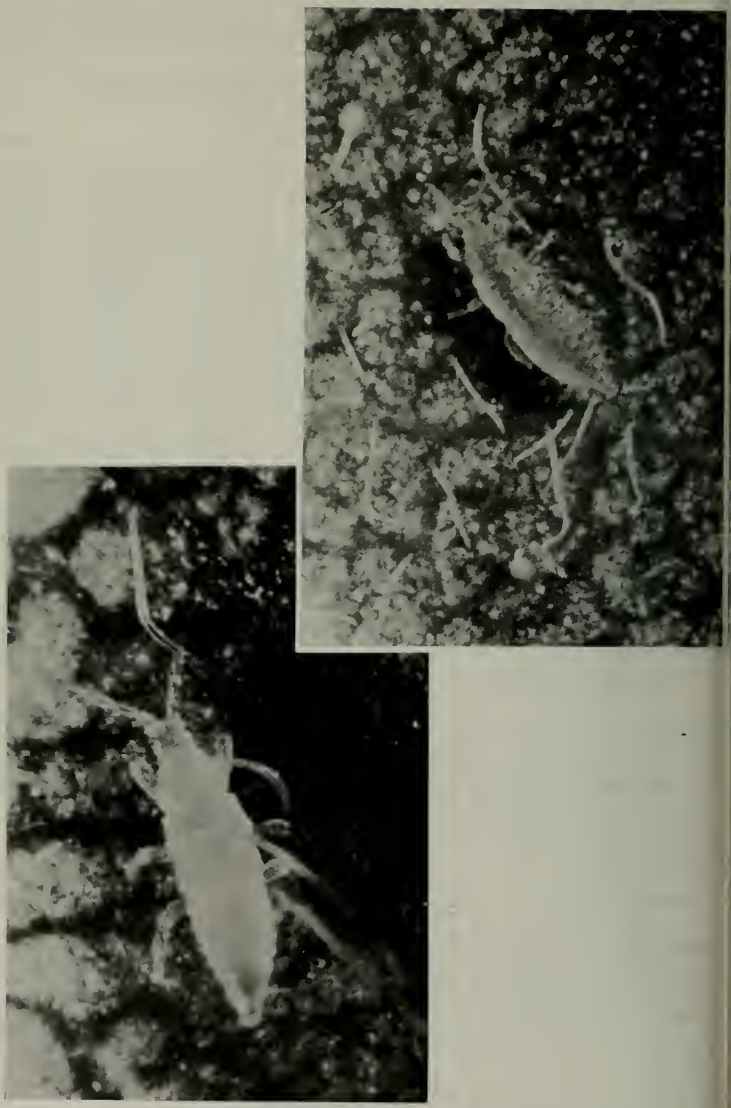

Frontispiece.—Larva I (lower left) and larva II (upper right) of **Sericothrips pulchellus** Hood on its host, wafer ash (**Ptelea** sp.). (Photographs by Lawrence S. Farlow)

Larvae of the Sericothripini (Thysanoptera: Thripidae), with Reference to Other Larvae of the Terebrantia, of Illinois

Thomas C. Vance

The morphology and taxonomy of the immature stages of the Thysanoptera have received minimum attention in North America. Significant contributions on the larvae of thrips have been made in Europe, East Asia, and North Africa (Priesner 1926*a*, 1926*b*–1928, and 1960) and in India (Jagadish & Ananthakrishnan 1972), and these studies constitute the basis of our knowledge. In the United States most of the descriptions of the immature stages are found in accounts of the life histories of economically important thrips.

This report deals mainly with the second-stage larvae, especially the known forms belonging to the tribe Sericothripini as represented in Illinois, and includes a comparison of the larval characteristics of many of the genera of the suborder Terebrantia that are found in the same region. Larval characteristics were used to substantiate the classification formerly based on adult features and to interpret the phylogeny of this insect order. A special study on the life history of *Sericothrips variabilis* (Beach) was included to provide an example of the bionomics of a common species.

References to the literature, with few exceptions, terminated in 1971 when this report was submitted as a Master of Science thesis to the Department of Entomology, University of Illinois, Urbana.

ACKNOWLEDGMENTS

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I thank all those who have helped in the preparation of this report. I am particularly grateful to Dr. Lewis J. Stannard, Jr., for many suggestions and continued help throughout the course of this study and to Dr. Bruce S. Heming for additional advice and information, especially on the tentorium and other morphological features. Appreciation is extended also to Dr. William H. Luckmann, Illinois Natural History Survey, for arranging financial support; to Lloyd L. LeMere, Survey Technical Illustrator, for drawing Fig. 1–5; to Wilmer D. Zehr, former Technical Photographer of the Natural History Survey, and Lawrence S. Farlow, present Survey Photographer, for photographic reproductions of the figures; and to many other staff members at the Survey for their assistance and kindness. Further, I wish to thank my former associate, Dr. Thomas H. Wilson, for help and consultation on many problems, and my wife, Susan, for constructive criticism.

Most of the material studied was from the collection of the Illinois Natural History Survey. Additional specimens were lent to me through the generous cooperation of Miss Kellie O'Neill, U.S. Department of Agriculture, and Dr. Tokuwo Kono, California Department of Agriculture.

The manuscript was edited for publication by Robert M. Zewadski, Associate Technical Editor, Illinois Natural History Survey, and reviewed by Dr. Bruce S. Heming, Associate Professor, University of Alberta, and Dr. Lewis J. Stannard, Jr., Illinois Natural

History Survey Taxonomist and Professor of Entomology, University of Illinois. The typing and proofreading of the manuscript were done by Mrs. Bernice Sweeney and Mrs. Grace Finger, Illinois Natural History Survey.

MATERIALS AND METHODS

During this study about 500 immature thrips were examined. In addition, diagnostic features were analyzed from descriptions of immatures in the literature, the reference being cited in each case. Repositories and institutions are identified in the Material-Examined sections by these abbreviations:

INHS = Illinois Natural History Survey collection

USNM = United States National Museum (National Museum of Natural History, Smithsonian Institution)

Three methods were used in collecting immature thrips. Large plants were sampled with a black sweep net (to make the light-colored immatures more visible), the thrips being recovered from the net with the aid of a hand lens and a small camel hair brush. Branches were shaken over a piece of cardboard or other material from which the thrips were recovered. Small host plants were sampled by examining individual leaves, and the thrips were removed directly from the leaf surfaces.

The preserving solution used was AGA (eight parts 95-percent ethanol, five parts distilled water, one part glycerine, and one part acetic acid), which kept the body soft and facilitated spreading of the appendages. For storage beyond 4 weeks, thrips were transferred to 70-percent ethanol.

Both Canada balsam and Hoyer's medium were used in making whole mounts. Canada balsam is a permanent mounting medium (Hartwig 1952; Priesner 1960; Stannard 1968), which preserves the color and features of thrips well, but it is difficult to use and much time is required to make good preparations. Further, because of dehydration and accompanying brittleness, specimens can be damaged during mounting in Canada balsam, and small setae, microtrichia, cuticular sculpturing, and areas of light brown coloration often are obscured.

Hoyer's is easier to use and renders visible many diagnostic features not usually seen on specimens mounted in balsam. Unfortunately, Hoyer's, a water-base medium, usually crystallizes within a few years. Specimens for the permanent collection, therefore, were mounted in Canada balsam, but some of each series were mounted in Hoyer's medium for temporary study.

Balsam mounts were prepared in a manner similar to that described by Heming (1969). Larvae and adults were transferred from AGA to 70-percent ethanol and were then passed successively through 95-percent ethanol, absolute ethanol, and absolute ethanol and clove oil, remaining in each solution for about one-half hour. Specimens were then placed in a small Syracuse watch glass containing pure clove oil; when each sank to the bottom, it was transferred to a slide. Clearing in 10-percent KOH or NaOH was usually unnecessary for immatures except to dissolve the excessive amounts of fat body found in some larvae.

In mounting, each thrips was placed ventral side up in a small drop of dilute balsam on a cover slip held in place on a small cardboard stage. The appendages were spread, and two chips of cover glass were added to the balsam. These chips prevent crushing of the specimen by the cover slip as the balsam dries. A small drop of balsam was placed in the center of a microscope slide, and the slide was inverted and placed gently upon the cover slip. When the slide was lifted and turned right side up, the cover slip and specimen adhered to it. Slight pressure applied to the cover slip with

an insect pin spread the appendages farther.

Whole mounts in Hoyer's medium were prepared in the same way, but the dehydration schedule was omitted. Most Hoyer preparations in the Survey collection deteriorated after a few years, even when ringed with Zut Slide Ringing Compound (Bennett's Paint Products, Salt Lake City) or clear fingernail polish. However, some preparations ringed with fingernail polish have remained in good condition for more than 20 years, indicating that efficient ringing compounds might prove successful in preserving Hoyer mounts.

Bright-light microscopes were used throughout this study except when minute structures, such as microtrichia, were being observed, for which work phase-contrast microscopes were employed.

ANALYSIS OF CHARACTERS

According to Priesner (1960) "the shape of the antennal segments, the sculpture of the body cuticle, the chaetotaxy, and last but not least, the colour, are important" in taxonomic study of larval thrips. These characters and certain others were the principal ones used in this investigation. Many characters varied with the stage of larval development, particularly color, many body dimensions, and cuticular sculpturing, which vary with growth and instar. Color also varies with the type of food consumed by the larvae. Different characters have been used in this study according to the taxonomic level concerned. In classifying thrips larvae at the family level, the form and shape of the antennal segments and the presence or absence of modified spines on the ninth abdominal tergite are important in making distinctions. At the subfamily level, the form of certain antennal segments is important. Many characters at the tribal level were found to intergrade, but certain features could generally be assigned to each tribal group. Members of subtribal groups tended to exhibit a greater degree of similarity and could be assigned to the proper group with less difficulty.

The greatest stabilization of characters occurs at the genus level. Most genera are sharply delimited, and even closely related genera usually exhibit diagnostic differences. One exception occurred in the tribe Thripini in which the larvae of the *Frankliniella-Thrips-Taeniothrips* complex are quite similar. Important generic characters include cuticular sculpturing; microtrichia; setal type, length, and placement; coloration; and proportions and features of the antennal segments.

Little distinction was found at the species level, closely related species often being nearly alike in form. Species differences that were found include the length and proportions of the body setae, brown sclerotized areas, setal basal rings, and cuticular and hypodermal coloration in mature larvae. Ward (1968) found that slight consistent differences are present in larvae of several closely related species of *Thrips* and that, despite their subtlety, these characteristics can be used to separate these species with confidence.

Most of the characters mentioned above apply to second-instar larvae; in first-instar larvae few diagnostic characters occur at the generic level and none were detected at the specific level. At the family and subfamily levels first-instar larvae may be recognized by the same antennal characters distinguishing second-instar larvae. At the tribal and subtribal levels the pattern of microtrichia on the antennae and general body and antennal features are useful in making distinctions.

The prepupal and pupal instars show little interspecific variation. According to Priesner (1960), the only distinguishing characters are the presence or absence of cuticular spines near the apex of the abdomen and the shape of the antennae. The taxonomic value of these

features above the species level may be questionable, since Priesner (1960) reported one species of *Taeniothrips* with spines and another species of the same genus without them.

COLOR

Four types of coloration occur in thrips larvae: (1) that of the internal organs and body contents, (2) that of the cuticle, (3) that of underlying hypodermal pigmentation, (4) and areas of brown sclerotization on the cuticle surface. Because color varies with the degree of larval development, it is best to deal only with fully mature larvae.

The colors of internal organs and body contents depend upon the food ingested. Phytophagous larvae often appear green due to the ingestion of chlorophyl, and predacious larvae may assume the color of the prey ingested. Such colors are usually leached out during the mounting process and are practically useless for taxonomic purposes.

Cuticle color among specimens of the same species varies from white to yellow to orange. These pigments can be affected by the mounting media used, and are leached out with prolonged storage in alcohol.

Underlying hypodermal pigmentation is usually not affected by mounting media but does vary greatly even in the members of a series of specimens. Some species never show hypodermal pigmentation, while in others it is usually present in some members of a series of specimens. Hypodermal pigmentation is susceptible to leaching with prolonged storage in alcohol although at a slower rate than is cuticular coloration.

Brown sclerotized areas, such as certain antennal segments, areas of the head and thorax, and areas of the terminal abdominal segments, are the most dependable color features. Distinctive brown sclerotized areas are particularly valuable in the identification of many species of the Heliothripinae, Anaphothripini, and Chirothripini. This brown color does not vary much within a species, is not leached with prolonged storage in alcohol, and is not affected by mounting media although these light brown areas may be difficult to see in balsam.

ANTENNAE

Antennal features are the most reliable characters in the taxonomy of larval thrips. Lengths of segments and the number of annulations present are important at the family and subfamily levels, whereas the shapes of the segments and the nature of their annulations and microtrichia can be diagnostic of genera and higher groups. The microtrichia of antennal segments III and IV and the shapes of the terminal segments are often diagnostic in first-stage larvae of certain groups. Larval members of the Sericothripini, for example, tend to have narrowed, tapering, seventh antennal segments and dense, random microtrichia on segment IV. However, members of some other tribes have broader seventh segments, and few have microtrichia on segment IV except on the annulations.

Antennal sense cones are of diagnostic value at the generic and higher levels. The length of sense cones in adult Thysanoptera often varies, but in the larvae it seems fairly stable. In general, the primitive families (Aeolothripidae, Merothripidae, and Heterothripidae) and the tribes Chirothripini and Thripini tend to have shorter sense cones, and the Anaphothripini, Sericothripini, and Dendrothripini have longer ones. The sense cones on segments IV, V, and VI are the best developed and therefore are used for taxonomic analysis.

The entire antennae of some genera are diagnostic (such as those of *Chirothrips,* which has greatly reduced antennae); features of the entire antennae, however, often show little differentiation at the generic level.

HEAD AND PRONOTUM

The shape and size of the head and pronotum are distinctive and diagnostic of certain genera of thrips larvae. These features include the ratio of length to width, shape, size of eye facets, degree of bulging of the eyes, and degree of constriction at cheek margins. Small, nonbulging eye facets occur in the Chirothripini, and construction of the cheeks seems to be characteristic of the Heliothripinae and some Anaphothripini.

Problems associated with the head and pronotum include distortion due to pressure from the cover slip and differences in their degree of development within the larval stage.

TERMINAL ABDOMINAL SEGMENTS

The shape of the terminal abdominal segments differs between the suborders Terebrantia and Tubulifera. In the Thripini and in *Anaphothrips* a posterior comb is present on abdominal segment IX. According to Priesner (1960), each species has a characteristic form of this comb.

SETAE

The type and length of body setae are important features in larval differentiation. Setae vary in length and type above the generic level; however, they are useful in the diagnoses of genera. Setal types, as listed by Priesner (1960:66–67), are: pointed, lanceolate, blunt or rounded, knobbed, funnel-shaped, forked or fringed, and spoon-shaped or fanned. Their lengths may vary from less than 5 μm up to 70 μm, and they may be slender or stout. Each genus has characteristic types and lengths of setae.

Setae differ in their widths and lengths between species, and certain setae differ in their proportionate lengths. The degree of development of the brown rings at the bases of the setae can be important diagnostic features. Some variation in the setae occurs between individuals; the lengths, however, do not change with the degree of development.

CUTICLE

The presence and nature of cuticular pustules and cuticular microtrichia provide good diagnostic characters at the generic and subtribal levels. Microtrichia are long to short, depending on the species. Short microtrichia are almost invisible when viewed through a light microscope and appear as a stippling effect. They are sparsely to densely scattered over the integument. Pustules are minute to large, depending on the species, and usually each pustule bears one microtrichium although the large pustules of the Anaphothripini and Heliothripinae lack microtrichia.

Cuticular features which are stable at the generic level present some problems. Small pustules and microtrichia are often difficult to see in balsam mounts and can be distorted by the mounting process. Also, cuticular sculpturing varies with the degree of larval development and abdominal distension.

METAMORPHOSIS

In the Terebrantia there are usually four immature stages, the first- and second-instar larvae, the prepupa (propupa), and the pupa. In the Tubulifera, by contrast, an additional pupal instar occurs, resulting in a total of five stages. Larval stages lack wings or wing pads and have free antennae, and active movements and feeding take place. The prepupal and pupal stages are quiescent and do not feed. Their antennae lack segmentation and are directly forward in prepupae and are bent back dorsally (Terebrantia) or laterally (Tubulifera) along the head in pupae. Wing pads are usually present in prepupae and pupae of the Terebrantia but only in the pupal stages of the Tubulifera. Each stage is terminated

by a molt, with the exuviae usually left on the leaf surface.

Thrips are usually recognized as exopterygote insects and are placed with the hemipteroid orders even though their postembryonic development more closely resembles the holometabolous transformations found in the Endopterygota. This intermediate type of development in the Thysanoptera has caused considerable controversy, some authors calling the immatures nymphs and others calling them larvae and pupae. Takahashi (1921) even proposed the term "Remetabola" for thysanopteran metamorphosis.

Recent histological studies on the postembryonic development of the Thysanoptera have provided insights into the problem. Davies (1961) found that the development and adult morphology of the female reproductive organs of *Limothrips cerealium* showed similarities to the exopterygote insects but that their delayed development recalled endopterygote morphogenesis. This conclusion is supported by Heming (1970) in a similar study on *Frankliniella fusca* (Hinds) and *Haplothrips verbasci* (Osborn). Davies (1969) studied the metamorphosis of the skeletal musculature of *L. cerealium* and found many details of myogenesis in the pupae of thrips to be similar to those in the pupae of endopterygote insects. He stated that "thysanopteran ontogeny shows histological changes at least as great as those in the holometabolous metamorphosis of many Endopterygota and these quiescent instars are perfectly entitled to rank as pupal stages." Davies further hypothesized that the holometabolous type of metamorphosis in the Thysanoptera developed independently of that of the Endopterygota and speculated about the selective value of two or three pupal stages in the Thysanoptera when only one is usually necessary for similar transformations in the Endopterygota.

LIFE HISTORY OF SERICOTHRIPS VARIABILIS (BEACH)

S. variabilis was the first species of *Sericothrips* described in North America (Beach 1896) and is one of the most common in the eastern states. It occurs abundantly on soybeans and other legumes, but its life history and the economic damage it causes are largely unknown.

Life-history studies have been made on several economically important thrips, the most complete being those of Horton (1918) on *Scirtothrips citri* (Moulton), Bailey (1933) on *Caliothrips fasciatus* (Pergande), and Ghabn (1948) on *Thrips tabaci* (Lindeman). Other accounts by Bourne (1926), Davidson & Bald (1930), Foster & Jones (1915), McKenzie (1935), Rivnay (1935), Russell (1912), Sakimura (1932), Schopp (1936), Watts (1934), and White (1916) are more brief. Bailey (1938) summarized and compared the life histories of several thrips of economic importance in California. Rearing methods are described by Bailey (1932 and 1933), Rivnay (1935), and Callan (1947).

The following data on *S. variabilis* are intended to provide information on the development of the immature stages, the effects of temperature and photoperiod, the site of pupation, mating, and predators, and an assessment of the economic importance of the species.

METHODS

Two types of rearing containers were used. The first was a covered plastic petri dish (35 mm in diameter and 10 mm deep) set vertically in a wooden rack. A soybean leaf was trimmed to fit into the dish with its stem extending through a hole in one side of the dish and into a vial of water below.

The second rearing container was a 100- x 15-mm covered glass petri dish

containing two soybean leaves and a piece of filter paper which was moistened daily. Larvae and adults were collected from soybeans on the South Farm of the University of Illinois, Urbana.

Rearing was done at controlled temperatures of 21.0°, 26.5°, and 32.0° C under constant light and at 22.0° C under an 8-hour-per-day light photoperiod. Two cultures were confined at each temperature. One culture was started with eggs already present in the leaves. A second culture was started with 10 adults. The number of larvae at each stage of growth was recorded twice daily between 0800 and 0900 hours and between 1600 and 1700 hours.

Data were tabulated and analyzed by recording the duration of each immature stage and computing each mean. Further analysis included the calculation of the standard error of the mean and *t* tests at a significance level of 0.01.

The site of pupal development was determined by examining for pupating thrips field samples of soil collected from beneath soybean plants at depths of 1 inch (25.4 mm) and at 4–5 inches (101.6–127.0 mm). Soil was placed in the lower end of a glass petri dish held at a 45° angle. Soybean leaves were set upright in the dish with the stems resting on the soil. Larvae present on the leaves could therefore drop or crawl to the soil when ready to pupate.

Sticky traps were set in the field to determine how the second-stage larvae reach the ground. Tanglefoot (Tanglefoot Company, Grand Rapids, Michigan) was placed in 1-inch (25.4-mm) bands 6 inches (152.4 mm) from ground level around and directly on the stems of 12 soybean plants to trap any larvae crawling down the stems. Two 12- x 18-inch (304.8- x 457.2-mm) cardboard sheets covered with Tanglefoot were placed on the ground beneath the plants at least 6 inches (152.4 mm) from the stems to catch any larvae dropping from the leaves.

FIRST-INSTAR LARVA

The mean duration of the first instar of *S. variabilis* larvae reared at 22.0° C with an 8-hour light photoperiod per day was 73.49 ± 7.32 hours. The mean body length of the cultured immatures of this instar varied from 560 ± 80 μm for the early larva I to 720 ± 70 μm for the late larva I. The early larva I has a narrow, tapering abdomen and a disproportionately large head and legs (Fig. 7a). As feeding takes place, the body becomes distended due to increases in the sizes of the internal organs, particularly the fat body (Fig. 7b). Cuticular color changes from white in the early larva I to yellow in the late larva I, and ingested chlorophyl often gives the body a green color.

The setae are short and narrowly fanned, setal pair P7 is lacking, and abdominal segment IX has three or four pairs of setae. (The setal and segmental numbering system used in this report is shown in Fig. 6.) Priesner (1958) speculated, but Ghabn (1948) had proved, that the male larva I has three pairs of setae on segment IX (two dorsally and one laterally), whereas the female has four pairs of setae on this segment (two dorsally, one laterally, and one ventrally). The sexes can be determined by these setal arrangements. Antennal segment IV is covered with random microtrichia, and segment VII is tapered apically.

Soon after hatching, the larva begins feeding, never moving far from the hatching site and often hiding in the angles of the larger veins on the lower leaf surface. The larvae are active and move about quickly when disturbed. In late larvae I the old cuticle becomes light gray. It splits dorsoventrally, the head and thorax are pushed out, and the antennae and legs are pulled free.

The exuviae is pushed partly down the abdomen by the hind feet, and the remainder of the abdomen is pulled free by forward pressure exerted on the leaf surface by the feet. About 4 minutes are required for this process.

