

THE THYSANOPTERA OF OREGON

by

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degree of

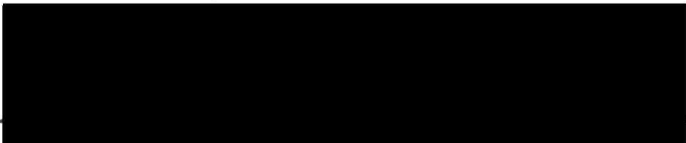
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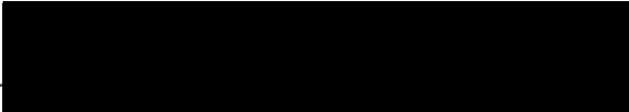
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## I. INTRODUCTION

In March, 1940, Dr. Don C. Mote advised the writer that very little taxonomic investigation had been done on Oregon Thysanoptera, and he suggested that the taxonomy of this order of insects would be highly desirable. Consequently, "The Thysanoptera of Oregon" was chosen for a thesis as partial requirement for a degree of Doctor of Philosophy.

Until 1940, 14 species of Thysanoptera had been recorded from Oregon. From 1940 until 1946, excluding three years in military service, 57 additional species were collected by the writer and as a result 71 species are now recorded from Oregon.

The writer is indebted to the following individuals who assisted him in the preparation of this manuscript:- Dr. Floyd Andre, Division of Insect Identification, Washington, D. C., for determination of material in 1939, for author's reprints, and for the loan of Oregon specimens from his collection.

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Mr. Dudley Moulton, Redwood City, California, for loan of type specimens, gift of author's reprints, and determination of specimens. Mr. Moulton invited the writer to visit him in March, 1946. The writer took advantage of this opportunity and examined every slide in his collection of 44,000 specimens for Oregon records. Without Mr. Moulton's assistance, positive identification of many species would have been impossible.

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## II. THE ORDER THYSANOPTERA Haliday, 1836

(From the Greek thysanos, fringe and pteron, wing.)

## A. Early Taxonomy

- 1744. Genus Physapus De Geer
- 1758. Genus Thrips Linnaeus
- 1806. Family Vesitarses ou Physapodes Dumeril
- 1814. Family Thripsides Fallen
- 1825. Tribe Thrypsides. Physapi Latreille
- 1829. Family Thripidae Stephens
- 1835. Order Thrypsites Newman
- 1835. Order Thripsites Newman
- 1836. Order Thysanoptera Haliday
- 1838. Tribe Physopoda Burmeister
- 1852. Order Physopoda Haliday-Walker
- 1855. Order Thripsina Newman
- 1855. Group Thripsidae Fitch
- 1856. Family Thripididae Fitch

The early entomologists grouped the thrips with other orders of insects as they did not recognize their true relationship. Most of the older workers listed the THYSANOPTERA under the orders HEMIPTERA and HOMOPTERA. The synonymy of the THYSANOPTERA listed above has been adopted from Hood (1915). The writer has followed the custom of current authors in employing the name THYSANOPTERA in preference to the earlier name THRYPSITES or THRIPSITES because it is definitive, more

satisfactorily formed, and is in general accepted by entomologists. It has two years priority over PHYSOPODA, which would otherwise, perhaps, be a more satisfactory term than either.

While the scientific name of the group has been subjected to so many changes, the most frequently used common name has persisted unchanged since the time of Linnaeus. It is the name which he gave to the genus Thrips, and is now applied in the same form to any individual of the order. It is therefore incorrect to drop the "s" when referring to an individual, as is frequently done. Thrips is a Latin name derived from the Greek and means wood louse. It is in the singular number and masculine gender, as will be also all generic names of which it forms the termination.

Most authors place the order Thysanoptera between the order Odonata and Homoptera. The parthenogenesis found in some thrips is a manner of reproduction found in the Homoptera and is not an Orthopteroid method of reproduction. The manner of nourishment of thrips with their mouthparts modified for piercing and sucking are Hemipterous-Homopterous in character.