SECOND-INSTAR LARVA

The mean duration of the second instar of *S. variabilis* larvae reared at 22.0° C under an 8-hour light photoperiod per day was 91.30 ± 10.44 hours. The mean body lengths of the cultured immatures of this instar varied from 910 ± 60 μm for the early larva II to 1,030 ± 50 μm for the late larva II. A newly molted larva has a narrow abdomen and thorax and a disproportionately large head and legs (Fig. 7c). As the larva feeds, the abdomen, particularly, and the thorax become distended (Fig. 7d). The cuticular color changes from white in the newly molted larva to orange, often with red hypodermal pigmentation, in the late larva II (although the red pigmentation was not observed in laboratory-reared larvae). Green body coloration due to ingested chlorophyl was predominant in many larvae.

The setae are long and widely fanned, appearing proportionately longer in the early larva II because the lengths of the setae remain unchanged throughout the larval stage. Setal pair P7 is present, and abdominal segment IX has five or six pairs of setae. Sex was determined by following Priesner (1958) on the number of setae on segment IX. Those larvae with five pairs of setae (two dorsally, two laterally, and one ventrally) were presumed to be females, and those with six pairs of setae (two dorsally, two laterally, and two ventrally) were presumed to be males. Priesner ignored one pair of lateral setae (A3 in this study) because they were greatly reduced, and gave the setal counts as four and five pairs. However, A3 is not reduced in larvae of certain genera (e.g., *Aeolothrips*, *Merothrips*, and *Heterothrips*), and for the sake of uniformity, this pair of setae was included in all setal counts here. The color of the setae are white immediately following the molt (sometimes making newly molted second-stage larvae easily confused with mid-first-stage larvae) but soon become sclerotized and turn brown. Antennal segment IV has microtrichia only on the annulations.

Second-instar larvae feed on the leaf surface and occasionally hide in crevices. In nature they are almost always found on the undersides of leaves, but they also occur on the upper sides in laboratory cultures. Near the end of the larval stage, the larvae drop to the ground and enter the soil for pupation.

PREPUPA

The mean duration of the prepupal stage of *S. variabilis* reared at 22.0° C under an 8-hour light photoperiod per day was 22.00 ± 2.38 hours. The mean body length was 1,180 ± 80 μm. Changes in size are imperceptible during the prepupal stage. The color is predominantly orange; wing pads are present, reaching posteriorly to the second abdominal segment; the antennae are indistinctly segmented, protruding anteriorly from the head; and the setae are simple and short. Abdominal segment IX lacks the cuticular spines found in the prepupae of some genera (Fig. 7e).

Female prepupae possess two pairs of short lobes arising ventrally on abdominal segments VIII and IX; these are the buds of the ovipositor valves. Male prepupae lack these structures (Priesner 1960).

The prepupal period is normally passed in the soil, but in laboratory cultures where soil was unavailable, prepupation readily took place on the leaf surface. Under laboratory rearing conditions, the prepupae were quies-

cent and nonfeeding and were usually hidden in crevices between the large leaf veins; activity was observed only when the prepupae were disturbed or threatened.

PUPA

The mean duration of the pupa stage of S. *variabilis* reared at 22.0° C under an 8-hour light photoperiod per day was 74.00 ± 2.83 hours. The mean body length was 1,040 ± 60 μm. No change in size was noted during pupal development. The color is predominantly orange during this stage. The wing pads reach the sixth abdominal segment, and the antennae are recurved along the dorsum of the head. The setae are simple and pointed and longer than in the prepupa. Abdominal segment IX lacks the cuticular spines found in the pupae of some genera (Fig. 7f).

The ventral lobes on segments VIII and IX in female pupae are longer and better developed than those found in female prepupae. Male pupae have a bluntly triangular production ventrally at the hind margin of segment IX.

Pupal development took place in the upper inch (25.4 mm) of soil beneath soybean plants or in the soil provided in laboratory cultures. In cultures where soil was not available, pupation readily took place on the leaf surface, the quiescent, nonfeeding pupae being hidden between the larger leaf veins.

ADULT

Adults of S. *variabilis* may be distinguished from those of other species of the genus in Illinois by the following combination of characteristics (Stannard 1968): each fore wing with two sharply defined crossbands; the pronotal blotch completely dark in contrast to the rest of the pronotum and deeply incised medially and posteriorly by yellow; anterior pronotal striations closely spaced; several abdominal segments dark brown.

Adults are quite active and, when disturbed, dart about or jump rapidly. Adults seldom survive long in a culture dish when transferred from field samples but remain alive for up to 4 or 5 days when reared in the laboratory.

EFFECT OF TEMPERATURE AND PHOTOPERIOD ON DEVELOPMENT

Both temperature and photoperiod affected the durations of the immature stages of S. *variabilis* (Table 1 and Fig. 1). Under constant light the durations of the stages were about 27 percent longer than that required at about the same temperature under an 8-hour-per-day light photoperiod. Temperature and durations of the stages were inversely correlated, the most rapid de-

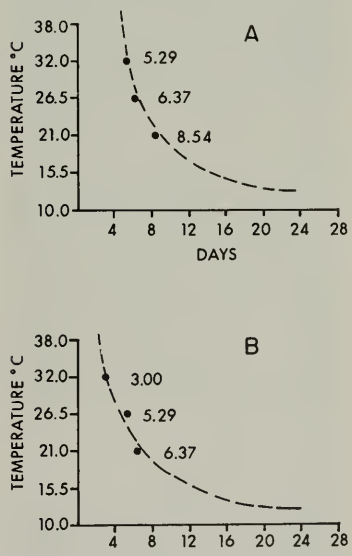

Fig. 1.—Growth curves of immature stages of **Sericothrips variabilis** reared in the laboratory. **A,** mean duration of the larva I and larva II stages, combined, at various constant temperatures. **B,** mean duration of the prepupal and pupal stages, combined, at various constant temperatures.

Table 1.—Duration of immature stages of **Sericothrips variabilis** at different temperatures and photoperiods. The numbers of insects observed are in parentheses.

Temperature (in Celsius) and Photoperiod	Mean Hours of Duration			
	Larva I	Larva II	Prepupa	Pupa
22.0°, 8-hour photoperiod	73.49 ± 7.32[a] (23)	91.30 ± 10.44 (24)	22.00 ± 2.38 (2)	74.00 ± 2.83 (2)
21.0°, constant light	97.33 ± 4.68 (6)	107.33 ± 6.99 (8)	35.00 ± 7.57 (4)	...
26.5°, constant light	65.33 ± 6.11 (5)	87.34 ± 14.09 (14)	29.33 ± 6.11 (3)	...
32.0°, constant light	58.67 ± 2.83 (7)	68.00 ± 6.85 (11)	16.00 ± 4.00 (7)	56.00 ± 6.20 (6)

[a] Standard error. Standard *t* tests computed at a probability level of 0.01 showed all means to be significantly different except for these pairs:
Larva I: 22.0° and 26.5°, 26.5° and 32.0°.
Prepupa: 22.0° and 21.0°, 22.0° and 26.5°, 22.0° and 32.0°, 21.0° and 26.5°.

velopment taking place at 32.0° C. At 26.5° C the mean duration of immature stages was increased by about 41 percent, and at 21.0° C the mean duration was increased by about 81 percent over the time required at 32.0° C. The least mortality occurred at 26.5° C, indicating that this might be the optimum of the three temperatures for the development of the immature stages of this insect.

S. *variabilis* requires more time for development of the immature stages than does *Thrips tabaci* Lindeman and *Taeniothrips simplex* Morison; the same time as *Scirtothrips citri* (Moulton), *Caliothrips fasciatus* (Pergande), and *Frankliniella tritici* (Fitch); and less time than *Taeniothrips inconsequens* (Uzel), *Heliothrips haemorrhoidalis* (Bouché), *Liothrips vaneecki* Priesner, and *Hercinothrips femoralis* (Reuter) (Bailey 1938).

SITE OF PUPATION

Studies on the biology of many pest thrips indicate that late second-stage larvae drop to the ground and pupate in the soil. S. *variabilis* also pupates in the soil, as shown by the results of the field tests conducted during this study. Pupae were found 1 inch (25.4 mm) below the surface in soil samples taken beneath soybean plants. Each pupa was located in a small chamber in the middle of a dirt particle one-half inch (12.7 mm) in diameter. In the experiment designed to discover how the larvae reach the ground, no immatures were caught in sticky traps placed around the stems of the plants. In contrast, on the sticky sheets beneath the plants 10 late second-stage larvae and three adults were found on one and 5 late second-stage larvae and two adults on another, indicating that the larvae drop to the soil from the leaves before pupation begins.

Information concerning the site and conditions of pupation of some thrips is given by Bailey (1933), and Parrot (1911) gives information on the use of sticky traps in locating pupation sites of certain of the Terebrantia.

MATING

The complete mating process was observed in two adults that had emerged in a laboratory culture. Seemingly the male first became aware of the female when he approached within about one-half inch (12.7 mm) of her. He immediately ran, caught her, and mounted her dorsally. The female began twisting the abdomen about 2 seconds after the male had mounted. Three attempts were then made to make genital contact, the third being successful. The

time lapse to this point from the initial mounting was 22 seconds. Two seconds after making genital contact, the male dismounted while maintaining genital contact, and both male and female remained motionless for 51 seconds facing in opposite directions. Contact was then broken, and each went in a separate direction.

PREDATORS

Three predators were found in association with S. *variabilis* in the laboratory cultures: *Aeolothrips fasciatus* (Linneaus) (Thysanoptera: Aeolothripidae), *Orius insidiosus* (Say) (Heteroptera: Anthocoridae), and mites of the family Phytoseiidae (Acarina).

Several *A. fasciatus* immatures appeared in the cultures and developed along with S. *variabilis*. The *Aeolothrips* larvae were observed feeding on *Sericothrips* larvae on three occasions. One *Aeolothrips* reached maturity in the culture dish, as did others reported on by Robinson, Stannard, & Armbrust (1972).

Phytoseiid mites were observed carrying dead *Sericothrips* larvae on two occasions but were not observed actually feeding. According to Chant (1958) and Chant & Fleschner (1960), phytoseiid mites can be important predators of certain phytophagous mites, but little is known of their predation on thrips or other insects. In laboratory cultures these mites survived well and could be reared easily with thrips for study on the interaction between the two.

Nymphs of *O. insidiosus* were observed in association with S. *variabilis* on many samples brought from the field and were found several times in the laboratory cultures. Although no predation was observed, it is probable that these anthocorids were feeding on thrips larvae. Borror & DeLong (1964) reported *O. insidiosus* as predatory on various species of thrips and other insects, and Bailey (1933) showed that another species, *O. tristicolor* White, is a predator of the bean thrips, *Caliothrips fasciatus*. The adults of *tristicolor* were observed to consume about one larva an hour, the nymphs appearing even more voracious. Both nymphs and adults preferred young larvae. *O. indicus* (Reuter) feeds extensively on *Taeniothrips nigricornis* (Schmutz) (= *T. distalis* Karny) in India (Rajasekhara & Chatterji 1970).

Other predators reported by Bailey (1933) were larvae of *Chrysopa californica* (Coquillett), *Hippodamia convergens* (Guerin), *Aeolothrips kuwanai* (Moulton), and *A. fasciatus*.

ECONOMIC ASSESSMENT

Although S. *variabilis* is generally considered to be of minor economic importance, Bailey (1940) rated it as ninth in economic importance among thrips species of the conterminous United States.

In laboratory cultures immature stages of S. *variabilis* apparently caused little damage to soybean leaves, even with a population of 8–10 thrips per leaf, despite the small amount of yellowing which was evident at times.

During the latter part of the summer, many upper leaves on soybean plants in the field showed yellowing, browning, and other evidence of insect-feeding damage. This damage, however, cannot be directly attributed to thrips because a variety of other insects also feed on soybeans. Furthermore, the population levels of S. *variabilis* in the field were estimated at an average of one or fewer thrips per leaflet at each observation. At this density level little economic damage results. However, thrips damage at levels of 30–60 insects per plant (number per leaflet not stated) was reported in Maryland in July 1971 in the *Cooperative Economic Insect Report* (U.S. Department of Agriculture 1971). So far as is known,

S. *variabilis* does not transmit plant viruses.

Other Sericothripini of economic importance include the citrus thrips, *Scirtothrips citri,* ranked seventh among economic thrips species by Bailey (1940); the grape thrips, *Drepanothrips reuteri* Priesner, given a rating of 11 and considered of minor importance; the long-winged thrips, *Scirtothrips longipennis* (Bagnall), ranked number 20 and considered as rarely of importance; and *Echinothrips americanus* Morgan, ranked 31 and also considered rarely of economic importance.

PHYLOGENY

Interpretations of the phylogeny of the Sericothripini and the relationships of that tribe to some of the other groups in the Thysanoptera were made on the basis of larval characteristics, as presented here.

Larval characters used in assessing the relationships of the major groups of Thysanoptera were: (1) the degree of elongation of antennal segments III and IV, (2) the length of antennal segment V, (3) the presence or absence of antennal microtrichia, (4) the presence or absence of antennal annulations, (5) the tendency toward fusion of antennal segments, (6) the degree of ornateness of the setae, (7) cuticular sculpturing, (8) the presence or absence of cuticular sclerotization, (9) the pigmentation of the cuticle, (10) general body size, (11) the modification of setae into spines on abdominal segment IX, and (12) the presence or absence of a posterior comb on abdominal segment IX.

The characters used in assessing the phylogeny of the Sericothripini were: (1) the distinctness of the suture between antennal segments IV and V, (2) the density of microtrichia on antennal segment IV in larva I, (3) body size, (4) the amount of cuticular pigmentation, (5) the presence or absence of hypodermal pigmentation, (6) the presence or absence of brown sclerotized body areas, (7) setal length, (8) the degree of setal ornateness, (9) the presence or absence and the position of setae, (10) the presence or absence of setal basal rings, (11) the density of the cuticular microtrichia, and (12) the presence or absence of cuticular pustules.

In selecting these characters and in determining their primitive and derived states, it was assumed that: (1) characters found mainly in primitive groups are primitive, and (2) characters regarded as primitive in adult Thysanoptera (Stannard 1968; Gentile & Bailey 1968) might be supposed, with reservations, to be primitive in the larval stages also. Large body size, moderately ornate and long antennal segments, greater degrees of coloration, moderately ornate setae, the presence of cuticular microtrichia, lack of body pustules, lack of a posterior comb on abdominal tergite IX, and setae modified into spines on the terminal abdominal segments were considered to be primitive features of the Sericothripini and of some other tribes of the Thripidae.

Each of the characters was assigned a value from 0 to 2 for each Illinois genus of the Terebrantia and for each species of the Sericothripini found in Illinois. A value of 0 indicates a plesiomorph or primitive condition for the character in the group or species; a value of 1, an intermediate or variable condition; and a value of 2, the apomorph or derived condition. The character states and values are summarized in Tables 2 and 4, and scores and sums are summarized for 29 genera and one family in Table 3 and for 16 species of the Sericothripini in Table 5. The sum of the values for the 12 characters gives a measure of the degree of divergence of the taxon from the primitive, ancestral stock. These values are shown graphically in Fig.

2 and 4, and the inferred phylogenies are represented in Fig. 3 and 5.

PHYLOGENY OF THE THYSANOPTERA

The Aeolothripidae have generally been accepted as representing the most primitive group because of their similarities to the more primitive Corrodentia (Psocoptera) (Stannard 1957). According to Stannard (1968), the Merothripidae and Heterothripidae are of more recent origin, and the Thripidae the most recent of the Terebrantian families. The Tubulifera, according to Stannard, evolved from a phyletic line related to the Heliothripinae of the Thripidae, the evidence being the many similarities between certain members of the two groups and the many specialized features of the Tubulifera. Gentile & Bailey (1968), however, believed that the Merothripidae and Thripidae evolved from the Heterothripidae, and Priesner (1926*b*-1928) felt that the Merothripidae represented a possible link between the Terebrantia and the Tubulifera because of certain intermediate features found in merothripids.

The phylogenetic and systematic status of the tribes in the family Thripidae have been much debated because of the difficulty in delimiting groups at this level. Stannard (1968) recognized the Sericothripini, Dendrothripini, and Thripini but did not separate the Chirothripini and Anaphothripini because they were difficult to categorize. Gentile & Bailey (1968) suggested a phylogenetic sequence for the tribes, from most primitive to most advanced: Heliothripini, Anaphothripini, Chirothripini, Sericothripini, Dendrothripini, and Thripini. These authors indicated that the Thripini have become specialized by degeneracy. All of these phylogenetic arrangements were derived, primarily, from studies of adult characteristics.

An interpretation of the higher Thysanoptera phylogeny, based on larval characters, can be depicted as in Fig. 3.

Most larval features in aeolothripids were assumed to be primitive although lack of color and pigmentation seemed to be an advanced trait. This family is characterized by such primitive larval features as spines (modified A1 and A2 setae) on abdominal tergite IX; large body size; cuticular sculpturing lacking pustules; complete anterior and posterior tentorial arms (personal communication, B. S. Heming, 31 January 1972); antennal segments III–V elongate and segments II–VII strongly annulated, with prominent microtrichia.

From the Aeolothripidae two phyletic lines seem to have emerged: the merothripid-phlaeothripid (Tubulifera) line and the heterothripid-thripid line.

The merothripid line is characterized by the retention of a smooth cuticle; long fifth antennal segment; large body size; the loss of antennal annulations and microtrichia; complete anterior and posterior tentorial arms (personal communication, B. S. Heming, 31 January 1972); and a tendency toward the fusion of antennal segments VI and VII. The heterothripid line is characterized by the retention of antennal annulations and microtrichia; the development of cuticular pustules; small body size; the reduction of the fifth antennal segment; and, occasionally, the fusion of antennal segments VI and VII.

The merothripids are more specialized than are the Aeolothripidae in the elongation of antennal segments III–V (V remaining equal to IV), the reduction of antennal annulations, the loss of annular microtrichia, the fusion of antennal segments VI and VII, and a partial reduction of the spines on abdominal tergite IX. Merothripids retain such aeolothripid features as abdominal spines, simple setae, smooth cuticle, large body size, and antennal segment V unreduced and equal to segment IV.

Table 2.—Phylogenetically significant characters of the Thysanoptera and their character states and values.

Character Number and State		Value[a]
I	Antennal segments elongated	0
	Antennal segments not elongated	2
II	Antennal segment V long	0
	Antennal segment V reduced	2
III	Antennal segments with prominent microtrichia	0
	Antennal segments with microtrichia reduced	2
IV	Antennal segments with prominent annulations	0
	Antennal segments with annulations reduced	2
V	No fusion of antennal segments	0
	Fusion of certain antennal segments	2
VI	Setae ornate or long	0
	Setae simple or short	2
VII	Cuticle without pustules	0
	Cuticle with pustules	2
VIII	Brown sclerotized body areas present	0
	Brown sclerotized body areas lacking	2
IX	Prominent cuticular and hypodermal coloration	0
	Little cuticular and hypodermal coloration	2
X	Body large	0
	Body small	2
XI	Setae on terminal abdominal segments modified into spines	0
	Setae on terminal abdominal segments not modified into spines	2
XII	Posterior comb lacking on abdominal segment IX	0
	Posterior comb present on abdominal segment IX	2

[a] An intermediate or variable state was given a value of 1.

The Tubulifera are more specialized than the Merothripidae in the total loss of antennal annulations and of abdominal spines on tergite IX, but the two groups are similar in the retention of a smooth cuticle, large body size, a long fifth antennal segment, and occasional fusion of antennal segments VI and VII.

Just as the merothripids are possibly intermediate between the Aeolothripidae and the Phlaeothripidae, so the heterothripids may be intermediate between the Aeolothripidae and the Thripidae. The heterothripids retain such aeolothripid features as annulations on antennal segments II–VII and prominent spines on abdominal segment IX but also have characteristic thripid features, such as reduced third and fourth antennal segments, the retention of antennal annulations and microtrichia, the reduction of the tentorium, and the development of cuticular pustules. One feature that is obviously intermediate in the Heterothripidae is the length of antennal segment V; in aeolothripids it is equal to the length of segment IV, and in thripids it is reduced to less than one-fourth the length of segment IV. In the heterothripids, however, antennal segment V is about one-half the length of segment IV.

The Thripidae have retained antennal annulations and microtrichia, but the length of antennal segment V has been greatly reduced, body size has become smaller, and cuticular pustules have appeared. Many features vary from a primitive to an advanced state within the group.

The family Thripidae shows considerable specialization and diversification. As the Tubulifera became specialized into a fungus-eating niche, the Thripidae diversified into a phytophagous niche and tended toward an evolutionary degeneration or simplification of many characters. Since the Thripidae

Table 3.—Character values for genera and one family of the Thysanoptera. The higher a group's total of character values, the more advanced the group is interpreted to be.

Taxon	Character[a]												Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Aeolothrips	0	0	0	0	0	1	0	2	1	0	0	0	4
Franklinothrips	0	0	0	0	0	1	0	2	0	0	2	0	5
Phlaeothripidae	1	1	2	2	2	0	0	1	0	0	0	0	9
Merothrips	2	1	2	1	2	1	0	1	1	0	0	0	11
Heterothrips	2	1	1	0	0	0	2	2	2	1	0	0	11
Caliothrips	1	1	2	0	0	0	2	1	0	2	2	0	11
Heliothrips	1	1	2	0	0	2	2	2	1	2	2	0	15
Hercinothrips	0	1	2	0	0	2	2	1	2	2	2	0	14
Parthenothrips	1	1	2	0	0	0	2	2	2	2	2	0	14
Limothrips	2	1	2	2	0	1	1	0	1	2	2	0	14
Chirothrips	2	2	2	2	2	2	1	1	1	2	2	0	19
Chilothrips	2	2	2	1	0	1	2	2	0	2	0	0	14
Oxythrips	2	2	2	1	0	1	2	1	0	2	0	0	13
Aptinothrips	2	2	2	1	0	2	2	1	1	2	2	0	17
Chaetanaphothrips	2	2	1	1	0	0	2	2	1	2	2	0	15
Anaphothrips	2	2	1	1	0	2	2	0	1	2	2	1	16
Echinothrips	2	2	0	1	0	0	1	2	2	0	2	0	12
Sericothrips	2	2	0	1	1	0	1	1	1	2	2	0	13
Zonothrips	2	2	0	1	1	0	1	2	1	2	2	0	14
Drepanothrips	2	2	0	1	1	1	0	2	2	2	2	0	15
Scirtothrips	2	2	0	1	1	1	0	2	2	2	2	0	15
Dendrothrips	2	2	0	1	1	1	1	2	2	2	2	0	16
Pseudodendrothrips	2	2	0	1	1	1	1	2	2	2	2	0	16
Leucothrips	2	2	0	1	1	1	1	2	1	2	2	0	15
Ctenothrips	2	2	1	1	2	2	2	2	2	2	2	2	22
Scolothrips	2	2	1	1	2	0	2	2	2	2	2	0	18
Thrips	2	2	1	1	2	2	2	1	1	2	2	2	20
Frankliniella	2	2	1	1	2	2	2	2	2	2	2	2	22
Taeniothrips	2	2	1	1	2	2	2	2	1	2	2	2	21
Microcephalothrips	2	2	1	1	2	1	2	1	2	2	2	1	19

[a] See Table 2 for characters and their states.

show a more pronounced delimitation of groups, this phyletic line probably originated earlier than did the Phlaeothripidae.

PHYLOGENY OF THE TRIBES OF THE THRIPIDAE

As when using adult characters, delimiting tribal groups of the Thripidae is also difficult when considering larval characters. As can be seen in Fig. 2, all tribal groups except the Thripini are derived to about the same extent from primitive stock. Since each group exhibits certain specializations and evolutionary advancements, it is possible that some of the tribes do not follow a single line of phyletic ascent but rather follow several separate lines, each being fairly independent of the others and of an origin ancient enough that many intermediate types have disappeared.

Although easily distinguished, the Sericothripini and Dendrothripini show many similarities, possibly indicating a divergence of these groups later than the divergences of most others. One feature unique to this phyletic line is the pattern of microtrichia on antennal segment IV of the first-stage larvae. The microtrichia are found randomly placed between as well as on the an-

nulations, whereas in other groups they occur mainly on the annulations and only sparsely between them.

The most primitive subfamily in the Thripidae is the Heliothripinae. This subfamily shares with the Heterothripidae the retention of annulations on antennal segments V–VII, less reduction of segment V than occurs in most thripids, an elongation of segment VII, and, in some genera, an elongation of segments III and IV (this latter feature

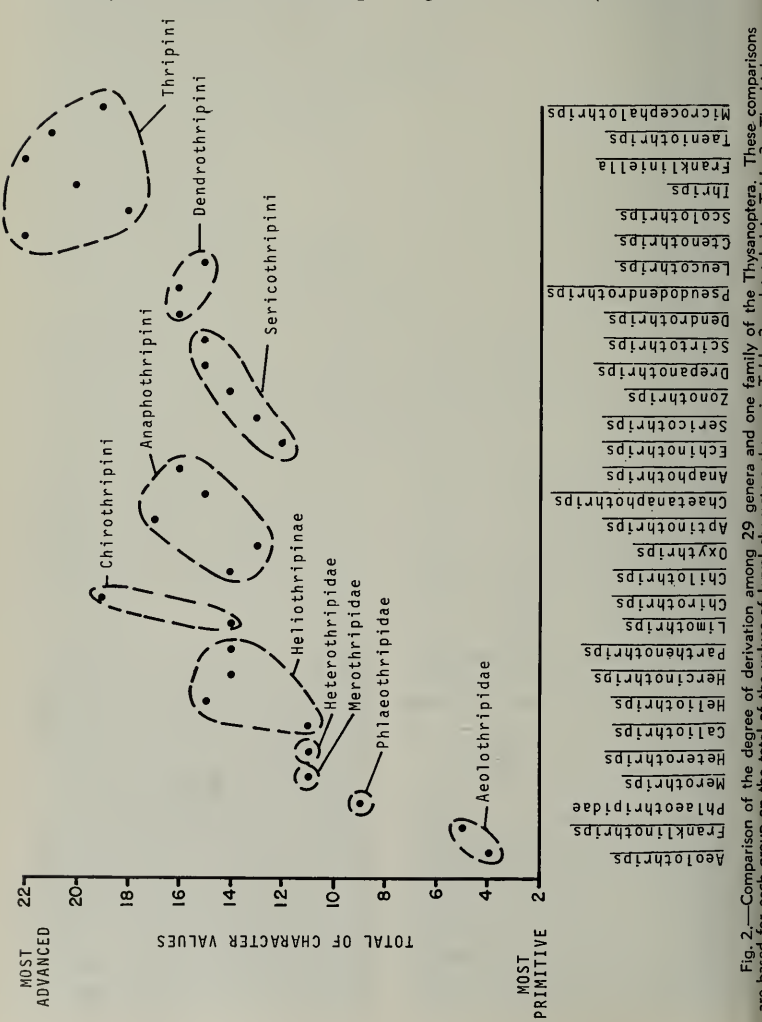

Fig. 2.—Comparison of the degree of derivation among 29 genera and one family of the Thysanoptera. These comparisons are based for each group on the total of the values of larval characters shown in Table 2 and totaled in Table 3. The higher a

reapproaching that in the Aeolothripidae). The Heliothripinae share with the Thripinae a partial reduction of antennal segment V and the loss of spines on abdominal tergite IX.

The Heliothripinae have such primitive thripid features as large pustules, brown sclerotized body areas in many species, long anal setae, and a great diversity in ornamentation.

The tribe Chirothripini shares several primitive features with the Heliothripinae. The genus *Limothrips*, like the Heliothripinae, has a reduction in the number of annular microtrichia and brown sclerotized body areas. Segment V in the antennae of first-stage larvae of *Limothrips* is elongate and has two annulations, a feature found only in more primitive groups, including the

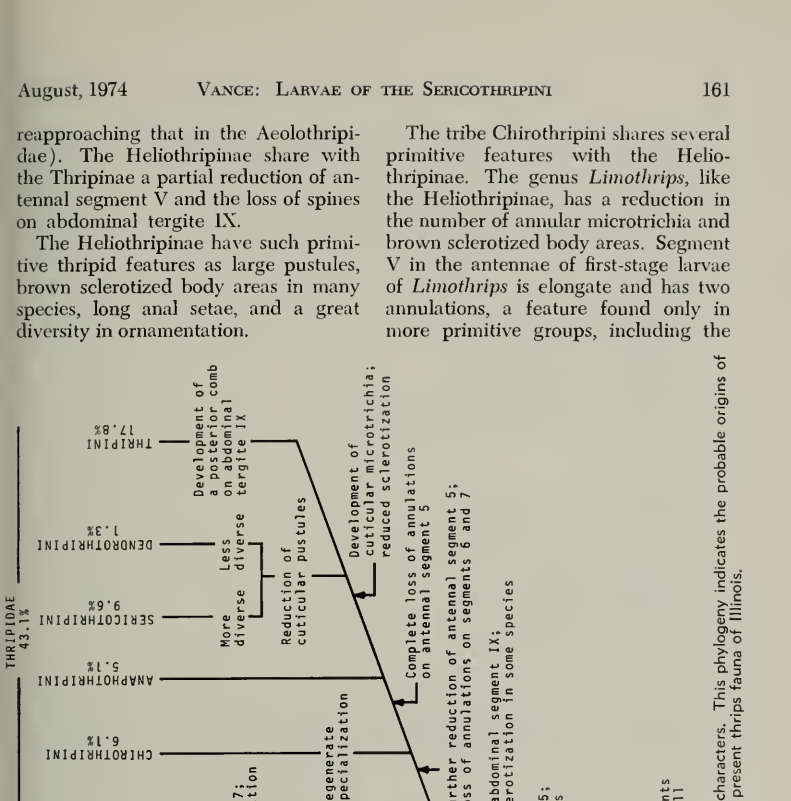

Fig. 3.—Phylogeny of the Thysanoptera, based on larval characters. This phylogeny indicates the probable origins of the major taxa and the relative proportions of the taxa in the present thrips fauna of Illinois.

Table 4.—Phylogenetically significant characters of the Sericothripini and their character states and values.

Character Number and State		Value[a]
I	Antennal segment V distinct in larva I	0
	Antennal segment V partially fused to segment IV in larva I	2
II	Microtrichia densely placed on antennal segment IV	0
	Microtrichia sparse on segment IV	2
III	Large body	0
	Small body	2
IV	Cuticle darkly pigmented	0
	Cuticle lightly pigmented	2
V	Hypodermal pigment present	0
	Hypodermal pigment absent	2
VI	Brown sclerotized body areas present	0
	Brown sclerotized body areas not present	2
VII	Setae long	0
	Setae short	2
VIII	Setae ornate	0
	Setae not ornate (simple)	2
IX	Some setae reduced or lacking	0
	All setae normally present	2
X	Setal basal rings present	0
	Setal basal rings absent	2
XI	Microtrichia dense on cuticle	0
	Microtrichia sparse on cuticle	2
XII	Cuticle with pustules	0
	Cuticle without pustules	2

[a] An intermediate or variable state was given a value of 1.

Heliothripinae. The second-stage antennae of *Limothrips* are typical of those of the Thripinae.

Within the Chirothripini, *Limothrips*, with normal antennae, long knobbed setae, and brown sclerotized body areas, is most primitive. *Chirothrips* exhibits an extreme evolutionary degeneracy and specialization. Some *Chirothrips* larvae, at least, spend their whole existence within a grass floret (Watts 1965); the antennae and legs of the larvae are greatly reduced, the setae are minute and pointed, and little brown sclerotization is present.

The Anaphothripini also share many primitive traits with the Heliothripinae. Cuticular pustulation and the lack of microtrichia are very similar between the two groups, and many Anaphothripini have brown sclerotized body areas similar to those in the Heliothripinae. Genera such as *Oxythrips* and *Chilothrips* show a modification of certain setae on the terminal abdominal segments into setaelike spines, a condition found only in the primitive families.

The Anaphothripini have antennal segment V reduced in the first-stage larva, and have shorter antennal segments, less ornate setae, shorter anal setae, and less diversification than have the Heliothripinae.

The tribe Sericothripini is transitional between the more primitive and the more specialized tribes in the Thripidae. The Sericothripina share, in some species, several characteristics with the Anaphothripini, and the Scirtothripina with the Dendrothripini. The *annulipes* group of *Sericothrips* have such seemingly primitive features as brown sclerotized body areas, hypodermal pigmentation, large basal rings on the setae, and in *Sericothrips cingulatus* small cuticular pustules. Except for cuticular pustules these features are

Table 5.—Character values for members of the Sericothripini. The higher a group's total of character values, the more advanced the group is interpreted to be.

Taxon	Character[a]												Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Echinothrips	0	2	0	1	2	2	0	0	0	2	2	1	12
Sericothrips													
cingulatus	2	0	1	0	2	0	1	0	2	0	2	0	10
pulchellus	2	0	1	0	0	0	1	0	2	0	2	1	9
annulipes	2	0	1	0	0	0	1	0	2	0	2	1	9
variabilis	2	0	0	0	0	2	1	0	2	0	2	1	10
baptisiae	2	0	1	2	2	2	2	0	2	1	2	1	17
campestris	2	0	1	0	2	2	1	0	2	1	2	1	14
beachae	2	0	1	2	2	2	1	0	2	1	2	1	16
sambuci	2	0	1	1	2	2	1	0	2	2	2	1	16
tiliae	2	0	1	1	2	2	1	0	2	1	2	1	15
nubilipennis	2	0	1	2	2	2	1	0	2	1	2	1	16
langei	2	0	1	1	2	2	2	1	2	1	2	1	17
Drepanothrips													
reuteri	2	?	2	2	2	2	2	2	2	2	1	2	21
Scirtothrips													
niveus	2	0	2	2	2	2	2	2	2	2	0	2	20
taxodii	2	0	2	1	2	2	2	2	2	2	0	2	19
brevipennis	2	0	2	1	2	2	2	2	2	2	0	2	19

[a] See Table 4 for characters and their states.

usually not found in the more advanced Thripinae. The *tiliae* group of *Sericothrips* also lacks these features. The Sericothripina and Echinothripina are plesiomorphic in their ornate, fringed setae and in certain other characteristics; in the Scirtothripina, however, the setae are reduced. The Scirtothripina are smaller, lack body coloration, and have shorter setae that are only terminally funneled, all seemingly indicating a more derived condition than those found in the Sericothripina and Echinothripina.

The Dendrothripini are similar in their morphology to the Scirtothripina, indicating close phyletic relationships.

Of the tribes in the subfamily Thripinae, the Thripini is the most specialized, lacking body coloration and brown sclerotization, having reduced setal ornateness, and exhibiting a general lack of diversification. The posterior comb of abdominal tergite IX is an advanced characteristic found in several genera in this group. Cuticular pustules and microtrichia are often reduced, and certain genera (e.g., the *Frankliniella-Taeniothrips-Thrips* complex) lack divergence in their larval stages, indicating close relationships between them.

PHYLOGENY OF THE SERICOTHRIPINI

There appear to be at least three subtribal groups in the tribe Sericothripini (Fig. 5). The Scirtothripina is seemingly the most specialized, and the Sericothripina is the most primitive. The Scirtothripina have reduced body size, reduced body coloration, and reduced setal ornateness, and lack sclerotized body areas, all of which are derived characters. Lack of cuticular pustules and proliferation of cuticular microtrichia may be specializations in this group.

Of the Scirtothripina genera, *Drepanothrips* is here considered the more primitive because most body setae in the members of this genus are terminally funneled, whereas only certain ones are so in *Scirtothrips*. Most body

setae in *Scirtothrips* are short and pointed, and cuticular pustules are totally lacking, these two features considered here to be derived.

The *Scirtothrips* species show a pattern of setal simplification. *S. niveus* has four pairs of setae terminally funneled, and *S. taxodii* and *S. brevipennis* have only two pairs of funneled setae, the latter situation being the derived state.

In the Sericothripina the genus *Sericothrips* contains two subgroups, the *annulipes* and *tiliae* groups. The *tiliae* group is characterized by light body coloration, a lack of hypodermal pigmentation, reduced brown sclerotized areas, and reduced rings at the bases of the setae, all considered here to be derived conditions (Fig. 5). The *annulipes* group is characterized by the presence of cuticular and hypodermal

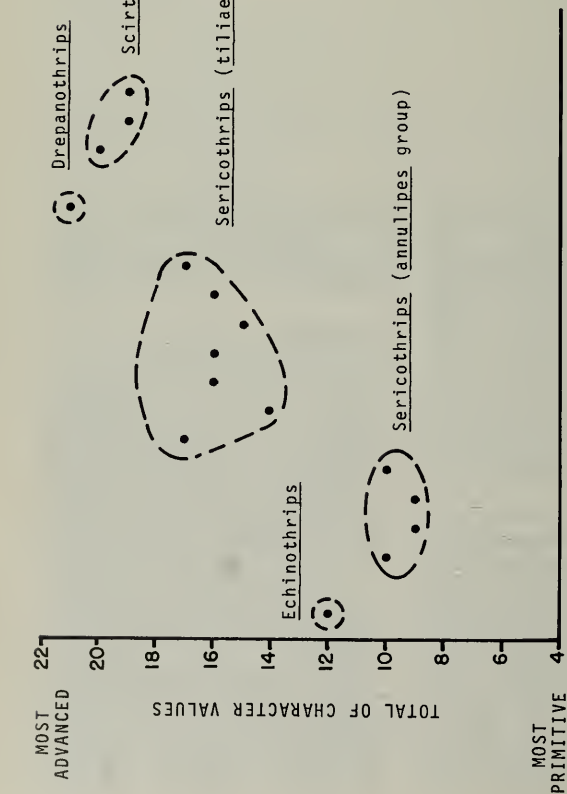

Fig. 4.—Comparison of the degree of derivation among the genera and species of the Sericothripini. These comparisons are based for each group on the total of the values of larval characters shown in Table 4 and totaled in Table 5. The higher a group's total of character values, the more advanced the group is interpreted to be.

pigmentation, brown sclerotized body areas, occasional enlarged rings at the setal bases, and, in one species, by small cuticular pustules, all suggested here to be the primitive state.

The *tiliae* group includes *campestris, beachae, sambuci, tiliae, nubilipennis, baptisiae,* and *langei* (Fig. 5). The first five species all have long body setae, and the other two, short setae. *S. campestris* resembles members of the *annulipes* group, having orange cuticular pigmentation and generally long, wide body setae. For these reasons *campestris* is considered the most primitive of the *tiliae* group. *S. beachae, S.*

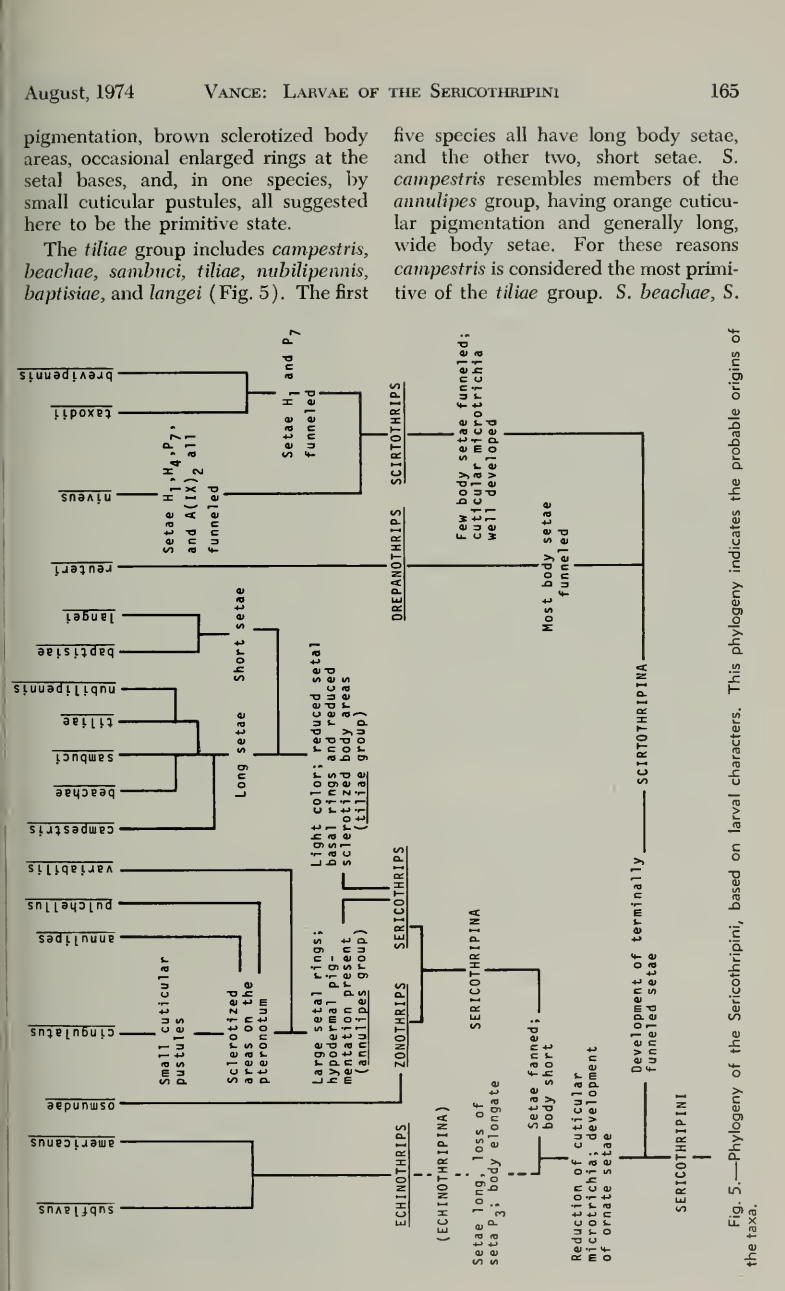

Fig. 5.—Phylogeny of the Sericothripini, based on larval characters. This phylogeny indicates the probable origins of the taxa.

sambuci, S. *tiliae*, and S. *nubilipennis* are light colored and have long setae; *beachae* and *sambuci* have wide setae, and *tiliae* and *nubilipennis* narrow setae. The larvae of the latter two species are seemingly indistinguishable, suggesting that they separated relatively recently. S. *baptisiae* and *langei* are considered to be the most derived of the *tiliae* group because of their setal reduction, those of *langei* being so narrow as to approach the condition found in the Scirtothripina.

The *annulipes* group includes *cingulatus, annulipes, pulchellus,* and possibly *variabilis* (Fig. 5). The most primitive species is *cingulatus*, as evidenced by its brown body areas, the presence of small cuticular pustules similar to those of the Chirothripini, its pteronotal sclerotized plates, and its enlarged setal basal rings. S. *annulipes* and *pulchellus* have a reduced amount of brown coloration and fewer pustules, but possess pteronotal sclerotized plates, setal basal rings, and hypodermal pigmentation. S. *variabilis* lacks pteronotal sclerotized plates, but has hypodermal pigmentation and somewhat enlarged setal basal rings.

The evolutionary status of the Echinothripina is uncertain. *Echinothrips* species have large body size and ornate setae, both primitive features, but also show derived features, such as weak body coloration and sclerotization and a reduction in certain setae.

SYSTEMATICS

The known larvae of the Thysanoptera of Illinois are described here at the family level and for the suborder Terebrantia at the subfamily and tribal levels. Genera and species larvae are described only for the tribe Sericothripini. Larval descriptions pertain to the second-instar larva unless otherwise stated and include as little repetition as possible from higher to lower groups. A key is included to the major groups and to many genera of the Illinois thrips fauna, and keys to the species of some genera of the Sericothripini are given.

Measurements, taken with a calibrated ocular micrometer, are expressed in microns. They include lengths and widths of antennal segments, antennal length, body length (excluding antennae), head and pronotal length and width, and lengths of certain body setae, the particular setae measured depending on the genus considered. The setal numbering system used in this report is given in Fig. 6.