#### B. Fossil Thysanoptera

Only three fossil Thysanoptera have been described from North American beds. The White River deposits are the only ones in this country from which they are known. Three species, representing as many genera, were described by Scudder (1890) from Tertiary beds and two of the species Lithadothrips vetusta Scudder and Palaeothrips fossilis Scudder belong to extinct genera. The third species

Melanothrips extincta Scudder, apparently has no living representative in this country, although living specimens of this genus are known in Europe.

The writer is indebted to Dr. Frank M. Carpenter (1945), Professor of Entomology at Harvard University for information as to the number of fossil species described. The oldest known Thysanopteron has been found in the Permian of Russia (Permothrips), and was described by Martynov in 1935. The same worker also described a thrips from the Jurassic of Turkestan. Fifty-six species have been described from the Baltic amber (Oligocene) by Bagnall and Priesner. Fifteen species have been described from Rott in Germany (Miocene) by several entomologists including Bagnall. Four have been described from Aix in France (Oligocene) and two from Oeningen in France (Miocene). One from the Isle of Wight, England (Oligocene) and three from Indian and African Copal (sub-fossil). A bibliography of fossil Thysanoptera follows the reference to the living species cited in the text of the monograph.

### C. Morphology

The Thysanoptera are small, slender, usually depressed insects with the winged forms generally capable of flight and frequently saltatorial. The metamorphosis is intermediate between hemimetabolous and holometabolous as the penultimate instar is usually quiescent. Reproduction is oviparous, often parthenogenetic and very rarely ovoviviparous.

The head is vertical, moderately movable, usually with large compound eyes and three ocelli in the winged forms. The antennae are

slender, four- to nine- segmented. Mouth parts hypognathous, haustellate, conical, asymmetrical, consisting of a triangular labrum fused with two pairs of maxillae to form a sheath in which move three piercing bristles. The arrangement of the mouth cone is as follows: Exterior has the labrum in front; maxillae on sides; labium behind. The interior has left mandible elongated, piercing; right mandible rudimentary; three stylets associated with bases of maxillae and hypopharynx.

Prothorax free, movable, longer than either mesothorax or the metathorax. Mesothorax and metathorax united, each usually with a pair of stigmata. Wings often rudimentary or lacking, four in number, somewhat similar, slender, with few or no veins, and closely fringed with long hairs from which the order derives its name. The veins often bear setae which, in some groups, are definite and constant in location and are used in the classification of species. When at rest the wings are folded flat over the abdomen. The legs are well developed, with the fore pair often enlarged, especially in the males. The tarsi are one- or two-segmented, with one or two claws, and a bladder-like organ.

The abdomen is normally ten-segmented, some with a very small eleventh segment, with the first segment short and closely united with the thorax. The terminal segment is tubular in the suborder TUBULIFERA and without an ovipositor. The ovipositor in the suborder TEREBRANTIA is sickle-shaped, serrate, and consists of two pairs of gonapophyses pertaining to segments eight and nine.

The digestive system is characterized by a sucking pharynx with radial muscles in the head similar to the Homoptera. There is an extensive mid-intestine which forms the largest portion of the alimentary

canal and is divided into a capacious anterior portion followed by a tubular coiled posterior region. The hind intestine is short and forms a straight passage to the anus. There are four malphigian tubules. The salivary glands normally consist of two pairs and are located in the thorax and abdomen, their ducts uniting to form a common canal opening at the apex of the mouth cone.

The tracheal system is well developed with nine or ten pairs of spiracles, there being one or two pairs on the thorax and eight pairs on the abdomen (one pair on each segment I to VIII inclusive).

The circulatory system consists of a very short contractile heart lying in the eighth abdominal segment and is continued forward as a long aorta.

In the female reproductive organs the ovaries each consist of four short panoistic ovarioles and a receptaculum seminis is present together with small accessory glands. The male reproductive organs consist of a pair of fusiform testes, a short vasa deferentia with an ejaculatory duct. The latter is somewhat swollen anteriorly where it received ducts of one or two pairs of large accessory glands.