KEY TO IMMATURES OF THE THYSANOPTERA

1. Antennae projecting forward, with distinct segmentation; wing pads absent (LARVA) 5

   Antennae short, projecting back over head or to side of head and indistinctly segmented; if antennae project forward, they are indistinctly segmented 2

2. Antennae directed forward and indistinctly segmented or short and directed laterally or directed posteriorly along sides of head, not reaching anterior margin of prothorax (If antennae are recurved over head, wing pads reach only to second or third abdominal segment.) (PREPUPA) 3

   Antennae are recurved posteriorly over dorsum of head or along sides of head, reaching or surpassing anterior margin of pronotum (PUPA) 4

3. Antennae long and directed forward (recurved over head in *Aeolothrips*); wing pads, if present, extending posteriorly only to second or third abdominal segment; abdominal segment X not tubelike ..... **Terebrantia Prepupa**

   Antennae short and directed to side or if long, posteriorly directed along sides of head; wing pads absent; abdominal segment X tubelike or elongately conical.. **Tubulifera Prepupa**

4. Antennae directed posteriorly over dorsum of head; wing pads, if present, reaching abdominal segment VI or VII; abdominal segment X never tubelike ..... **Terebrantia Pupa**

   Antennae directed posteriorly along sides of head; wing pads, if present, reaching to abdominal segment

II or III; abdominal segment X tubelike or elongately conical ....Tubulifera Pupa

5. Abdominal segment X never tubelike, usually broader than long; middle antennal segments with microtrichia-bearing annulations ....Terebrantia Larva

Abdominal segment X tubelike or elongately conical, usually longer than wide; middle antennal segments without annulations (Fig. 21, 42, and 61).....Tubulifera Larva

GENERIC KEY TO LARVAE OF THE TEREBRANTIA OF ILLINOIS

1. Prothorax usually with six pairs of setae; abdominal segment IX with three or four pairs of setae...Larva I

Prothorax usually with seven pairs of setae; abdominal segment IX with five or six pairs of setae (LARVA II) 2

2. Antennal segment V from one-half to equal to the length of antennal segment IV (PRIMITIVE FAMILIES) 3

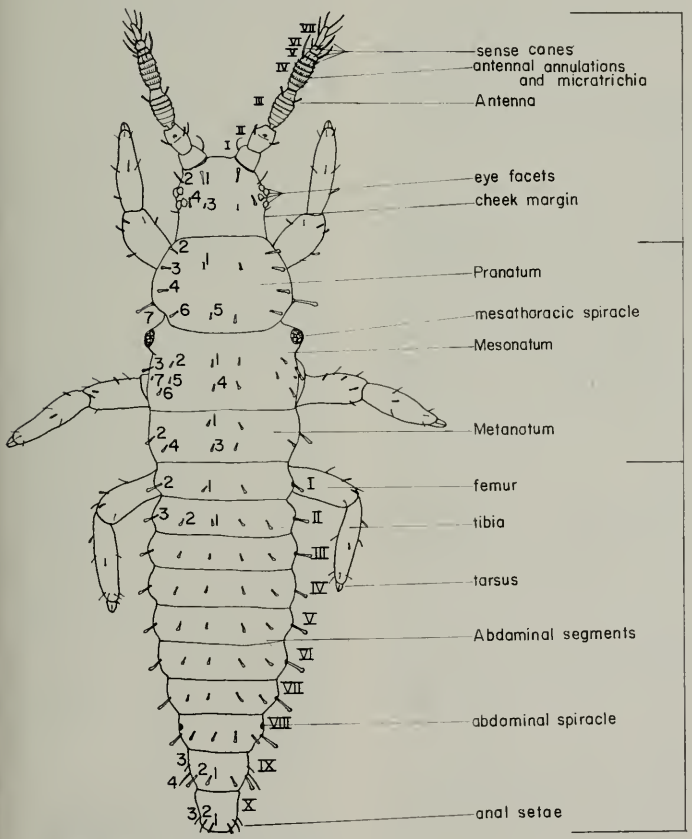

Fig. 6.—The external morphology of a Terebrantian larva (**Sericothrips** [illegible]).

Antennal segment V much less than one-half the length of segment IV (usually about one-fifth as long) (THRIPIDAE) 6

3. Antennal segment V one-half the length of segment IV (Fig. 22); segments VI and VII with visible annulations ..... **Heterothripidae** (genus *Heterothrips*)

Antennal segment V equal or subequal to length of segment IV; segments V, VI, and VII with or without annular rings 4

4. Antennal segments VI and VII fused; segments V–VII without annular rings, and segments III and IV not greatly elongated (Fig. 20) ..... **Merothripidae** (genus *Merothrips*)

Antennal segments VI and VII not fused; segments V–VII with annulations, and segments III and IV elongated (Fig. 18) (AEOLOTHRIPIDAE) 5

5. Four median dorsal setae on abdominal segment IX thornlike (Fig. 57) ..... **Aeolothrips**

Four posterior setae on abdominal segment IX not thornlike; not yet found in Illinois ..... **Franklinothrips**

6. Antennal segment VII greatly elongated, length seven to eight times the greatest width (Fig. 25) (HELIOTHRIPINAE) 7

Antennal segment VII not greatly elongated, length only two to three times the greatest width (THRIPINAE) 10

7. Abdominal segment X with six anal setae 8

Abdominal segment X with less than six anal setae 9

8. Body setae somewhat fanned for entire length (Fig. 46) .... **Caliothrips**

Body setae moderately long and simple, with hyaline terminal knob (Fig. 43) ..... **Heliothrips**

9. Body setae moderately long and widely funneled at tip.. **Parthenothrips**

Body setae very short and simple (Fig. 65) ..... **Hercinothrips**

10. Body cuticle generally smooth, with minute pustules or a stippling of fine microtrichia; abdominal segment IX never with a posterior comb (CHIROTHRIPINI, SERICOTHRIPINI, DENDROTHRIPINI)... 11

Body cuticle generally with raised protuberances or pustules, with or without microtrichia; with or without a posterior comb on abdominal segment IX (ANAPHOTHRIPINI, THRIPINI) 19

11. All major dorsal body setae expanded and fimbriate or quite long and fimbriate, or if most dorsal body setae are small and simple, cuticle densely covered with fine but obvious (under high-power magnification) microtrichia (SERICOTHRIPINI) 12

Setae mostly small and simple and cuticle with stippling pattern devoid of obvious microtrichia (DENDROTHRIPINI, CHIROTHRIPINI)..... 15

12. Setae only terminally funneled, not greatly fimbriate (SCIRTOTHRIPINA) 13

Setae fanned and fimbriate for most of length (except in *Scricothrips langei*) (SERICOTHRIPINA)..... 14

Setae long, unexpanded, and fimbriate for most of length (Fig. 54) (ECHINOTHRIPINA) ..... **Echinothrips**

13. Cuticle with closely set microtrichia; a maximum of four or five pairs of setae expanded, the remainder small and simple (Fig. 49 and 50) ..... **Scirtothrips**

Cuticle with prominent stippling and with less dense and less obvious microtrichia; all major dorsal body setae terminally funneled (Fig. 52) ..... **Drepanothrips**

14. Associated adults with eight antennal segments; found statewide in Illinois ..... **Sericothrips**

Associated adults with seven antennal segments; found only in Volo Bog in Lake County, Illinois.... **Zonothrips**

15. Eye facets large and eyes bulging at sides of head; brown sclerotized body areas lacking (DENDROTHRIPINI) 16

Eye facets reduced and eyes not bulging at sides of head; brown sclerotized areas present or if absent, antennae and legs greatly reduced (CHIROTHRIPINI) 18

16. Lateral abdominal setae with minute terminal knobs ..... **Leucothrips**

Certain dorsal body setae terminally funneled 17

17. Lateral setae expanded only on abdominal segment IX (Fig. 71) .... **Dendrothrips**

Lateral setae expanded on abdominal segments II–IX and posteroangular

setae also expanded (Fig. 74) .... Pseudodendrothrips

18. Antennae and legs greatly reduced; all body setae reduced and pointed (Fig. 45) .....Chirothrips

Antennae and legs not reduced; certain body setae on posterior abdominal segments long and knobbed (Fig. 44) .....Limothrips

19. Cuticular protuberances without microtrichia; abdominal segment IX without posterior comb (except in some *Anaphothrips*); body often with brown sclerotized areas; all or certain setae often knobbed or blunted (ANAPHOTHRIPINI) 20

Cuticular protuberances with or without microtrichia; abdominal segment IX with a posterior comb (except in *Scolothrips*); body without brown sclerotized areas; setae usually pointed (THRIPINI) 24

20. Median and lateral dorsal setae on abdominal segment IX all nearly equal in length and width 21

Median setae significantly shorter or thicker than lateral dorsal setae on abdominal segment IX 22

21. Dorsal setae on abdominal segment IX pointed, with prominent rings at bases (Fig. 67) .....Anaphothrips

Dorsal setae narrowly fanned, without fimbriation and without basal rings .....Chaetanaphothrips

22. Most body setae roundly blunt; mid-dorsal setae of abdominal segment IX shorter and much thicker than lateral setae and almost thornlike (Fig. 66) 23

All body setae pointed; mid-dorsal setae of abdominal segment IX not thornlike; lateral setae long and whiplike .....Aptinothrips

23. Abdominal tergal sculpture in form of wavy, thickened, raised, transverse striae .....Chilothrips

Abdominal tergal sculpture in form of raised pustules arranged in transverse rows .....Oxythrips

24. All body setae quite long (each epimeral seta = 60μm); posterior comb absent on abdominal segment IX (Fig. 56 and 77) .....Scolothrips

Body setae much shorter, normally less than 30–40 μm; posterior comb present on abdominal segment IX.. 25

25. Antennal segment IV reduced and shorter than the combined length of segments V–VII (IV about two-thirds the length of V–VII) (Fig. 37) .....Ctenothrips

Antennal segment IV not reduced and equal to or longer than the combined length of segments V–VII.... 26

26. Other Thripini genera (*Baliothrips, Dorcadothrips, Frankliniella, Iridothrips, Microcephalothrips, Odontothrips, Plesiothrips, Rhaphidothrips, Taeniothrips,* and *Thrips*) larvae cannot be keyed at this time.

AEOLOTHRIPIDAE Uzel (1895)

Larva.—Antennae (Fig. 8, 18, and 19) each seven segmented; segments III–V elongate, III–VII with well-developed, numerous annular rings; microtrichia present on most annuli. Antennal segment V as long as or longer than IV. Sense cones (segments IV–VI) generally long and pointed.

Head (Fig. 39) usually rounded from the dorsal aspect, with well-developed tentorium, mouth cone short and hypognathous; body elongate and cylindrical. Setae usually long, moderately stout, and pointed or knobbed. Abdominal tergite IX (Fig. 57) with two median pairs of setae modified into stout spines (not modified in *Franklinothrips*). Cuticle with fine microtrichia producing a stippled pattern.

Larva I lacking stout spines on abdominal segment IX.

Diagnosis.—Larvae of the Aeolothripidae are easily distinguished by antennal features: segments III–V are elongate, annular rings are numerous on segments III–VII, and segment V is as long as or longer than segment IV. In heterothripids, antennal segment V is about one-half the length of segment IV, and in the Thripidae, segment V is greatly reduced and less than one-fourth the length of IV.

In the Merothripidae, antennal segment V is as long as IV, but both are relatively short, fewer annulations occur on the antennal segments, and segments VI and VII in *Merothrips* are fused.

Descriptions of *Aeolothrips*, *Melanthrips*, and *Ankothrips* larvae and a key to species of *Aeolothrips* larvae were given by Priesner (1926*b*-1928). In 1960 Priesner presented a key to the genera of larval Aeolothripidae, including *Franklinothrips* and *Rhaphidothrips* in addition to those mentioned above, and gave descriptions of the larvae of *Melanthrips* and *Rhaphidothrips* and some larval characters of *Aeolothrips* and *Franklinothrips*.

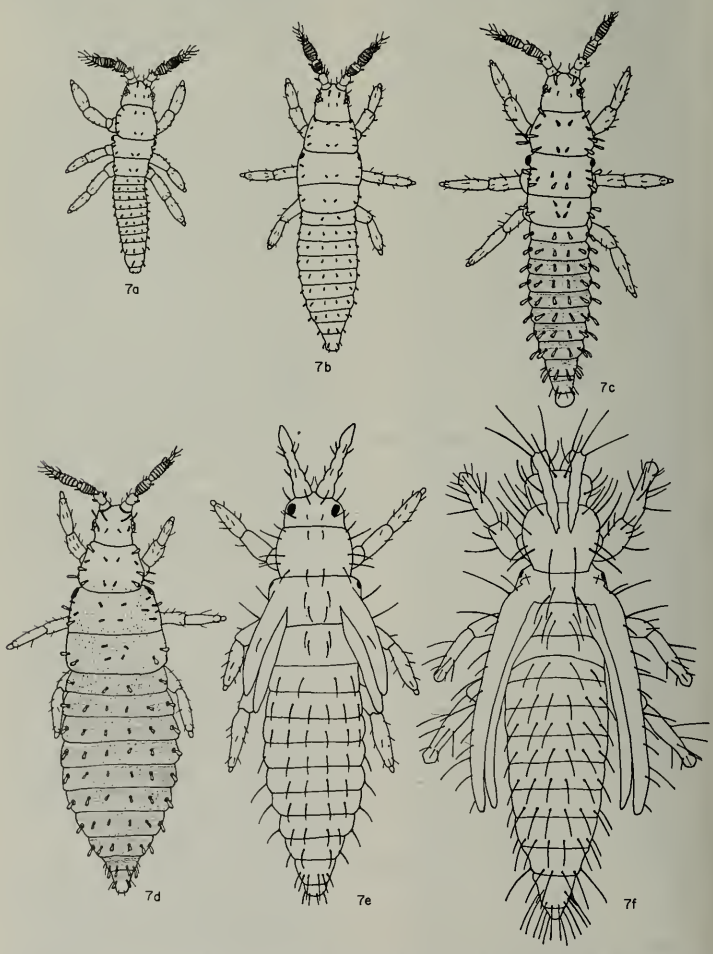

Fig. 7.—Immature stages of **Sericothrips variabilis.** a, Early first-instar larva. b, Late first-instar larva. c, Early second-instar larva. d, Late second-instar larva. e, Prepupa. f, Pupa.

Melis (1959) published descriptions (in Italian) and illustrations of *Aeolothrips* and *Melanthrips* immatures.

Material Examined.—INHS: *Aeolothrips bicolor* Hinds; 1 larva I; June; on grasses; Vermilion County, Illinois.

A. fasciatus (Linneaus); 5 larvae I, 2 larvae II; August and September; on soybeans; Champaign County, Illinois.

A. vittipennis Hood; 3 larvae I, 3 larvae II; June and July; on black locust; Johnson and Union counties, Illinois.

MEROTHRIPIDAE Hood (1914)

Larva.—Antennae (Fig. 20) each six segmented, segments VI and VII usually fused; segments not elongate, having faint annular rings and lacking microtrichia; segment V as long as segment IV.

Head and pronotum (Fig. 40) small and tapering anteriorly, posterior and anterior tentorial arms joined. Body cylindrical. Setae generally long and pointed. Abdominal tergite IX (Fig. 58) with two median pairs of setae modified into stout spines. Cuticle with very fine microtrichia on abdomen and pteronotum, producing a stippled pattern.

Diagnosis.—Merothripid larvae can be easily distinguished by the fusion of antennal segments VI and VII and by the reduction of annular rings and absence of the annular microtrichia found in other families of the Terebrantia.

The larvae of the Merothripidae appear to be transitional between those of the Aeolothripidae and Phlaeothripidae (suborder Tubulifera). Antennal segment V is relatively long in *Merothrips,* as in the Aeolothripidae and Phlaeothripidae, but it is reduced in the Heterothripidae and Thripidae. Merothripids have the median setae of abdominal tergite IX modified into spines, as in the Aeolothripidae, and a reduced number of annular rings and a lack of microtrichia on the antennal segments, as in the Phlaeothripidae.

Material Examined.—INHS: *Merothrips morgani* Hood; larva II, 1 ♂; 28 September 1952; on ground cover; Key West, Florida.

HETEROTHRIPIDAE Bagnall (1912)

Larva.—Antennae (Fig. 9 and 22) each seven segmented, segments II–V with four or five annular rings, segments VI and VII with two or three annular rings; microtrichia present on most rings; segment V about half the length of IV.

Setae short to long and blunt to terminally funneled. Abdominal tergite IX (Fig. 59) with two median pairs of setae modified into stout spines. Cuticle with prominent pustules bearing fine microtrichia (Fig. 41).

Larva I with stout spines on abdominal segment IX.

Diagnosis.—Larvae of the Illinois Heterothripidae can be distinguished by the length of antennal segment V and by a combination of many features which they share with aeolothripid and thripid larvae. Heterothripid larvae appear transitional between Aeolothripidae and Thripidae larvae. Antennal segment V is relatively long, annular rings are present on segments VI and VII, and two pairs of setae on abdominal tergite IX are modified into stout spines, characteristics also present in aeolothripids. The shorter antennal segments with fewer annular rings and the presence of cuticular pustules are thripid characteristics.

Material Examined.—INHS: *Heterothrips arisaemae* Hood; 2 larvae I, 10 larvae II; May-June; on jack-in-the-pulpit (*Arisaema* sp.); La Salle and Carroll counties, Illinois, and Raleigh, North Carolina.

THRIPIDAE Stephens (1829)

Larva.—Antennae each seven segmented, usually only segments III and IV have annular rings (also segments V–VII in the Heliothripinae); micro-

trichia often but not always present on annulations; segment V reduced to less than one-fourth the length of segment IV.

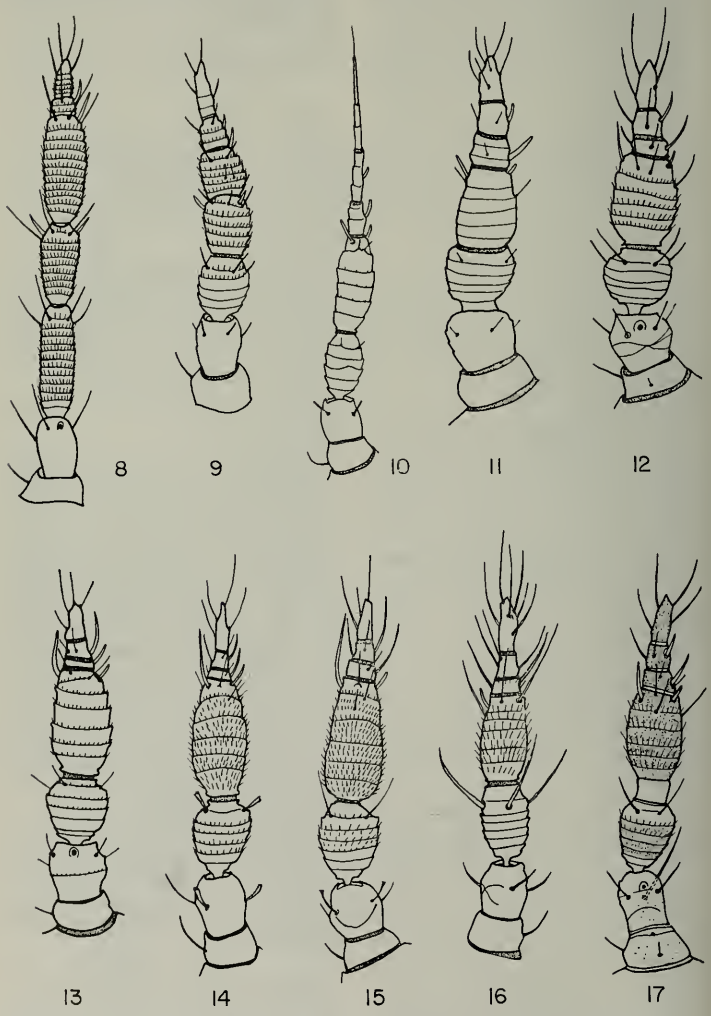

Fig. 8–17.—Right antenna (except where indicated) of the first-instar larva. 8.—**Aeolothrips vittipennis.** 9.—**Heterothrips arisaemae.** 10.—**Heliothrips haemorrhoidalis.** 11.—**Limothrips denticornis.** 12.—**Anaphothrips secticornis.** 13.—**Dendrothrips ornatus.** 14.—**Sericothrips variabilis.** 15.—**Scirtothrips taxodii.** 16.—**Echinothrips americanus,** left antenna. 17.—**Frankliniella tritici.**

Abdominal tergite IX without spines (a posterior comb usually present on tergite IX in the Thripini). Setal features and cuticular sculpturing variable.

Diagnosis.—Larvae of the Thripidae can be recognized by the great reduction of antennal segment V and by the lack of spines on abdominal tergite IX.

The Thripidae include the subfamilies Heliothripinae and Thripinae. These subfamilies and their tribes are distinguished by antennal features, cuticular sculpturing, and other characteristics.

Subfamily HELIOTHRIPINAE
Karny (1921)

Larva.—Terminal antennal segment greatly elongate (length seven to eight times the greatest width, as in Fig. 10, 25, 26, and 27); antennae with annulations on segments V–VII, annulations often with no or few microtrichia; sense cones fairly short. Body often with prominent areas of brown coloration. Cuticle usually with small to large pustules, which generally lack microtrichia. Head usually constricted behind the eyes (Fig. 43 and 46). Abdominal segment IX (Fig. 60, 63, and 65) lacks a posterior comb; segment X sometimes with long anal setae. Body setae variable, often ornate.

Diagnosis.—Larvae of the Heliothripinae are easily recognized by the elongate terminal antennal segments and by the combination of features mentioned above. The Heliothripinae may be considered the most primitive subfamily in the Thripidae. Primitive features are the elongate antennal segments, the presence of annulations on the terminal segments, and the shorter sense cones found also in the Aeolothripidae. The Heliothripinae resemble the Anaphothripini in having cuticular pustulation, cheek constrictions, and body areas of brown sclerotization. They resemble the Chirothripini in having a reduced number of annular microtrichia, an enlarged antennal segment V (in the first-stage larva of *Limothrips*), and body areas of brown sclerotization.

The only native genus of this subfamily in Illinois is *Caliothrips*; exotic genera occurring in greenhouses and homes are *Heliothrips, Parthenothrips,* and *Hercinothrips.*

Material Examined.—INHS: *Caliothrips indicus* (Bagnall); 2 larvae I, 1 larva II; 3 March 1970; reared from soybeans; Jabalpur, M.P., India.

Heliothrips haemorrhoidalis var. *angustior* Priesner; 1 larva I, 3 larvae II, prepupa (on slide with ♀ lectotype); on plants of virgin forest; Paramaribo, Surinam, S.A.

Hercinothrips femoralis (Reuter); 1 larva II; 30 April 1953; on African violet; St. Louis, Missouri.

Parthenothrips dracaenae (Heeger); 1 larva II; March 1952; on *Cordyline feminalis* leaves; Wahiawa, Oahu, Hawaii.

Subfamily THRIPINAE
Stephens (1829)

Larva.—Terminal antennal segments not greatly elongated (length only two to three times the greatest width), antennae without annulations on segments V–VII, antennal microtrichia and sense cones variable. Body coloration, cuticular sculpturing, head shape, and abdominal segment IX variable. Abdominal segment X lacks long anal setae.

Diagnosis.—Larvae of the subfamily Thripinae can be distinguished from those of the Heliothripinae by the short, terminal antennal segments and by other features not usually occurring in the Heliothripinae.

Priesner (1957) recognized the tribes Dendrothripini, Sericothripini, Thripini, and Chirothripini in the Thripinae, and included the Anaphothripini under the Thripini as a subtribe. Stannard (1968) recognized these tribes, too, but tenta-

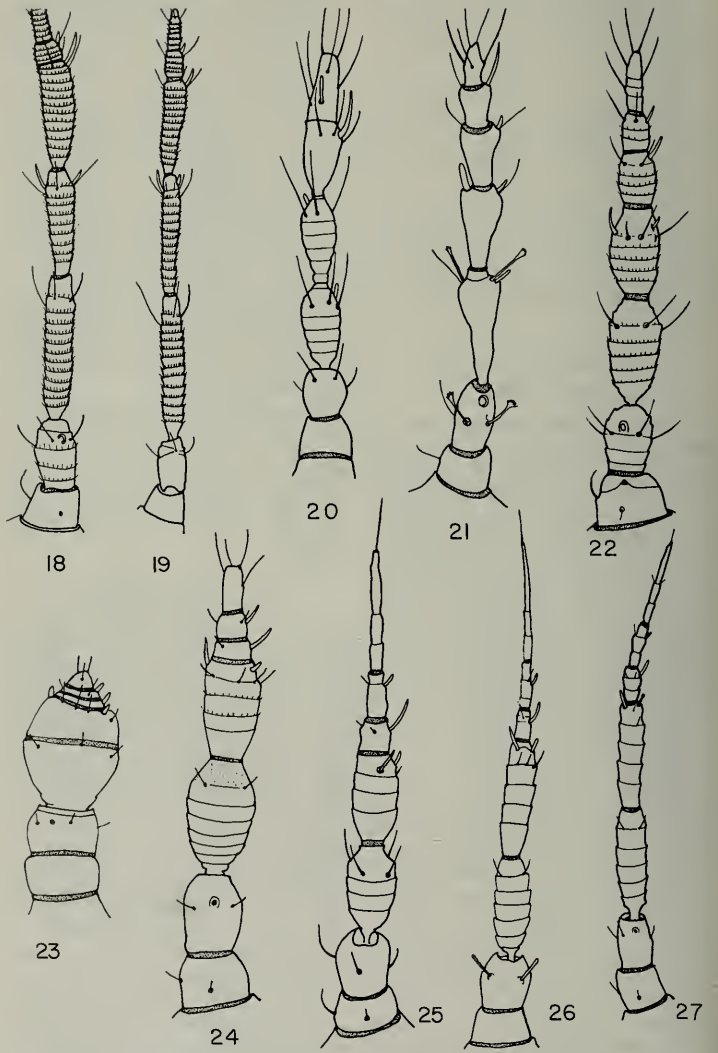

Fig. 18–27.—Right antenna of the second-instar larva. 18.—**Aeolothrips vittipennis.** 19.—**Franklinothrips** sp. 20.—**Merothrips morgani.** 21.—Phlaeothripid (Tubulifera). 22.—**Heterothrips arisaemae.** 23.—**Chirothrips simplex.** 24.—**Limothrips cerealium.** 25.—**Caliothrips indicus.** 26.—**Heliothrips haemorrhoidalis.** 27.—**Hercinothrips femoralis.**

tively included the Chirothripini under the Thripini because of difficulties in their categorization.

Here, five tribes are tentatively recognized in the Thripinae: the Chirothripini, Anaphothripini, Dendrothripini, Thripini, and Sericothripini. Certain combinations of larval features have been found to be characteristic of each tribe. Important characters at the tribal level include cuticular sculpturing; features of the antennal annulations, microtrichia, and sense cones; presence or absence of a posterior comb on abdominal tergite IX; and to a lesser extent the setal types and brown sclerotized body areas.

Tribe CHIROTHRIPINI Priesner (1949)

The diagnostic features of Chirothripine larvae are: (1) cuticle with small pustules bearing minute microtrichia, (2) body setae simple with certain ones knobbed (Fig. 64) (all reduced and pointed in *Chirothrips*) (Fig. 45 and 62), (3) head and pronotum often with brown sclerotized areas (Fig. 44) (reduced in *Chirothrips*) (Fig. 45), (4) antennal microtrichia greatly reduced, (5) antennal sense cones short to moderately long (Fig. 23 and 24), and (6) eye facets small and not bulging at sides of head.

The Chirothripini larvae resemble the Heliothripinae larvae in the reduction of the annular microtrichia on the antennae, segment V in the first-stage larva being longer and having two annulations (Fig. 11) (a trait found in most Heliothripinae but in no other Thripinae). The brown sclerotized areas of *Limothrips* resemble those found in many Heliothripinae.

Two genera in this tribe occur in Illinois, *Chirothrips* and *Limothrips*. Both contain species that are grain feeders and can be serious pests.

Material Examined.—INHS: *Limothrips cerealium* (Haliday); 1 larva II; 24 June 1953; Kenney, Illinois.

USNM: *Chirothrips simplex* Hood; 10 larvae II, 1 prepupa; 21 October 1961; reared from *Bouteloua eriopoda;* Las Cruces, New Mexico.

Limothrips denticornis Haliday; 2 larvae I, 3 larvae II, 2 prepupae; 10 July 1959; on barley; Northwood, North Dakota.

Tribe ANAPHOTHRIPINI Priesner (1949)

The diagnostic features of anaphothripine larvae are: (1) cuticle covered with large pustules and usually lacking microtrichia; (2) dorsal body setae pointed, knobbed, or blunt; (3) brown sclerotized body areas present in some species (Fig. 47 and 48); (4) posterior comb on abdominal tergite IX usually lacking (Fig. 66 and 67) (sometimes present in *Anaphothrips*); (5) annular microtrichia on antennae generally reduced (Fig. 12, 28, and 29); and (6) antennal sense cones moderately long to long.

The status of the Anaphothripini has long been variously interpreted. Priesner (1957) included the members of this tribe within the Thripini. Gentile & Bailey (1968) considered the Anaphothripini to be the most primitive of all thripine tribes, and Stannard (personal communication) is of the opinion that the Anaphothripini are close to the Heliothripinae.

The larvae of the Anaphothripini resemble those of the Heliothripinae in cuticular sculpturing, the presence of brown coloration in some species, a reduction of antennal microtrichia, and other features. They resemble the Thripini larvae in cuticular sculpturing and in the posterior comb that is sometimes present in *Anaphothrips*. *Anaphothrips secticornis* has brown sclerotized areas on the pteronotum similar to those in the *annulipes* group of *Sericothrips*. *Chaetanaphothrips* possesses expanded setae similar to those of *Sericothrips*.

In Illinois the tribe Anaphothripini

is represented by *Anaphothrips*, *Aptinothrips*, *Bregmatothrips*, *Chaetanaphothrips*, *Chilothrips*, *Oxythrips*, and *Prosopothrips*.

Material Examined.—INHS: *Anaphothrips secticornis* Karny; 3 larvae I, 6 larvae II; 21 January 1964; on short grasses; Barff Peninsula, Sörling Valley, South Georgia Island.

Aptinothrips rufus (Gmelin); 8 larvae I, 4 larvae II; 23 June 1933; on timothy heads; Champaign County, Illinois.

Oxythrips cannabensis Knechtel; 13 larvae I, 20 larvae II; August; on marijuana; Henry and Morgan counties, Illinois.

Chilothrips pini Hood; 5 larvae II; on cottonwood; 15 October 1959; Parkland, Adams County, Wisconsin.

Chilothrips sp.; 4 larvae II; on rotten wood and pigmy cypress duff; Deschutes County, Oregon, and Mendocino County, California.

Tribe DENDROTHRIPINI Priesner (1926*b*-1928)

The diagnostic features of dendrothripine larvae are: (1) cuticle covered with minute microtrichia, resulting in a stippled pattern and forming larger pustules in transverse rows on the terminal abdominal segments (Fig. 71); (2) body setae generally simple but with certain ones terminally knobbed (Fig. 74); (3) brown sclerotized areas lacking (Fig. 51); (4) antennal sense cones long (Fig. 35 and 36); (5) antennal microtrichia prominent and located between the annulations on segment IV (larva I) (Fig. 13), as in the Sericothripini.

Larval characters of the Dendrothripini are well defined and easily delineated; the larvae are very similar to those of the Sericothripini. Cuticular sculpturing is similar to that of the Sericothripina, and setae are similar to those of the Scirtothripina. Random microtrichia on antennal segment IV are also diagnostic for larvae of the Dendrothripini and Sericothripini.

The tribe Dendrothripini in Illinois includes one native genus, *Leucothrips*, and two genera introduced from Europe and Japan, *Dendrothrips* and *Pseudodendrothrips*, respectively.

Material Examined.—INHS: *Dendrothrips ornatus* (Jablonowski); 5 larvae I, 3 larvae II; 23 August 1955; on privet; Champaign County, Illinois.

Leucothrips piercei (Morgan); 1 larva I, 3 larvae II; 20 June 1967; on redbud leaves; Montgomery County, Illinois.

Pseudodendrothrips mori (Niwa); 1 larva I, 4 larvae II; 25 October 1961; on Japanese mulberry leaves; McLean County, Illinois.

Tribe THRIPINI Stephens (1829)

The diagnostic features of thripine larvae are: (1) cuticle covered with small to large pustules (Fig. 55), often with microtrichia present; (2) dorsal body setae pointed (Fig. 56), knobbed, blunt, or terminally funneled; (3) brown sclerotized body areas usually absent; (4) posterior comb or teeth usually present on abdominal tergite IX except in *Scolothrips* (Fig. 75, 76, and 77); (5) antennal annular microtrichia not reduced; and (6) antennal sense cones short to moderately long (Fig. 17, 37, and 38).

The Thripini larvae resemble the Anaphothripini larvae in cuticular sculpturing and general body appearance. Generally, less diversification is found among closely related members of the Thripini than is usual among the members of other tribes.

The tribe Thripini in Illinois includes *Baliothrips*, *Ctenothrips*, *Dorcadothrips*, *Frankliniella*, *Iridothrips*, *Microcephalothrips*, *Odonotothrips*, *Plesiothrips*, *Rhaphidothrips*, *Scolothrips*, *Taeniothrips*, and *Thrips*.

Material Examined.—INHS: *Ctenothrips bridwelli* Franklin; 1 larva II; 11

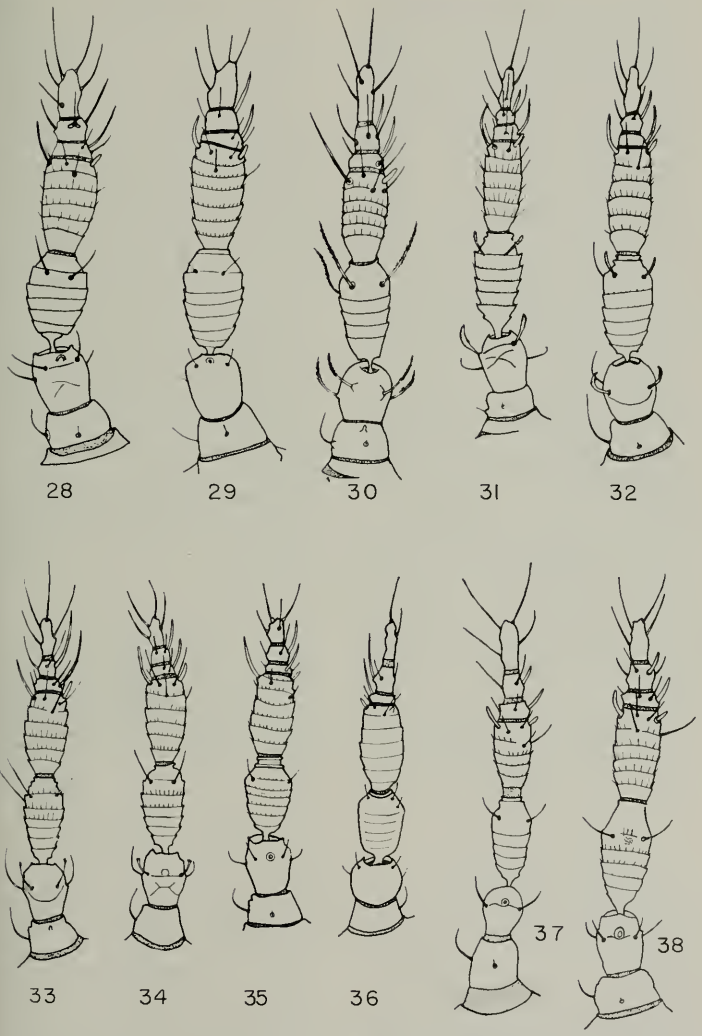

Fig. 28–38.—Right antenna (except where indicated) of the second-instar larva. 28.—**Anaphothrips secticornis.** 29.—**Oxythrips cannabensis.** 30.—**Echinothrips americanus.** 31.—**Sericothrips annulipes.** 32.—**Sericothrips variabilis.** 33.—**Scirtothrips taxodii.** 34.—**Drepanothrips reuteri.** 35.—**Dendrothrips ornatus.** 36.—**Pseudodendrothrips mori,** left antenna. 37.—**Ctenothrips bridwelli.** 38.—**Taeniothrips simplex.**

July 1947; on *Arisaema dracontium;* La Salle County, Illinois.

Frankliniella fusca (Hinds); 3 larvae II; 9 June 1949; Berlese collecting method; Mercer County, Illinois.

F. parvula Hood; 1 larva II; 20 June 1970; on bananas; Ciudad Chontalpa, Tabasco, Mexico.

F. tritici (Fitch); 1 larva I, 9 larvae II; on flowers of yarrow and Culver's root flowers; Lake, Livingston, and Massac counties, Illinois.

Frankliniella sp.; 12 larvae II, 3 prepupae, 2 pupae; May–July; on oats and from Berlese collecting method; Jackson County, Illinois, and Friday Harbor, Washington.

Microcephalothrips sp.; 5 larvae II; 16 December 1949; on Spanish moss; Chiefland, Florida.

Scolothrips pallidus (Beach); 1 larva II; 28 July 1964; on cotton; Kewanee, Missouri.

Taeniothrips simplex (Morison); 10 larvae II, 7 prepupae, 11 pupae; July–August; on gladiolus; Champaign and Will counties, Illinois.

Thrips impar Hood; 1 larva I, 5 larvae II; 16 July 1969; on jewelweed; Edward, Henry, and McLean counties, Illinois.

Thrips physapus Linneaus; 1 larva II; December 1959; Recoaro, Italy.

Thrips tabaci Lindeman; 1 larva I, 1 larva II; 25 April 1968; on clover; Champaign County, Illinois.

Tribe Sericothripini
Priesner (1926*b*-1928)

The diagnostic features of sericothripine larvae are: (1) cuticle covered with fine microtrichia, resulting in a stippled pattern over the abdomen and pteronotum; (2) cuticular pustules absent or very reduced; (3) all or some dorsal body setae expanded and/or fimbriate; (4) brown sclerotization lacking; (5) fourth antennal segment of first-instar larva densely covered with microtrichia.

The tribe Sericothripini is divided into the subtribes Sericothripina, Scirtothripina, and a new subtribe, the Echinothripina. Each of these groups is distinctive in certain larval characteristics, and each shows certain similarities with other tribes, indicating possible lines of relationship.

Sericothrips, particularly the *annulipes* group, resembles the Anaphothripini in such genera as *Anaphothrips* and *Chaetanaphothrips.* Most members of the *annulipes* group possess pteronotal sclerotized areas similar to those found in *Anaphothrips sticticornis. Sericothrips cingulatus* has darker brown markings and small pustules reminiscent of those in the Anaphothripini and Chirothripini. *Chaetanaphothrips* has fanned (but not fimbriate) setae similar to those in *Sericothrips.*

Scirtothrips and *Drepanothrips* show similarities to the Dendrothripini in setal features, coloration, and cuticular sculpturing.

Subtribe Sericothripina
Priesner (1957)

Larvae of the Sericothripina are characterized by fan-shaped, fimbriate setae; minute cuticular microtrichia set on pustulelike bases on the terminal abdominal segments; and the absence of pustules elsewhere. An exception is *Sericothrips cingulatus,* in which all microtrichia are set on small pustules. Microtrichia in all *Sericothrips* species form transverse rows on the abdomen, especially on the terminal abdominal segments, similar to the rowed ordering of the larger pustules in other groups.

Setal form in this group is unique among all thrips larvae and is an easily recognized diagnostic character. *Caliothrips* and possibly *Chaetanaphothrips* have fan-shaped setae somewhat like those of the Sericothripina, but the setae of *Caliothrips* and *Chaetanaphothrips* are smooth rather than fimbriate. The only genera in the Sericothripina

in Illinois are *Sericothrips* Haliday and *Zonothrips* Priesner.

Subtribe SCIRTOTHRIPINA Priesner (1957)

Larvae of the Scirtothripina are characterized by setae expanded or funneled terminally only and by long, dense cuticular microtrichia in the absence of cuticular pustules. Larvae of this subtribe are smaller than those of the Sericothripina and tend to have less ornamentation and less interspecific variation. Larval Scirtothripina have no hypodermal pigmentation, brown sclerotized areas, or setal basal rings; the setae are much simpler, and no cuticular pustulation is evident except for transverse rows formed by stippling on abdominal segments IX and X. Scirtothripina larvae resemble those of the Dendrothripini in their setae, both having combinations of long, terminally-funneled and short, pointed setae. Larvae of the Scirtothripina can be easily identified (particularly *Scirtothrips*) by their dense, long cuticular microtrichia and their lack of cuticular pustules. The genera included in this subtribe, according to Priesner (1957), are *Charassothrips* Hood, *Drepanothrips* Uzel, *Enneothrips* Hood, *Ensiferothrips* Bianche, *Octothrips* Moulton, *Scirtodothrips* Hood, *Scirtothrips* Shull, and *Sericopsothrips* Hood.

Subtribe ECHINOTHRIPINA, New Subtribe

The proper placement of the genus *Echinothrips* in higher categories has long been in question. Moulton (1911) placed *Echinothrips* in the Heliothripinae, and Medina as late as 1961 still considered this to be the best placement. Priesner (1957), however, considered this genus to be in the Thripini because of imaginal endothoracic morphology, and Stannard (1968) transferred *Echinothrips* into the Sericothripini because of the presence of abdominal microtrichia and the lack of fusion of the fore vein to the costa in the fore wing of the adults.

The larval characters of *Echinothrips* support Stannard's placement of the genus. Similarities of *Echinothrips* larvae to the larvae of other Sericothripini genera can be seen in cuticular microtrichia, fimbriate setae, antennal shape and sense cones, and extra microtrichia on antennal segment IV of first-stage larvae. *Echinothrips* differs in its unexpanded and more elongate body setae, larger and more elongate body size, positioning of head setae H1, and loss of pronotal setae P3.

Generally, *Echinothrips* most closely resembles the Sericothripina, but because of the differences described, the genus has been placed in its own subtribe. Wilson (1971) delimits a group of closely related genera that he calls the *Echinothrips* complex, including *Cercyothrips* Morgan, *Echinothrips* Moulton, *Enneothrips* Hood, *Plesiopsothrips* Hood, *Plesiothrips* Hood, and *Pteridothrips* Priesner. Some of these he placed with the Thripini and others with the Sericothripini. Wilson feels that this group is transitional between the Sericothripini and the Thripini and that possibly it merits tribal status. The only genus included here in this subtribe is *Echinothrips* Moulton.

Drepanothrips Uzel (1895)

Larva II.—Body color yellow. Antennal segments, tibiae, bases of femora, setae, and setal basal rings light brown to brown. Apices of antennal segments I and II and base and apex of segment III pale gray. Eyes red.

Antennae each seven segmented (Fig. 34); longer sense cone on segment IV, and sense cones on segments V and VI moderately long and slightly blunted; all of equal length. Segment II with a pair of terminally funneled setae; segment III with six annulations,

the distal three with short microtrichia; segment IV with five annulations, all with longer microtrichia.

Head (Fig. 52) longer than wide. Eyes with four large facets bulging at sides of head. Mouth cone moderately blunt. Head with four pairs of dorsal setae; H1, H3, and H4 subequal and terminally funneled.

Pronotum longer than wide with seven pairs of terminally funneled setae; P6 and P7 somewhat longer than P1–P5. Mesonotum with seven pairs and metanotum with five pairs of funneled setae, all of nearly equal length. Abdominal tergite I with two pairs and tergites II–VIII each with three pairs of funneled setae; A1, A2, and sometimes A3 on tergite IX (Fig. 70) funneled, and all subequal to equal in length. Abdominal tergite X with three pairs of setae, A1 funneled.

Almost all dorsal body setae terminally funneled and of moderate length. Bases of setae with faint brown rings. Abdominal and pteronotal cuticle with dense stippling and fine microtrichia, which are shorter and less obvious than those on *Scirtothrips* and longer than those on *Sericothrips*, stippling forming transverse rows on abdominal segments IX and X. Segment IX lacking a posterior comb.

Diagnosis.—*Drepanothrips* larvae most closely resemble *Scirtothrips* larvae from which they can be distinguished by the dorsal body setae, all of which are terminally funneled, while only a few characteristic ones are funneled in *Scirtothrips*. The cuticular microsetae are shorter and less dense in *Drepanothrips* than they are in *Scirtothrips*. Larvae of *Drepanothrips* differ from those of other Sericothripini in having terminally expanded setae, the setae of the other genera being either totally expanded or long and unexpanded. *Dendrothrips* and *Pseudodendrothrips*, which resemble *Drepanothrips* in the larval stages, can be differentiated by their lack of cuticular microtrichia and by their having only certain dorsal body setae funneled.

The genus contains only one species, *D. reuteri*, in Illinois.

Drepanothrips reuteri Uzel (1895) (Fig. 34, 52, and 70)

Larva II.—Body light yellow to yellow. Antennae, tibiae, bases of femora, and setal basal rings light brown; antennal segments II, V–VIII, and apex of IV often darker brown. Apices of antennal segments I and II and base and apex of segment III very pale gray. Eyes dark red.

Most body setae slender, terminally funneled or dilated, and subequal in length (14–19 μm). Bases of setae with faint unraised brown rings. Dorsal sclerotized areas lacking. Stippling forming transverse rows only on abdominal segments IX and X.

Measurements of the *D. reuteri* larva II are shown in Table 6.

Diagnosis.—*D. reuteri* occurs on grapevines (*Vitis* sp.), of which it

Table 6.—Measurements, in microns, of three **Drepanothrips reuteri** larvae II.

Character	Length		Width
	Range	Mean	Range
Antennal segment			
I	19[a]	...	22–23
II	28–31	...	22–23
III	42–46	...	22
IV	42–46	...	17–20
V	8–11	...	12–14
VI	8–9	...	9
VII	16	...	6
Antenna	163–178	171	...
Head	70–78	...	78–85
Pronotum	93–124	...	124–140
Body	660–825	765	...
Setae			
H1	16		
H4	16–19		
P7	16–19		
A(IX)1	14–16		
A(IX)2	17–19		
Ventral setae (IX)	15		

[a] A single measurement in a range column indicates that all such measurements were identical.

has been reported to be a pest. Bailey (1942) gave an account of the biology of this thrips and discussed the literature concerning it. This species has been recorded only once in Illinois, two adult females having been taken in

Fig. 39–48.—Head and pronotum (except where indicated) of the second-instar larva. 39.—**Aeolothrips vittipennis.** 40.—**Merothrips morgani.** 41.—**Heterothrips arisaemae.** 42.—Phlaeothripid (Tubulifera). 43.—**Heliothrips haemorrhoidalis.** 44.—**Limothrips cerealium,** head, pronotum, and left foreleg. 45.—**Chirothrips simplex,** head, pronotum, and left foreleg. 46.—**Caliothrips indicus.** 47.—**Oxythrips cannabensis.** 48.—**Anaphothrips secticornis.**

Urbana from a sparrow nest built in a grape arbor.