The nervous system is compact consisting of the brain, suboesophageal ganglion and prothoracic ganglion fused to form the anterior nerve center. The mesothoracic and metathoracic ganglia remain separate. A median nerve cord passes down the abdomen, but the ganglia have shifted forward and are concentrated into a single center so that there is an abdominal ganglion in segment I only.

The adult thrips vary in size from the small Thrips minutissima Linn., of Europe 0.6 mm. long to the Giant Thrips, Acanthinothrips

spectrum (Haliday) of Australia which attains a length of 14 mm. The smallest Oregon species is the Small Thrips, Frankliniella minuta (Moulton), 0.83 mm. in length. The largest Oregon thrips is a new species of Megalothrips which attains a length of 5 mm. This species is being described by J. C. Crawford.

The general body form is elongate and slender, but some species as Ankothrips robustus Craw. are short, wide and flat and members of the genus Oedaleothrips are ant-like in form.

The color range varies from shades of yellow, tan, orange, red, brown, or wholly black to combinations of these hues. The wings are either transparent, the color of the body, or streaked or mottled with darker shades.

Thrips are normally bisexual, the sexes being similar in structure except that the males are usually smaller than the females. In the TEREBRANTIA the females have an external ovipositor. In some TUBULIFERA of the subfamily MEGATHRIPINAE the males have a horn-like appendage on each side of the sixth abdominal segment. Both sexes may either be wingless, brachypterous or macropterous, and in a few species all of these conditions occur.

#### D. Biology

Thrips are commonly found on all types of vegetation, being most abundant on flowers and on the leaves of the host plants, but they also occur on the fruits, twigs, and in galleries or galls of other insects. Some species eat decayed vegetable matter and in the subfamily MEGATHRIPINAE members eat spores of fungi. A few are

predaceous upon mites, aphids, other thrips, and eggs and young of larger insects. Mr. Dudley Moulton has shown the writer certain Australian species of the genera Kladothrips and Haplothrips which produce true galls or pseudogalls on the leaves of trees in which the young are reared. Moulton said that some gall forming species construct galleries resembling those of the bark beetles family Scolytidae. With the exception of a few genera such as Limothrips or Neoheegeria, species of which are confined to a family or a single genus of host plants, most species are found on a variety of host plants. As it would serve no practical purpose to attempt to give a complete list of host plants, no list has been prepared. The plants or various situations where the various species were found are listed under each species.

The usual manner of reproduction is by oviparity. Parthenogenesis is not uncommon and in a number of species especially the Greenhouse Thrips, Heliothrips haemorrhoidalis (Bouche) and the Pear Thrips, Taeniothrips inconsequens (Uzel) males are exceedingly rare or unknown. Members of some exotic genera give birth to living young.

In the TEREBRANTIA the eggs are inserted within the plant by means of the sickle-shaped ovipositor, whereas in the TUBULIFERA they are laid in cracks, crevices, galls, under bark or debris, and on the exterior of their hosts. The eggs are small and almost invisible to the unaided eye. With the aid of a hand lens or microscope the location of those eggs which are inserted in the plant tissue may be ascertained by the puncture and swelling of the surrounding tissues.

The young squeeze out through the egg punctures made by the females or they escape freely from those eggs laid externally on the

host. The young are commonly referred to as larvae by Thysanopterists. The use of the term larva in this connection is not unappropriate as the wings are developed internally during these early stadia. This is indicated by the large size of the wing pads when they first appear externally. The young pass through from two to four instars. After the last larval moult the insect assumes a form known as the propupa or Prepupa. This resembles the larva in appearance, the antennae being slender, and directed forwards. The insect is moderately active and possesses wing pads which attain about the end of the second abdominal segment. With the next moult the insect becomes what is termed the pupa. In this stage the wing pads are longer, attaining about the end of the sixth abdominal segment. The antennae extend back over the head and prothorax and the insect is quiescent. With the next moult, the adult form is attained.

Some species of Thysanoptera spin cocoons above or below the ground in which to pupate. Kurdjumov (1913) was the first to report this habit as observed in the larvae of Aeolothrips fasciatus (L.) in Russia. Members of the genera Aeolothrips, Anaphothrips, Ankothrips, Franklinothrips, and Orothrips have been reported by Bailey (1940) as spinning cocoons. The "silk" came from the anal end of the body and the cocoons were formed by the twisting and turning of the abdomen. The cocoons were not uniform in shape, but were usually oval.