Material Examined.—INHS: 3 larvae II; 23 August 1965; on grape; collected by K. Stahlik; Selma, Fresno County, California.

Echinothrips Moulton (1911)

Larva II.—Cuticular color usually yellow to orange. Antennal segments, tibiae, bases of femora, and setae generally light brown. Eyes red.

Antennae each seven segmented (Fig. 30); longest sense cone on segment IV, sense cones on V and VI long and pointed; segments II and III each with two pairs of fimbriate setae; segment III with five annulations, none with microtrichia; segment IV with five annulations, all with microtrichia.

Head (Fig. 54) wider than long. Eyes with four large facets bulging at sides of head. Mouth cone moderately blunt. Head with four pairs of dorsal setae, all long and fimbriate; H1 located more posteriorly than usual in most known thrips larvae and almost opposite to H4; H3 and H4 equal and shorter than H1.

Pronotum (Fig. 54) wider than long with six pairs of fimbriate setae; P3 lacking; P1, 2, 4, and 6 all longer than P7. Mesonotum with seven pairs and metanotum with four pairs of long fimbriate setae of varying lengths. Setae A1 and 2 of abdominal segment IX long; A3 of varying length, sometimes reduced (Fig. 73). Segment X with three pairs of dorsal setae; A1 and A3 long and fimbriate.

Most dorsal body setae fimbriate and long, the setal lengths on abdominal tergites sometimes varying greatly. Cuticle with minute microtrichia sparsely scattered on abdominal tergites, microtrichia becoming pustulelike and forming transverse rows on the terminal abdominal segments. Abdominal segment IX lacking a posterior comb.

Larva I.—Cuticle yellow to orange; hypodermal pigment lacking. Antennal segments I, III, and most of IV, tibiae, and bases of femora generally light brown; segment II, apex of IV, and all of V–VII darker brown. Eyes red.

Antennae each seven segmented; suture between IV and V usually distinct. Sense cones on segments IV–VI as in larva II, but longer (Fig. 16). Segments II and III each with a pair of long fimbriate setae. Segment III with five annulations, with minute microtrichia present ventrally. Segment IV with six annulations; microtrichia present randomly on and between annulations but less dense than in *Scirtothrips*. Apical segment not narrowed terminally.

Chaetotaxy similar to that of larva II, except posteroangular setae (P7) lacking, the mesonotum with four pairs of setae, the metanotum with three pairs of setae, and abdominal segment IX with two pairs of dorsal setae. Integument with stippling, as in larva II, but fainter.

Diagnosis.—*Echinothrips* larvae can be easily recognized by their long fimbriate setae and elongate body shape, which are unique among the Thripinae in Illinois. Antennal and cuticular sculpturing are similar to those of *Sericothrips*, but setal length and type, body shape, placement of setae HI (more posterior in *Echinothrips*), and loss of one pronotal setal pair (P3) differ from those of *Sericothrips*. These features distinguish *Echinothrips* from all other genera. The only other thripine genus in Illinois possessing long setae similar to those in *Echinothrips* is *Scolothrips*.

Interspecific variation in *Echinothrips* is very limited in the two species considered, *E. americanus* and *E. subflavus*. In the one slide of *E. subflavus* studied, body dimensions and setal lengths were larger than those in

E. americanus. However, considerable variation in setal lengths was found in *americanus;* so the extent of variation in both species will have to be investigated before setal measurements can be used as a diagnostic feature.

Echinothrips americanus Morgan (1913)

(Fig. 16, 30, 54, and 73)

Larva II.—Cuticle yellow to orange. Antennae, tibiae, bases of femora, and

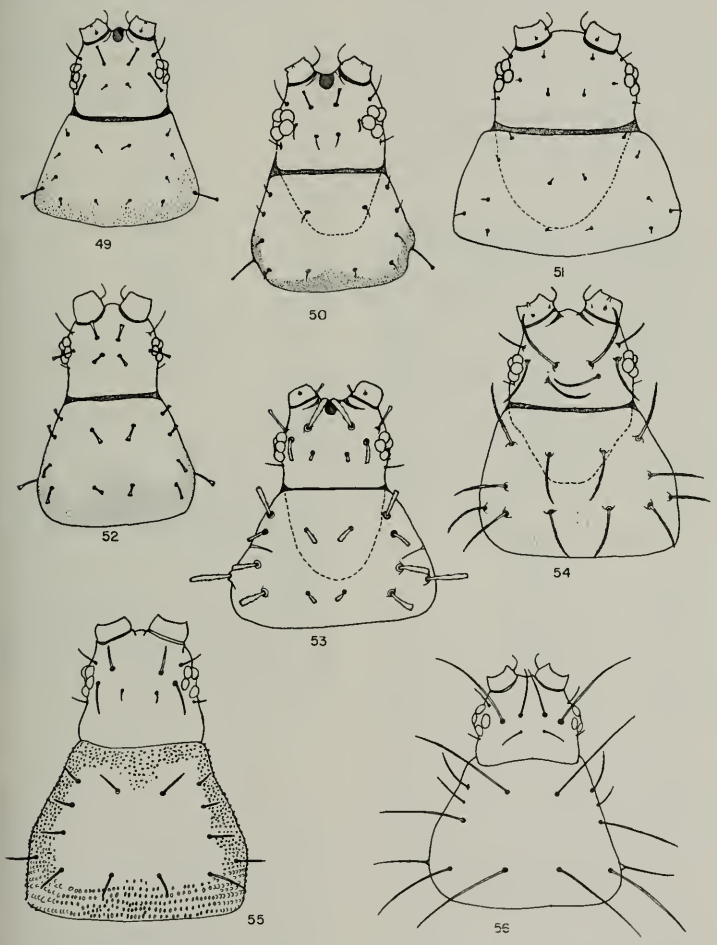

Fig. 49–56.—Head and pronotum of the second-instar larva. 49.—**Scirtothrips niveus.** 50.—**Scirtothrips taxodii.** 51.—**Dendrothrips ornatus.** 52.—**Dreparothrips reuteri.** 53.—**Sericothrips annulipes.** 54.—**Echinothrips americanus.** 55.—**Taeniothrips simplex.** 56.—**Scolothrips pallidus.**

setae brown; apices of antennal segments I and II and base and apex of III light brown. Eyes red.

Most dorsal setae long (50–70 μm) and fimbriate for most of their length; others (H2; Ms1, 2, 5, and 6; and Mt1) shorter (20–30 μm). Light brown spot present on head anteriorly. Cuticle with large stippling on abdomen forming transverse rows and becoming finer and randomly distributed on pteronotum and posterior portion of pronotum.

Measurements of the *E. americanus* larva II are shown in Table 7.

Table 7.—Measurements, in microns, of five **Echinothrips americanus** larvae II.

Character	Length		Range
	Range	Mean	Width
Antennal segment			
I	19–23	...	28–31
II	28–36	...	25–29
III	50–62	...	23–28
IV	43–54	...	19–23
V	11–12	...	16–19
VI	12–16	...	12–16
VII	26–28	...	8[a]
Antenna	195–217	209	...
Head	85–93	...	96–116
Pronotum	105–124	...	148–178
Body	1,065–1,281	1,167	...
Setae			
H1	54		
H4	39–46		
P7	39–46		
A(IX)1	54–70		
A(IX)2	67–78		
A(IX)3	51–54		
A(X)1	54–67		

[a] A single measurement in a range column indicates that all such measurements were identical.

Larva I.—Cuticle yellow to orange. Antennal segments I, III, and most of IV brown; apices of I and II and base and apex of III pale brown; segments II, apex of IV, and V–VII darker brown. Tibiae, bases of femora, and setae light brown. Eyes red.

Setae long and fimbriate as in larva II, but generally shorter (30–45 μm in larva I).

Cuticle with stippling visible only on abdominal segment X.

Measurements of the *E. americanus* larva I are shown in Table 8.

Table 8.—Measurements, in microns, of two **Echinothrips americanus** larvae I.

Character	Length Range	Width Range
Antennal segment		
I	16–19	23–26
II	26–28	23[a]
III	39–40	23
IV	43–46	23
V	6–8	12
VI	12–16	9
VII	26	8
Antenna	168–183	...
Head	70	88
Pronotum	85	116
Body	807–814	...
Setae		
H1	32–40	
A(IX)1	50–51	
A(IX)2	40–43	
A(X)1	132	

[a] A single measurement in a range column indicates that all such measurements were identical.

Diagnosis.—*E. americanus* larvae cannot at this time be distinguished from those of *subflavus* except by associated adults and host-plant data and by their somewhat smaller size. *E. americanus* is found on many forest plants, in particular on jewelweed (*Impatiens*).

Material Examined.—INHS: 2 larvae I, 10 larvae II; June–October; on *Desmodium*, hydrangea, and jewelweed foliage; Gallatin, Clark, Henry, and Johnson counties, Illinois.

Echinothrips subflavus
Hood (1927*b*)

Larva II.—Cuticle yellow. Antennal segments, tibiae, bases of femora, and setae brown; apices of antennal segments I and II and base and apex of III light brown. Eyes dark red.

Most dorsal setae long (60–80 μm) and fimbriate for most of their length; others (H2; P7; Ms1, 2, 5, and 6; and Mt1) shorter (25–40 μm). Cuticle with larger stippling on abdomen, and

forming transverse rows and becoming finer and randomly distributed on pteronotum and posterior portion of pronotum.

Measurements of the *E. subflavus* larva II are shown in Table 9.

Table 9.—Measurements, in microns, of one **Echinothrips subflavus** larva II.

Character	Length	Width
Antennal segment		
I	23	31
II	42	28
III	65	25
IV	57	23
V	11	16
VI	16	12
VII	28	8
Antenna	242	...
Head	116	124
Pronotum	124	194
Body	1,350	...
Setae		
H1	62	
H4	46	
P7	28	
A(IX)1	85	
A(IX)2	85	
A(IX)3	60	
A(X)1	85	

Diagnosis.—*E. subflavus* larvae cannot at this time be distinguished from those of *E. americanus* except by associated adults and host-plant data. *E. subflavus* is found on hemlock (*Tsuga canadensis* (L.)) in the eastern United States and could possibly be brought into Illinois on hemlocks intended for ornamental plantings.

Material Examined.—USNM: 1 larva II; 23 July 1939; on hemlock; collected by J. D. Hood; Oswegatchie, New York.

Seirtothrips Shull (1909)

Larva II.—Cuticular color yellow to orange, sometimes with orange hypodermal subintegumental pigment. Antennae, bases of femora and entire tibiae, and an anterior median cephalic spot all light brown to brown. Apices of antennal segments I and II and base and apex of III pale gray.

Antennae each seven segmented (Fig. 33). Longest sense cone on segment IV and sense cones on segments V and VI long, pointed, and all subequal. Segment II with a pair of funneled setae. Segment III with six annulations, fine microtrichia present on all annulations.

Head (Fig. 49) wider than long. Eyes with four large facets bulging at sides of head. Mouth cone moderately blunt. Head with four pairs of dorsal setae; H1 usually and H4 sometimes funneled; H1 and H4 of equal length; H3 subequal to H1 and H4.

Pronotum (Fig. 49) wider than long with seven pairs of dorsal setae. All except the posteroangular setae (P7) short and pointed; P7 longer and often funneled. Mesonotum with seven pairs and metanotum with four pairs of short, pointed dorsal setae. Abdominal segment I with two pairs and segments II–VIII each with three pairs of dorsal setae. Segment IX (Fig. 72) with four pairs of dorsal and lateral setae; A2 longest and sometimes funneled; ventral setae about as long as A1. Segment X with two pairs of dorsal setae; A1 sometimes funneled.

Most setae pointed and fairly short; H1 and P7 always, and H4, A(IX)2, and A(X)1 sometimes longer and terminally funneled or knobbed. Integument with dense microtrichia, resulting in a dense stippling effect over the abdomen and pteronotum and forming transverse rows on abdominal segments IX and X. Abdominal segment IX lacking a posterior comb.

Larva I.—Cuticular color light yellow to orange. Antennal segments, tibiae, and bases of femora light brown to brown. Apices of antennal segments I and II and base and apex of III pale gray. Terminal antennal segments darker brown.

Antennae each seven segmented (Fig. 15), the suture between IV and V sometimes indistinct. Sense cones as in larva II; segment II with pair

of terminally funneled setae; segment III with six annulations with fine microtrichia present on the distal four and some microtrichia scattered between the annulations; segment IV with five annulations, with longer microtrichia

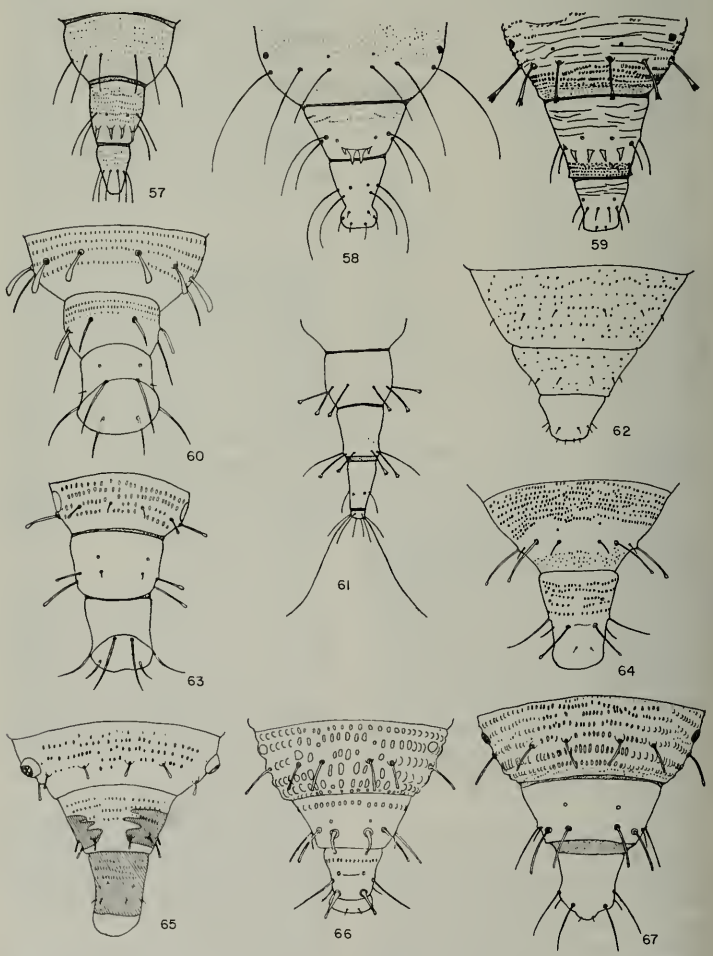

Fig. 57–67.—Abdominal segments VIII–X of the second-instar larva. 57.—**Aeolothrips vittipennis.** 58.—**Merothrips morgani.** 59.—**Heterothrips arisaemae.** 60.—**Caliothrips indicus.** 61.—Phlaeothripid (Tubulifera). 62.—**Chirothrips simplex.** 63.—**Heliothrips haemorrhoidalis.** 64.—**Limothrips cerealium.** 65.—**Hercinothrips femoralis.** 66.—**Oxythrips cannabensis.** 67.—**Anaphothrips secticornis.**

present on and randomly between the annulations; segment VII tapering apically.

Chaetotaxy similar to that of larva II, except the posteroangular setae lacking, mesonotum with four pairs and metanotum with three pairs of setae, and abdominal segment IX with two dorsal pairs and one lateral pair of setae. Integument with microtrichia, and resultant stippled pattern fainter than in larva II.

Diagnosis.—*Scirtothrips* larvae can be distinguished from the larvae of other sericothripines by their long dense cuticular microtrichia and by their simple reduced dorsal body setae, only a few of which are long and terminally funneled. *Drepanothrips* and *Sericothrips* have less dense and shorter cuticular microtrichia and all setae either terminally funneled or fanned. *Scirtothrips* resembles *Dendrothrips* in having small simple setae with only certain ones longer and terminally funneled, but larvae of the latter genus lack the dense cuticular microtrichia of *Scirtothrips*.

Morphological characters used to separate the larvae of *Scirtothrips* are uncertain. The extent of intraspecific variation in the species is not known due to a lack of specimens. Host-plant data and associated adults should be used where possible to supplement larval identifications.

KEY TO THE MATURE LARVAE II OF *SCIRTOTHRIPS*

1. Dorsal setae H1, H4, P7, A(IX)2, and A(X)1 all terminally funneled; H1 and H4 both longer, about 23 μm (Fig. 49); body color yellow; found on dogwood ..... **niveus**

   At most, only dorsal setae H1 and P7 funneled; H1 and H4 shorter, about 15 μm (Fig. 50); body color yellow or orange; found on red cedar or on cypress 2

2. Body color usually orange; setae A(IX)1 and 3 significantly shorter than A(IX)2; found on red cedar ..... **brevipennis**

   Body color yellow, sometimes with orange subintegumental pigment; setae A(IX)1 and 3 long (19 and 23–25 μm) and subequal to A(IX)2 (Fig. 72); found on cypress... **taxodii**

Scirtothrips brevipennis Hood (1914)

Larva II.—Body pale orange to yellow-orange, sometimes with darker orange pigmentation. Antennal segments I–IV brown; apices of segments I, II, and III pale gray; segments V–VII darker brown. Tibiae, bases of femora, and anterior median cephalic spot brown. Eyes red.

Most setae simple, pointed, and short; H1 and P7 longer and funneled; A(IX)2 pointed and decidedly longer than A(IX)1 and A(IX)3. Cuticle with fine dense microtrichia.

Measurements of the *S. brevipennis* larva II are shown in Table 10.

Table 10.—Measurements, in microns, of two **Scirtothrips brevipennis** larvae II.

Character	Length Range	Width Range
Antennal segment		
I	17[a]	23
II	31	23
III	46	22
IV	46	22
V	8	14
VI	8	12
VII	15	6
Antenna	170	...
Head	93–108	78
Pronotum	90–101	140–155
Body	631	...
Setae		
H1	16	
H4	16	
P7	16–17	
A(IX)1	14–16	
A(IX)2	25–26	
A(IX)3	16	

[a] A single measurement in a range column indicates that all such measurements were identical.

Diagnosis.—*S. brevipennis* larvae are distinguished from those of *niveus* in having shorter cephalic setae (H1 and H4) and having H4, A(IX)2, and

A(X)1 pointed instead of terminally funneled. *S. brevipennis* larvae are separated from those of *taxodii* by having orange body color (usually yellow in *taxodii*) and shorter setae (A1 and A3) on abdominal segment IX than *taxodii* larvae have. *S. brevipennis* is found on eastern red cedar (*Juniperus virginiana*).

Material Examined.—INHS: 2 larvae II; June; on red cedar; Johnson and Pope counties, Illinois.

Scirtothrips niveus Hood (1913) (Fig. 49)

Larva II.—Body yellow with darker yellow pigmentation. Antennae, tibiae and bases of femora light brown. Apices of antennal segments I and II and base and apex of III pale gray. Eyes red.

Most setae simple, fairly short (12 μm), and pointed; H1, H4, P7, A(IX)2, and A(X)1 all longer and funneled. Cuticle with fine dense microtrichia.

Measurements of the *S. niveus* larva II are shown in Table 11.

Diagnosis.—*S. niveus* larvae can be distinguished from other *Scirtothrips* larvae considered here by the longer H1 and H4 setae and by knobbed rather than pointed H4, A(IX)2, and A(X)1 setae. *S. niveus* occurs on leaves of dogwood (*Cornus* sp.).

Material Examined.—INHS: 1 larva II; June; on dogwood; Cook County, Illinois.

Table 11.—Measurements, in microns, of one **Scirtothrips niveus** larva II.

Character	Length	Width
Antennal segment		
I	16	25
II	29	22
III	46	22
IV	43	22
V	11	16
VI	11	11
VII	16	8
Antenna	172	...
Head	93	93
Pronotum	108	163
Body	840	...
Setae		
H1	23	
H4	23	
P7	23	
A(IX)1	20	
A(IX)2	28	
A(IX)3	23	
A(X)1	14	

Scirtothrips taxodii Hood (1954) (Fig. 15, 33, 50, and 72)

Larva II.—Body color yellow, often with red-orange body pigment. Antennae, tibiae, bases of femora, and anterior median cephalic spot light brown. Antennal segments V–VII usually darker brown. Apices of antennal segments I and II and base and apex of III pale gray. Eyes red.

Most setae pointed and short (11–12 μm); H1, H4, P7, A(IX)2, and A(X)1 longer and knobbed. A(IX)1 and A(IX)3 long and subequal to A(IX)2. Cuticle with dense microtrichia.

Measurements of the *S. taxodii* larva II are shown in Table 12.

Table 12.—Measurements, in microns, of six **Scirtothrips taxodii** larvae II.

Character	Length		Width
	Range	Mean	Range
Antennal segment			
I	16–17	...	22–24
II	18–30	...	20–23
III	43–46	...	20–23
IV	43–46	...	20–23
V	6–8	...	12–16
VI	9–11	...	9–11
VII	19–23	...	8[a]
Antenna	164–185	174	...
Head	78–85	...	93–100
Pronotum	85–125	...	140–155
Body	670–780	720	...
Setae			
H1	14–16		
H4	14–17		
P7	19–23		
A(IX)1	19		
A(IX)2	25–28		
A(IX)3	23–25		
A(X)1	20–23		

[a] A single measurement in a range column indicates that all such measurements were identical.

Larva I.—Body pale yellow, often with red-orange body pigment. Antennal segments I and II light brown; segments III and proximal portion of IV brownish orange; apex of IV and segments V–VII all darker brown; tibiae and bases of femora brown. Eyes red.

Most setae pointed and short (8 μm); only HI knobbed. Posteroangular setae lacking. Anterior median cephalic spot

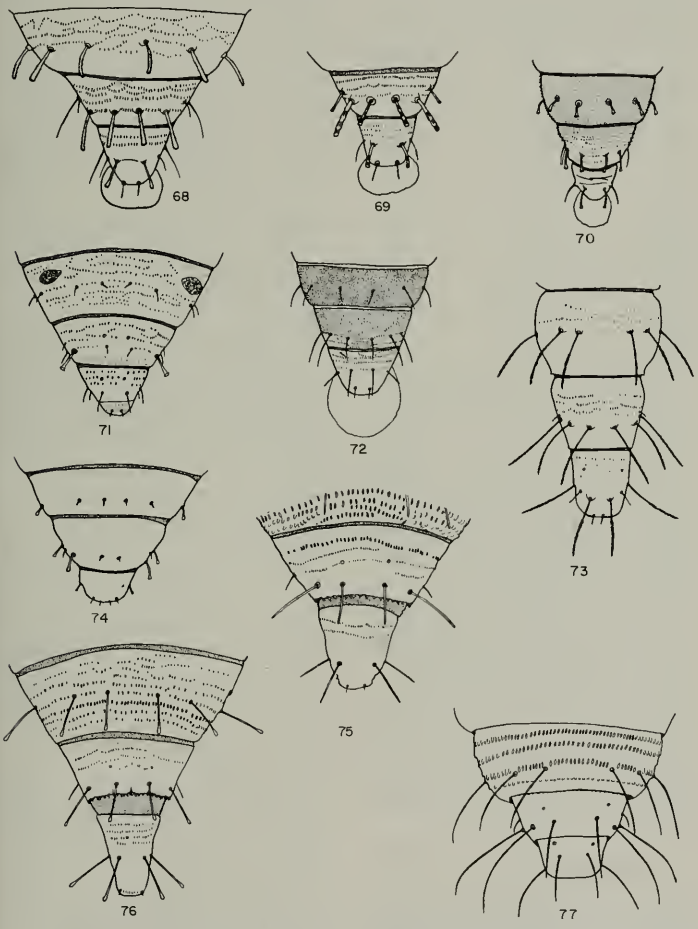

Fig. 68–77.—Abdominal segments VIII–X (except where indicated) of the second-instar larva. 68.—**Sericothrips campestris.** 69.—**Sericothrips annulipes,** abdominal segments IX and X. 70.—**Drepanothrips reuteri.** 71.—**Dendrothrips ornatus.** 72.—**Scirtothrips taxodii.** 73.—**Echinothrips americanus.** 74.—**Pseudodendrothrips mori.** 75.—**Taeniothrips simplex.** 76.—**Ctenothrips bridwelli.** 77.—**Scolothrips pallidus.**

lacking. Cuticle with very fine microtrichia.

Measurements of the S. *taxodii* larva I are shown in Table 13.

Table 13.—Measurements, in microns, of two **Scirtothrips taxodii** larvae I.

Character	Length Range	Width Range
Antennal segment		
I	12[a]	18–20
II	18–20	19–20
III	27–30	24
IV	38–47	19–27
V	6–7	12
VI	6–7	8–9
VII	15	5–6
Antenna	120–138	...
Head	74	85
Pronotum	85	119–124
Body	527–542	...
Setae		
H1	9	
A(IX)1	13	
A(IX)2	24	
A(X)1	15	

[a] A single measurement in a range column indicates that all such measurements were identical.

Diagnosis.—S. *taxodii* larvae are distinguished from S. *niveus* larvae by shorter H1 and H4 setae and by pointed instead of knobbed H4, A(IX)2, and A(X)1 setae. S. *taxodii* is differentiated from S. *brevipennis* by body color, which tends to be yellow in *taxodii* and orange in *brevipennis*, and by setae A1 and A3 on abdominal segment IX being longer and closer to the length of A2. S. *taxodii* is found on leaves of bald cypress (*Taxodium distichum*).

Material Examined.—INHS: 2 larvae I, 11 larvae II; June–August; on bald cypress; Alexander and Massac counties, Illinois.

Sericothrips Haliday (1836)

Larva II.—Body color pale yellow to yellow to yellow-orange, several species showing light to heavy orange or red hypodermal pigmentation. Antennal segments, tibiae, bases of femora, setae, and setal basal rings (and abdominal segments IX and X in S. *annulipes*) light brown to brown. Apices of antennal segments I and II and base and apex of III pale gray. Brown sclerotized areas present on anterior median head area and, in certain species, on pteronotum. Eyes red.

Antennae each seven segmented (Fig. 31); longest sense cone on segment IV and sense cones on segments V and VI moderately long and slightly blunted, all subequal. Sense cones on segment V slightly shorter. Segments II and III each with a pair of fanned setae. Segment III with six annulations; very fine microtrichia present on the distal annulations. Segment IV with five annulations, all with longer, more prominent microtrichia.

Head (Fig. 53) wider than long. Eyes with four large facets bulging at sides of head. Mouth cone moderately blunt. Head with four pairs of dorsal setae; H1 and H4 always, and H2 and H3 sometimes, fanned; H1 directly opposite H2; H3 reduced and much smaller than H4; H4 varying from shorter than to subequal to H1.

Pronotum wider than long and with seven pairs of setae. Setae P1, 3, and 5 usually shorter, and P7 longer than P2, 4, and 6. Mesonotum with seven pairs of fanned setae, two pairs located medially and five pairs laterally. Metanotum with four pairs of fanned setae, two pairs located medially and two pairs laterally. Meso- and metanotum each with two pairs of brown sclerotized areas in *annulipes, pulchellus,* and *cingulatus.*

Abdominal segment I with two pairs and abdominal segments II–VIII each with three pairs of fanned setae; A1 usually shortest and A3 usually longest, their lengths varying among *Sericothrips* species. Segment IX with setae A1 and A2 long and narrowly fanned, A3 reduced and sometimes fanned. Segment X with A1 narrowly fanned.

Most dorsal body setae fanned to

varying degrees and of varying lengths. Setal bases usually with faint brown rings (much larger and more prominent in *annulipes, pulchellus,* and *cingulatus* and to a lesser degree in *variabilis*). Integument with dense stippling resulting from very fine microtrichia; stippling forming transverse

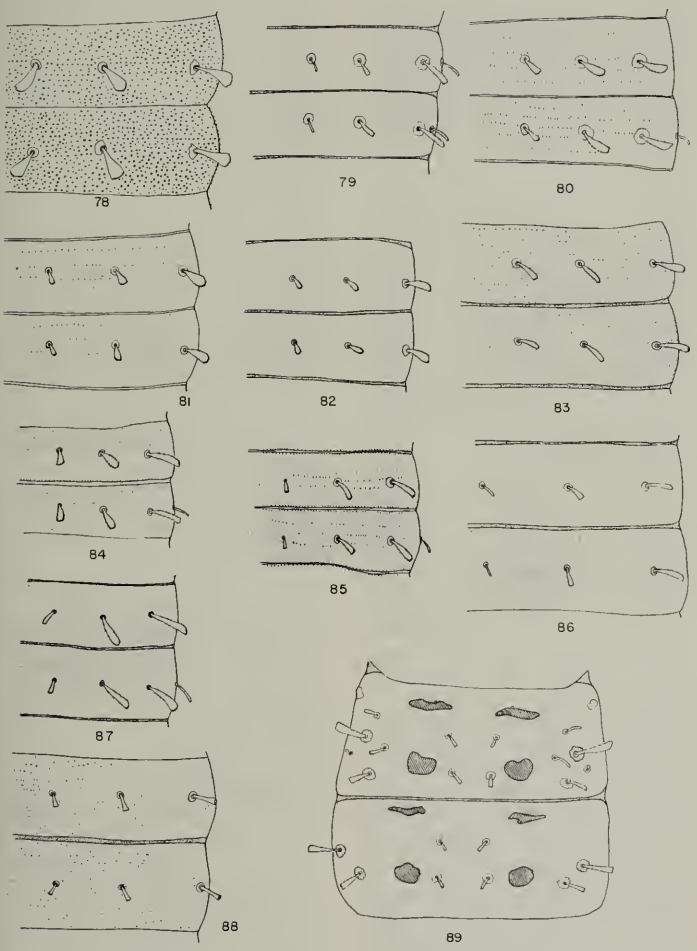

Fig. 78–89.—Abdominal segments III and IV (except where indicated) of **Sericothrips** species. 78.—**S. cingulatus.** 79.—**S. annulipes.** 80.—**S. pulchellus.** 81.—**S. variabilis.** 82.—**S. baptisiae.** 83.—**S. campestris.** 84.—**S. beachae.** 85.—**S. tiliae.** 86.—**S. nubilipennis.** 87.—**S sambuci.** 88.—**S. langei.** 89.—**S. annulipes,** meso- and metanotum.

rows on abdominal segments, particularly on segments IX and X (minute pustules present in *cingulatus*). Abdominal segment IX lacking a posterior comb.

Larva I.—Body color pale yellow to orange-yellow, with hypodermal pigment in some species. Antennal segments, tibiae, bases of femora, and setae light brown. Apices of antennal segments I and II and base and apex of III pale gray. Terminal antennal segments darker brown.

Antennae each seven segmented, the suture between IV and V sometimes indistinct. Sense cones on segments IV and V as in larva II, but longer; sense cone on segment VI as in larva II (Fig. 14). Segments II and III each with a pair of fanned setae. Segment III with six annulations with small microtrichia present on most. Segment IV with five annulations with longer microtrichia present on and randomly between the annulations. Segment VII tapering apically.

Chaetotaxy similar to that of larva II, but setae much reduced and fanned only terminally; posteroangular setae (P7) lacking; mesonotum with four pairs and metanotum with three pairs of setae; abdominal segment IX with two dorsal pairs of fanned setae. Anterior median cephalic spot, pteronotal sclerotized areas, and raised setal basal rings all lacking. Integument with stippling as in larva II, but fainter.

Diagnosis.—Sericothrips larvae can be distinguished from those of all other Thripinae except *Zonothrips* by the presence of fimbriate fan-shaped setae. Larvae of *Zonothrips* were unavailable to me, but they can be separated from those of *Sericothrips* through the associated adults and host-plant data. A description and illustration of *Z. karnyi* (larva II) were given by Priesner (1926*a*), but this description and illustration are lacking in diagnostic characters sufficient to separate *Zonothrips* from *Sericothrips*.

Characters used to differentiate between larvae of *Sericothrips* species vary in their value. Presence or absence of large setal basal rings and brown sclerotized areas on the pteronotum are always consistent. Presence or absence of an anterior median cephalic spot and the proportions of the lengths of the abdominal dorsal setae are fairly reliable. Body color, hypodermal pigmentation, proportionate lengths of certain head and pronotal setae, and the general length and width of the setae are useful only when used in conjunction with other characters.

KEY TO THE MATURE LARVAE II OF *SERICOTHRIPS*

1. Pteronotum with brown sclerotized areas (Fig. 89); abdominal and pteronotal setae with basal rings moderately or greatly enlarged (7–15 μm in diameter) 2

   Pteronotum lacking brown sclerotized areas; abdominal and pteronotal setae with basal rings reduced and faint (6–7 μm in diameter) (the lateral abdominal setae with larger rings in *variabilis*) 4

2. Cuticle with microtrichia on small pustules; setal basal rings only moderately enlarged (Fig. 78) .... **cingulatus**

   Cuticle with microtrichia alone resulting in a stippled pattern; setal basal rings greatly enlarged 3

3. Abdominal segments IX and X usually brown; abdominal segment IV with setal pair A2 significantly shorter than A3, and A1 nearly subequal to A2 (Fig. 79); found on black locust ..... **annulipes**

   Abdominal segments IX and X not brown; abdominal segment IV with setal pair A2 subequal to A3, and A1 significantly shorter than A2 (Fig. 80); found on wafer ash... **pulchellus**

4. Dorsal body setae generally short, the longest setae rarely exceeding 20–25 μm and either widely or narrowly fanned; abdominal segment IV with setae A1 and A2 subequal and significantly shorter than A3... 5

   Dorsal body setae generally long, the longer setae measuring up to 30–35 μm; proportions of abdominal setae variable 6

5. Body setae widely fanned (Fig. 82); found on false indigo ..... **baptisiae**

Body setae narrowly fanned (Fig. 88); found on water lily..... **langei**

6. Setal pair A2 on anterior abdominal segments subequal to A3, the length of A1 varying 7

Setal pair A2 on anterior abdominal segments significantly shorter than A3, and A1 usually significantly shorter than A2 8

7. Setal pair A1 subequal to A2 (Fig. 83); A3 not over 25 μm long on abdominal segment IV; found on wild four-o'clock ..... **campestris**

Setal pair A1 shorter than A2 (Fig. 87); A3 up to 30 μm long on abdominal segment IV; found on elderberry ..... **sambuci**

8. Setae generally widely fanned (Fig. 81 and 84) 9

Setae generally narrowly fanned (Fig. 85 and 86) 10

9. Lateral abdominal setae with large basal rings (Fig. 81); body color yellow to orange, sometimes with red hypodermal pigmentation ..... **variabilis**

Lateral abdominal setae with reduced basal rings (Fig. 84); body color pale white to yellow without red hypodermal pigmentation .... **beachae**

10. Body color usually white to whitish yellow; found on various forest trees and in forest debris.. **nubilipennis**

Body color usually more yellow; found on basswood ..... **tiliae**

Sericothrips annulipes Hood (1927*b*) (Fig. 31, 53, 69, and 79)

Larva II.—Body yellow with prominent red-orange hypodermal pigmentation dorsally in mature larvae. Antennae, tibiae, bases of femora, abdominal segments IX and X, setae, setal rings, and cephalic spot brown. Apices of antennal segments I and II and base and apex of segment III pale gray. Eyes red.

Most dorsal body setae fairly long and fairly narrowly fanned. Longer body setae generally twice the length of the shorter setae; longer setae, 22–30 μm, shorter setae, 9–16 μm. Bases of setae with prominent raised brown rings (7–13 μm in diameter) on abdomen and pteronotum. Head sometimes with a truncate apical point; anterior median brown cephalic spot usually present. Mesonotum and metanotum each with two pairs of brown sclerotized areas (Fig. 89). Abdominal segment IV with setal pair A1 subequal to A2, and both significantly shorter than A3 (Fig. 79); A1 usually shorter than A2 on segment IX.

Measurements of the *S. annulipes* larva II are shown in Table 14.

Table 14.—Measurements, in microns, of 10 **Sericothrips annulipes** larvae II.

Character	Length		Width
	Range	Mean	Range
Antennal segment			
III	48–54	...	21–22
IV	45–52	...	18–21
V	6–7	...	10–13
VI	7–9	...	7–10
VII	18–22	...	4–6
Antenna	170–189	176	...
Head	132–150	...	87–97
Pronotum	90–127	...	135–160
Body	882–1,061	995	...
Setae			
H1	25–30		
P7	25–32		
A(IV)1	9–13		
A(IV)2	13–18		
A(IV)3	24–30		
A(IX)1	22–28		
A(IX)2	28–31		
Ventral setae (IX)	9–15		

Larva I.—Body pale yellow to yellow. Antennal segments I–IV, legs, and setae light brown; antennal segments V–VII darker brown. Eyes red.

Most body setae fanned or expanded only terminally, fimbriate for most of their length, and shorter than in larva II (10–20 μm in larva I). Setal basal rings and brown sclerotized areas of pteronotum lacking. Abdominal cuticle with faint stippling, but more prominent and forming transverse rows on segments IX and X.

Measurements of the *S. annulipes* larva I are shown in Table 15.

Table 15.—Measurements, in microns, of seven **Sericothrips annulipes** larvae I.

Character	Length Range	Width Range
Antennal segment		
I	14–19	19–25
II	22–28	20–25
III	28–36	22–25
IV	46–50	22–25
V	5[a]	11–12
VI	6–8	8
VII	19–23	5
Antenna	140–169	...
Head	165–178	105–120
Pronotum	120–135	180–186
Body	571–681	...
Setae		
H1	11–12	
A(IX)1	12–19	
A(IX)2	12–20	

[a] A single measurement in a range column indicates that all such measurements were identical.

Diagnosis.—S. *annulipes* larvae are similar to those of *pulchellus* and *cingulatus*. All possess brown sclerotized areas on the pteronotum and enlarged rings at the setal bases. S. *annulipes* can be distinguished from *cingulatus* by the lack of cuticular pustules and by the presence of some shorter body setae in *annulipes*. It differs from *pulchellus* by the brown color of abdominal segments IX and X and in the proportions of the anterior abdominal setae. In *annulipes* setal pair A(IV)1 is shorter than A(1V) 2 and both are shorter than A(IV)3; in *pulchellus* (Fig. 80) A(IV)1 is shorter than A(IV)2, which is subequal to A(1V)3. S. *annulipes* is found on locust trees, particularly black locust, throughout the state.

Material Examined.—INHS: 14 larvae I, 10 larvae II; on black locust; Johnson, Piatt, Putnam, Stephenson, and Union counties, Illinois.

Sericothrips baptisiae Hood (1916) (Fig. 82)

Larva II.—Body yellow to yellow-orange, without hypodermal coloring. Antennae, tibiae, bases of femora, setae, setal rings, anterior cephalic spot, and sometimes abdominal segment X light brown to brown. Apices of antennal segments I and II and base and apex of III pale gray. Eyes red.

Most setae, except H1, P7, and A(IX)1 and 2, short (22–33 μm) and widely fanned; shorter setae, 9–13 μm; longer setae, 15–18 μm. Bases of setae with small unraised brown rings (6 μm in diameter). Head with anterior median brown spot. No dorsal brown sclerotized areas on pteronotum. Abdominal segment IV with setal pair A1 subequal to A2 and both significantly shorter than A3 (Fig. 82). Stippling on abdominal segments forming irregular transverse rows.

Measurements of the S. *baptisiae* larva II are shown in Table 16.

Table 16.—Measurements, in microns, of three **Sericothrips baptisiae** larvae II.

Character	Length Range	Length Mean	Width Range
Antennal segment			
III	52–55	...	22–24
IV	51–55	...	21–22
V	7[a]	...	10–12
VI	7	...	10
VII	21–24	...	6–7
Antenna	185–202	198	...
Head	165–178	...	105–120
Pronotum	120–135	...	180–186
Body	791–889	936	...
Setae			
H1	22–25		
P7	21–24		
A(IV)1	10		
A(IV)2	10–13		
A(IV)3	18–19		
A(IX)1	21–30		
A(IX)2	29–33		
Ventral setae (IX)	15–18		

[a] A single measurement in a range column indicates that all such measurements were identical.

Diagnosis.—S. *baptisiae* larvae are distinguished from other *Sericothrips* larvae by having short and widely fanned dorsal body setae and by setae A1 and A2 on abdominal segment IV being equal and significantly shorter

than A3. S. *langei* larvae are similar to *baptisiae* larvae in setal length and proportions, but have narrower setae. S. *baptisiae* is found exclusively on false indigo (*Baptisia*) throughout the state.

Material Examined.—INHS: 3 larvae II; September; on *Baptisia;* Adams and Vermilion counties, Illinois.

Sericothrips beachae Hood (1927*a*) (Fig. 84)

Larva II.—Body very pale yellow or white without hypodermal pigmentation. Antennae, tibiae, bases of femora, setae, and anterior cephalic spot light brown. Apices of antennal segments I and II and base and apex of III pale gray. Eyes red.

Most body setae fairly long and moderately fanned. Longer body setae (24–36 μm) about twice the length of shorter body setae (10–16 μm). Bases of setae with very faint small rings. Apex of head sometimes pointed and with an anterior median brown spot.

Table 17.—Measurements, in microns, of four **Sericothrips beachae** larvae II.

Character	Length		Width
	Range	Mean	Range
Antennal segment			
III	45–60	...	22[a]
IV	45–52	...	17–19
V	6–7	...	12
VI	7–9	...	7–9
VII	24	...	6
Antenna	157–202	189	...
Head	150–180	...	82–97
Pronotum	115–135	...	150–180
Body	725–995	890	...
Setae			
H1	30–36		
P7	29–31		
A(IV)1	9–13		
A(IV)2	12–18		
A(IV)3	18–27		
A(IX)1	31–33		
A(IX)2	31–34		
Ventral setae (IX)	18–23		

[a] A single measurement in a range column indicates that all such measurements were identical.

No brown sclerotized areas on pteronotum. On abdominal segment IV setal pair A1 subequal to A2 (occasionally decidedly shorter) and both significantly longer than A3 (Fig. 84). Stippling on abdominal segments faint and forming irregular transverse rows.

Measurements of the S. *beachae* larva II are shown in Table 17.

Diagnosis.—S. *beachae* larvae can be distinguished from other light-colored *Sericothrips* larvae with longer body setae by their wide body setae and by setal pair A(IV)2 being significantly shorter than A(IV)3. S. *beachae* can be distinguished from *variabilis*, a closely related species, by the total lack of any hypodermal and cuticular pigmentation and by the absence of small basal rings on lateral abdominal setae. S. *beachae* is found on hops in many areas of the state.

Material Examined.—INHS: 4 larvae II; 2 June 1970; on hops; Iroquois County, Illinois.

Sericothrips campestris Hood (1939) (Fig. 68 and 83)

Larva II.—Body usually yellowish orange without hypodermal pigmentation. Antennae, tibiae, bases of femora, setae, and setal rings brown. Antennal segment I, apex of II, and base and apex of III pale gray. Eyes red.

Setae fairly long and moderately fanned. Shorter body setae (12–22 μm) usually about two-thirds the length of longer setae (22–31 μm). Setae with faint, unraised, brown basal rings (8 μm in diameter). Apex of head obtusely pointed; anterior median cephalic spot lacking. Dorsal sclerotized areas lacking. Lengths of setae on abdominal segment IV unequal to subequal (Fig. 83). Setal pair A1 usually subequal to A2 on segment IX (Fig. 68). Stippling on abdominal segments forming definite transverse rows on terminal segments and to a lesser extent on others.

Measurements of the S. *campestris* larva II are shown in Table 18.

Table 18.—Measurements, in microns, of 10 **Sericothrips campestris** larvae II.

Character	Length		Width
	Range	Mean	Range
Antennal segment			
III	52–55	...	22–27
IV	48–60	...	19–23
V	6–9	...	12–14
VI	9–12	...	9–10
VII	21–24	...	6–8
Antenna	195–220	202	...
Head	112–150	...	175–210
Pronotum	147–180	...	97–120
Body	990–1,179	1,001	...
Setae			
H1	25–31		
P7	28–34		
A(IV)1	15–22		
A(IV)2	16–30		
A(IV)3	22–30		
A(IX)1	24–34		
A(IX)2	29–35		
Ventral setae (IX)	22–30		

Larva I.—Body yellow to yellow-orange. Antennae, tibiae, and setae very light brown. Antennal segment I, apex of II, and base and apex of III pale gray. Eyes red.

Most dorsal body setae fanned or expanded only terminally, fimbriate for most of their length, and shorter than in larva II (10–22 μm in larva I). Setal rings lacking. Abdominal cuticle with faint stippling, becoming more prominent on terminal segments.

Table 19.—Measurements, in microns, of three **Sericothrips campestris** larvae I.

Character	Length Range	Width Range
Antennal segment		
I	16–19	23–26
II	25–28	23–25
III	23–39	25–28
IV	46–54	23–25
V	5–8	11–12
VI	8–11	8[a]
VII	20–22	5–6
Antenna	150–170	...
Head	62–85	78–85
Pronotum	85–93	116–140
Body	573–636	...
Setae		
H1	12–14	
A(IX)1	14	
A(IX)2	19–22	

[a] A single measurement in a range column indicates that all such measurements were identical.

Measurements of the *S. campestris* larva I are shown in Table 19.

Diagnosis.—Larvae of *S. campestris* resemble those of *sambuci* in having long setae and having setal pair A2 subequal to A3 on segment IV; AI is subequal to A2 on segment IV in *campestris,* but is shorter in *sambuci,* and *sambuci* has slightly longer setae.

S. campestris occurs on wild four-o'clock (*Mirabilis nyctaginea*) along gravelly railroad embankments in Illinois.

Material Examined.—INHS: 3 larvae I, 12 larvae II; June–August; on wild four-o'clock; Champaign and Vermilion counties, Illinois; Lathrop, Missouri; and Ogallala, Nebraska.

Sericothrips cingulatus
Hinds (1902)
(Fig. 78)

Larva II.—Cuticle yellow to orange without hypodermal pigmentation. Antennal segments, tibiae, bases of femora, setae, setal basal rings, sclerotized areas on pteronotum, and abdominal segment X brown to dark brown. Apices of antennal segments I and II and base and apex of III pale gray.

Most dorsal body setae long and widely fanned. Bases of setae on abdomen and pterothorax with prominent brown rings (8–12 μm in diameter). Mesonotum and metanotum each with a pair of brown sclerotized areas as in *S. annulipes* (Fig. 89). Anterior abdominal segments with dorsal setae equal or subequal (Fig. 78); AI on segment IX subequal to A2. Abdominal stippling large, almost forming small pustules (Fig. 78).

Measurements of the *S. cingulatus* larva II are shown in Table 20.

Diagnosis.—*S. cingulatus* larvae resemble the larvae of the *annulipes*

Table 20.—Measurements, in microns, of one **Sericothrips cingulatus** larva II.

Character	Length	Width
Antennal segment		
I	23	39
II	39	29
III	59	28
IV	37	23
V	6	17
VI	12	12
VII	28	6
Antenna	204	...
Head	101	116
Pronotum	140	202
Body	1,050	...
Setae		
H1	31	
P7	28	
A(1V)1	26	
A(1V)2	29	
A(IV)3	29	
A(IX)1	31	
A(IX)2	39	
Ventral setae (IX)	12	

group of *Sericothrips* in possessing pteronotal sclerotized areas and prominent (although smaller) rings at the bases of the setae, and in having abdominal segment IX brown. S. *cingulatus* can be recognized by its dark brown body color, its having almost all dorsal body setae long and equal or subequal, and the presence of small pustules.

Larval and adult morphology of *cingulatus* indicate that this species is atypical of most *Sericothrips*. Adults of *cingulatus* possess dense abdominal microtrichia completely covering the tergites, whereas the tergites of most species in this genus possess microtrichia only laterally. In the larvae the cuticular stippling is modified into small pustules, and the brown sclerotized areas are similar to those found in the more primitive Chirothripini.

S. *cingulatus* is found scattered statewide in grassland areas and particularly in grass-sedge marshes.

Material Examined.—INHS: 1 larva II; 18 March 1971; on clover and vetch; Amite, Louisiana.

Sericothrips langei Moulton (1929) (Fig. 88)

Larva II.—Body white to light yellow, sometimes light orange, without subintegumental pigmentation. Antennae, tibiae, bases of femora, setae, and setal rings light brown. Most of antennal segment I, the apex of II, and the base and apex of III pale gray. Eyes red.

Most body setae short and all narrowly expanded. Shorter body setae (7–13 μm) usually about one-half the length of longer setae (13–24 μm). Setae with small faintly brown unraised rings (6 μm in diameter). Head often with an apical point. Anterior cephalic spot lacking. Abdominal segment IV with setal pair A1 subequal to A2 and both significantly shorter than A3 (Fig. 88). Setal pair A1 on segment IX significantly shorter than A2. Stippling on abdomen forming prominent transverse rows on the terminal segments, becoming less prominent on the others.

Measurements of the S. *langei* larva II are shown in Table 21.

Table 21.—Measurements, in microns, of nine **Sericothrips langei** larvae II.

Character	Length		Width
	Range	Mean	Range
Antennal segment			
III	48–55	...	22–27
IV	21–23	...	21–23
V	7–12	...	13–15
VI	10[a]	...	10–12
VII	22–30	...	6–7
Antenna	202–227	214	...
Head	180–190	...	123–130
Pronotum	123–140	...	180–202
Body	901–1,159	1,040	...
Setae			
H1	18–22		
P7	25–31		
A(1V)1	7–11		
A(IV)2	8–15		
A(IV)3	15–24		
A(IX)1	13–17		
A(IX)2	18–25		
Ventral setae (IX)	12–15		

[a] A single measurement in a range column indicates that all such measurements were identical.

Larva I.—Body light yellow to yellow-orange. Antennal segments I–IV, tibiae, and setae very light brown; antennal segments V–VII darker brown. Eyes red.

Most body setae expanded only terminally and shorter than those of larva II (6–15 μm in larva I). Setal rings lacking. Cuticle with faint stippling becoming more prominent on the terminal segments.

Measurements of the S. *langei* larva I are shown in Table 22.

Diagnosis.—S. *langei* larvae can be distinguished from all other *Sericothrips* larvae considered here by the very short and very narrowly fanned setae. The species is found on water lilies of the genus *Nymphaea* throughout the state.

Material Examined.—INHS: 5 larvae I, 20 larvae II; June–August; on water lily; Lake and Monroe counties, Illinois, and Au Train, Michigan.

Table 22.—Measurements, in microns, of four **Sericothrips langei** larvae I.

Character	Length Range	Width Range
Antennal segment		
I	16–19	26–28
II	28–31	23–26
III	31–37	25–28
V	5–6	11–12
VI	9–12	8[a]
VII	20–25	5
Antenna	162–174	...
Head	85–100	93–100
Pronotum	85–124	140
Body	642–734	...
Setae		
H1	9–12	
A(IX)1	8–9	
A(IX)2	14–16	

[a] A single measurement in a range column indicates that all such measurements were identical.

Sericothrips nubilipennis
Hood (1924)
(Fig. 86)

Larva II.—Body whitish yellow without hypodermal pigmentation. Antennae, tibiae, and setae light brown. Antennal segment I, base of II, and base and apex of III pale gray. Eyes red.

Setae fairly long and moderately fanned. Shorter body setae (12–18 μm) generally two-thirds the length of the longer setae (19–31 μm). Setae with very faint basal rings (6 μm in diameter). Apex of head usually rounded; median anterior spot lacking. Dorsal sclerotized areas lacking. Abdominal segment IV with all setae varying from decidedly unequal to subequal in certain cases (Fig. 86). Setal pair A1 of segment IX usually shorter than A2. Abdominal stippling generally faint, transverse rows being prominent mainly on the terminal segments.

Measurements of the S. *nubilipennis* larva II are shown in Table 23.

Table 23.—Measurements, in microns, of five **Sericothrips nubilipennis** larvae II.

Character	Length Range	Length Mean	Width Range
Antennal segment			
III	45–55	...	20–22
IV	48–60	...	18–21
V	7–13	...	12–15
VI	10–12	...	9–10
VII	26–30	...	5–7
Antenna	189–214	202	...
Head	135–165	...	90–112
Pronotum	112–135	...	157–202
Body	850–1,033	932	...
Setae			
H1	30–31		
P7	22–36		
A(IV)1	10–18		
A(IV)2	12–22		
A(IV)3	18–25		
A(IX)1	22–30		
A(IX)2	22–31		
Ventral setae (IX)	15–22		

Diagnosis.—Larvae of *S. nubilipennis* are distinguished by their narrowly fanned setae and by A(IV)2 being significantly shorter than A3. This species is similar to and often indistinguishable from *S. tiliae*. The body color of *nubilipennis* tends to be white, whereas that of *tiliae* tends to be yel-

low. Host-plant data are unreliable criteria, too, since both species can occur on adjacent forest plants with accidental transfers being made from one host to the other.

S. *nubilipennis* generally occurs on various forest trees, such as hackberry (*Celtis*) or dogwood (*Cornus*) throughout the state.

Material Examined.—INHS: 5 larvae II; June–October; on hackberry leaves and forest leaf litter; Champaign, Henderson, Macon, and Piatt counties, Illinois.

Sericothrips pulchellus Hood (1908) (Fig. 80)

Larva II.—Cuticle orange with prominent red-orange hypodermal pigmentation, often faint. Antennae, tibiae, bases of femora, setae, setal rings, anterior cephalic spot, and dorsal sclerotized pteronotal areas light brown to brown. Apices of antennal segments I and II and base and apex of III gray.

Table 24.—Measurements, in microns, of 10 **Sericothrips pulchellus** larvae II.

Character	Length		Width
	Range	Mean	Range
Antennal segment			
III	44–52	...	22[a]
IV	44–52	...	20–22
V	7	...	12–15
VI	10	...	10–13
VII	24–30	...	7
Antenna	160–189	176	...
Head	150–165	...	97–112
Pronotum	97–142	...	150–210
Body	867–1,128	945	...
Setae			
H1	27–32		
P7	30–32		
A(IV)1	12–18		
A(IV)2	19–27		
A(IV)3	22–30		
A(IX)1	21–30		
A(IX)2	27–33		
Ventral setae (1X)	15–18		

[a] A single measurement in a range column indicates that all such measurements were identical.

Most dorsal body setae fairly long and moderately fanned. Shorter body setae (12–20 μm) usually two-thirds the length of the longer setae (22–31 μm). Bases of setae with prominent, raised brown rings (7–15 μm in diameter) on abdomen and pterothorax. Head usually without an apical point; anterior median cephalic spot present. Mesonotum and metanotum each with a pair of brown sclerotized areas. Abdominal segment IV with setal pair A2 subequal to A3 and both significantly longer than A1 (Fig. 80). Setal pair A1 on segment IX usually shorter than A2. Abdominal stippling forming prominent transverse rows on most abdominal segments (Fig. 80).

Measurements of the S. *pulchellus* larva II are shown in Table 24.

Larva I.—Body orange. Antennae and setae generally light brown. Apex of antennal segment IV and all of segments V–VIII brown. Eyes red.

Body setae expanded terminally and shorter than in larva II (9–25 μm in larva I). Setal basal rings, cephalic spot, and sclerotized pteronotal areas lacking. Abdominal stippling faint.

Table 25.—Measurements, in microns, of five **Sericothrips pulchellus** larvae I.

Character	Length Range	Width Range
Antennal segment		
I	11–16	23–25
II	23–25	22–23
III	26–31	23–26
IV	42–48	23–26
V	5–6	9–12
VI	8–9	8[a]
VII	22–25	5
Antenna	150–158	...
Head	70–78	78–85
Pronotum	70–85	101–132
Body	496–611	...
Setae		
H1	11–19	
A(IX)1	19–25	
A(IX)2	12–16	

[a] A single measurement in a range column indicates that all such measurements were identical.

Measurements of the *S. pulchellus* larva I are shown in Table 25.

Diagnosis.—*S. pulchellus* larvae can be distinguished from all other *Sericothrips* larvae considered here except *annulipes* and *cingulatus* by the large raised rings at the bases of the setae and by the brown sclerotized areas on the pteronotum. Red hypodermal pigmentation is also characteristic of this species although it is sometimes faint or absent.

S. pulchellus can be distinguished from *cingulatus* by the absence of cuticular pustules and by some body setae being shorter than others. *S. pulchellus* differs from *annulipes* in the absence of brown coloration on abdominal segments IX and X and in the length proportions of setae on abdominal segment V; in *annulipes* setal pair A1 is subequal to A2 and both are shorter than A3; in *pulchellus* A2 is subequal to A3 and both are longer than A1.

S. pulchellus is found on wafer ash (*Ptelea*), sometimes in great numbers. Adults and larvae feed together, often causing the foliage to turn white because of the feeding scars. At times of great abundance, adults may be scattered and found resting on a variety of trees and shrubs (Stannard 1968).

Material Examined.—INHS: 6 larvae I, 23 larvae II; June–August; on wafer ash; Carroll, Kankakee, Mason, and Winnebago counties, Illinois.

Sericothrips sambuci Hood (1924)
(Fig. 87)

Larva II.—Body yellow. Antennal segments I and II yellow; segments III–VII and setae light brown. Base and apex of antennal segment III pale gray. Eyes red.

Most body setae long and moderately fanned. Shorter body setae (10–16 μm) usually less than half the length of longer setae (24–29 μm). Bases of setae without rings. Apical cephalic point, median cephalic spot, and dorsal sclerotized areas lacking. Abdominal segment IV with setal pair A2 subequal to A3 and much longer than A1 (Fig. 87); A1 on segment IX subequal to A2. Abdominal stippling forming fine transverse rows.

Measurements of the *S. sambuci* larva II are shown in Table 26.

Table 26.—Measurements, in microns, of 10 **Sericothrips sambuci** larvae II.

Character	Length		Width
	Range	Mean	Range
Antennal segment			
III	48–60	...	22–26
IV	51–60	...	21–33
V	7–10	...	13–15
VI	10–13	...	10–13
VII	27–32	...	6–7
Antenna	202–233	220	...
Head	150–180	...	98–120
Pronotum	120–142	...	165–202
Body	900–1,216	1,046	...
Setae			
H1	30–39		
P7	30–42		
A(IV)1	10–15		
A(IV)2	24–31		
A(IV)3	25–33		
A(IX)1	27–36		
A(IX)2	30–42		
Ventral setae (IX)	22–30		

Larva I.—Body yellow. Antennal segments I–IV pale brown; apex of IV, all of V–VII, and setae light brown. Eyes pale red.

Body setae fairly long and expanded terminally; setae generally shorter than in larva II (10–25 μm in larva I). Stippling on abdominal cuticle faint.

Measurements of the *S. sambuci* larva I are shown in Table 27.

Diagnosis.—Larvae of *S. sambuci* resemble those of *campestris* in having long setae and A(IV)2 subequal to A(IV)3. However, A(IV)1 is subequal to A(1V)2 in *campestris* and shorter than A2 in *sambuci*.

S. sambuci is found statewide on elderberry (*Sambucus*).

Material Examined.—INHS: 1 larva I, 17 larvae II; August–October; on

Table 27.—Measurements, in microns, of one **Sericothrips sambuci** larva I.

Character	Length	Width
Antennal segment		
I	16	26
II	28	26
III	34	26
IV	50	26
V	5	12
VI	8	9
VII	23	4
Antenna	160	...
Head	78	78
Pronotum	93	124
Body	621	...
Setae		
H1	21	
A(IX)1	16	
A(IX)2	19	

Sambucus; Calhoun, Iroquois, Marion, and Union counties, Illinois.

Sericothrips tiliae Hood (1931) (Fig. 85)

Larva II.—Body yellow (dark orange in one specimen). Antennae, legs, and setae uniformly light brown. Eyes red.

Table 28.—Measurements, in microns, of seven **Sericothrips tiliae** larvae II.

Character	Length		Width
	Range	Mean	Range
Antennal segment			
III	52–56	...	22–24
IV	49–57	...	16–22
V	7–9	...	13–15
VI	9–12	...	9–12
VII	23–30	...	7[a]
Antenna	189–214	202	...
Head	135–180	...	90–107
Pronotum	105–135	...	157–172
Body	838–1,014	882	...
Setae			
H1	30–36		
P7	27–34		
A(IV)1	9–13		
A(IV)2	15–18		
A(IV)3	24–29		
A(IX)1	24–30		
A(IX)2	27–35		
Ventral setae (IX)	9–12		

[a] A single measurement in a range column indicates that all such measurements were identical.

Most dorsal body setae fairly long and moderately fanned; longer setae (22–33 μm) usually twice the length of shorter setae (9–18 μm). Anterior median cephalic spot, brown pteronotal areas, and setal basal rings all lacking. Abdominal segment IV with setal pair A(IV)1 shorter than A(IV)2, and A(IV)2 shorter than A(IV)3 (Fig. 85); A1 on segment IX subequal to A2.

Measurements of the *S. tiliae* larva II are shown in Table 28.

Larva I.—Body yellow. Antennal segments I–IV and setae light brown; segments V–VII darker brown. Eyes red. Setae only slightly expanded and 5–17 μm long.

Measurements of the *S. tiliae* larva I are shown in Table 29.

Table 29.—Measurements, in microns, of one **Sericothrips tiliae** larva I.

Character	Length	Width
Antennal segment		
III	36	20
IV	50	20
V	6	11
VI	8	8
VII	14	5
Antenna	165	...
Head	78	70
Pronotum	85	110
Body	622	...
Setae		
H1	9	
A(IX)1	9	
A(IX)2	17	

Diagnosis.—Larvae of *S. tiliae* are distinguished by their narrowly fanned setae and by A(IV)2 being significantly shorter than A(IV)3. This species is similar to and often indistinguishable from *S. nubilipennis.* The body color of *tiliae* is usually yellow, whereas that of *nubilipennis* is usually white.

S. tiliae is found statewide on linden (*Tilia*), being most common in the northern part of the state.

Material Examined.—INHS: 1 larva I, 8 larvae II; July–September; on linden; Effingham and Kankakee counties, Illinois.

Sericothrips variabilis (Beach 1896)
(Fig. 14, 32, and 81)

Larva II.—Body color white, changing to yellow and orange with increasing maturity of larva; red hypodermal pigment occasionally present in mature larva. Antennae, tibiae, setae, setal rings, and anterior median cephalic spot brown. Antennal segment I, apex of II, and base and apex of III pale gray. Eyes red.

Most dorsal body setae moderate in length and moderately fanned. Shorter body setae (13–19 μm) between one-half and two-thirds the length of the longer setae (25–33 μm). Bases of pteronotal and abdominal setae with small, faint brown rings (6 μm in diameter); the lateral abdominal setae with larger (8 μm in diameter) and more prominent rings. Anterior median cephalic spot present but often not visible in balsam mounts. Brown pteronotal areas lacking. Abdominal segment IV with setae A1, A2, and A3 progressively longer (Fig. 81); segment IX with A1 usually subequal to A2.

Table 30.—Measurements, in microns, of 10 **Sericothrips variabilis** larvae II.

Character	Length Range	Length Mean	Width Range
Antennal segment			
III	53–55	...	22–24
IV	48–55	...	18–21
V	7–9	...	10–13
VI	10–12	...	9–10
VII	25–27	...	6–7
Antenna	189–202	195	...
Head	142–165	...	105–112
Pronotum	120–150	...	165–195
Body	882–1,089	1,021	...
Setae			
H1	30–31		
P7	29–39		
A(IV)1	12–19		
A(IV)2	15–24		
A(IV)3	22–31		
A(IX)1	25–31		
A(IX)2	30–34		
Ventral setae (IX)	8–11		

Measurements of the *S. variabilis* larva II are shown in Table 30.

Larva I.—Body color white to yellow. Antennal segments I–IV light brown; apex of IV and all of V–VII darker brown; apices of segments I and II and base and apex of III pale gray. Setae expanded terminally and measuring 6–16 μm. Anterior median cephalic spot and setal rings lacking.

Measurements of the *S. variabilis* larva I are shown in Table 31.

Table 31.—Measurements, in microns, of five **Sericothrips variabilis** larvae I.

Character	Length Range	Width Range
Antennal segment		
III	30–34	25–26
IV	46–50	22–26
V	5–6	11–12
VI	8[a]	6–9
VII	20–22	5
Antenna	158–171	...
Head	54–85	78–85
Pronotum	78–101	115–132
Body	490–621	...
Setae		
H1	9–12	
A(IX)1	11–12	
A(IX)2	16–20	

[a] A single measurement in a range column indicates that all such measurements were identical.

Diagnosis.—Larvae of *S. variabilis* resemble those of *beachae* in having wider setae and A(IV)2 shorter than A(IV)3. From *beachae, variabilis* can be distinguished by the larger lateral setal basal rings and by often having cuticular and hypodermal coloration.

S. variabilis occurs statewide on many legumes, particularly soybeans. Its life history is discussed earlier in this report.

Material Examined.—INHS: 24 larvae I, 74 larvae II; August; on and reared from soybeans; Champaign County, Illinois.

Zonothrips Priesner (1926*a*)

Larva II.—Cuticle yellow, generally with red hypodermal pigment. Eyes

red. Antennae, setae, and probably tibiae and bases of femora light brown.

Antennae six (possibly seven) segmented; segments II and III each with a pair of fanned setae; segment III with six annulations, all with microtrichia.

Head constricted below eyes and longer than wide. Eyes with four large round facets bulging at sides of head. Head with four pairs of dorsal setae, H2 fanned. Pronotum with seven pairs of expanded setae. Mesonotum with seven pairs and metanotum with four pairs of fanned setae. Abdomen with two pairs of expanded setae on tergite I and three pairs on tergites II–VIII; segment IX with three pairs of dorsal setae, A1 and A2 both being fanned and A3 pointed and reduced. Segment X with three pairs of dorsal setae, A1 fanned.

Major dorsal body setae all moderately to widely fanned and moderately long. Cuticle with fine stippling probably resulting from fine microtrichia. Abdominal segment IX lacking a posterior comb.

Larva I.—Cuticle yellow without hypodermal pigmentation. Eyes red. Antennae six segmented; segments II and III with weakly expanded setae.

Chaetotaxy similar to that of larva II, but posteroangular setae lacking, and setae shorter and less expanded. Cuticular sculpture similar to that of larva II, but fainter. Abdominal segment IX lacking a posterior comb.

Diagnosis.—This description of the genus *Zonothrips* is based on a description and illustration by Priesner (1926*a*) of *Z. karnyi*. *Zonothrips* can be distinguished easily from all other thripine genera except *Sericothrips* by the widely fanned, dorsal body setae. Differentiation of *Zonothrips* and *Sericothrips* is more difficult. Stannard (1968) reported the adults of these two genera as being similar, only separated by the number of antennal segments and the placement of abdominal sternal setae. The only way of separating the two genera at the present time is by considering host-plant data and associated adults.

Zonothrips osmundae
Crawford, J.C. (1941)

No larvae of this genus and species were available for study. Adults were collected in Illinois at Volo Bog, Lake County, from September to October on and around cinnamon fern (*Osmunda cinnamomea*) by L. J. Stannard, Jr., and are deposited at the Illinois Natural History Survey.

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