There are normally five to seven generations a year, but in the case of The Pear Thrips, Taeniothrips inconsequens (Uzel) there is but a single generation. The majority of the species probably hibernate as adults although those species infesting bulbs and plant tissues may

overwinter as mature larvae as well as adults. In Bolothrips lativerticis, a new species described in this paper, there were eggs, larvae, and adults present in January. The records of many hibernating species, collected by the writer in his studies and presented in this paper, are the first reports as to how they overwinter.

#### E. Natural Enemies

The natural enemies which prey upon thrips are not well known. Ladybird beetles and their larvae eat the young. In the west Triphleps tristicolor White, Family Anthocoridae, is a common and effective predator on young thrips as well as other insects. The larvae of lacewings, Chrysopa spp. are important predators in controlling injurious species. Predaceous thrips as The Black Hunter, Leptothrips mali (Fitch) and The Six-banded Thrips, Scolothrips sexmaculatus (Perg.) commonly feed on other species of thrips. A thrips parasite, Thripocentrus russelli Craw., Family Tetrastichidae, was reared by Russell (1912) from several injurious species in California. Its effectiveness in control of injurious thrips is uncertain. However, Essig (1926) reports that as high as seventy percent of The Bean Thrips, Hercothrips fasciatus (Perg.) may succumb to attacks of this parasite.

An interesting relationship between a hymenopterous parasite, Psilogaster, Family Eucharidae and Selenothrips rubrocinctus Giard. is reported by Clausen ('40). This is a most remarkable adaption for oviposition and the relationship appears obligatory. The females of Psilogaster observed in Malaya occur on mango and other foliage infested with Selenothrips rubrocinctus Giard. This thrips imbeds its

eggs singly in the leaf tissue and covers them with a mass of excrement. The Psilogaster female deposits her eggs, standing vertically and evenly spaced, in clusters of 50 to 100 or more, surrounding a freshly laid thrips egg. It was not possible to secure oviposition in the absence of these eggs. The parasite eggs are fully incubated at the time of hatching of the thrips egg and the young thrips, as it emerges, finds itself surrounded by the cluster of erect Psilogaster eggs. During the time it is clambering among them, many of the eggs may hatch, and the planidia immediately attach themselves to the body of the thrips. One of the latter was found to bear 53 planidia, representing several times its own weight. This association is not accidental, for the planidia consistently retain their position until the first moult of the carrier. The host preference of the members of the parasitic family Eucharidae are remarkably consistent, and all species where the hosts are known are parasitic upon the mature larvae or pupae of ants. Unfortunately, the ant host of this species was not discovered and further details of the life history, after the abandonment of the thrips carrier, could not be determined.

#### F. Economic Importance

Many of the plant infesting species are serious pests. Thrips destroy bulbs, buds, blossoms, deform leaves, and scab or deform fruit. Many species, normally feeding on grasses and weeds, migrate to cultivated fields and orchards when the native vegetation dries up and damage developing young fruit. The injury caused by thrips is treated under the discussion of the individual species.

Several species of thrips have been incriminated as vectors of plant disease. In Oregon McWhorter and Milbrath (1938) have found that Thrips tabaci (Linde.) is responsible for the rapid spread of the tip-blight disease of tomato. This species of thrips also transmits pineapple yellow spot (Ananas virus 1) and tomato spotted wilt (Lycopersicum virus 3). Frankliniella occidentalis (Perg.) and Frankliniella lycopersici Andr. transmit tomato spotted wilt (Lycopersicum virus 3).

In addition to being vectors of plant viruses, thrips carry the spores of fungi and bacteria. The following species of thrips have been indicted as mechanical carriers of plant diseases:

Hercothrips femoralis (Reuter) transmits bacterial disease of beans.

Taeniothrips inconsequens (Uzel) transmits pear blight.

Cryptothrips floridensis Watson transmits Pestalozzia sp., a disease on raw camphor.

Frankliniella occidentalis (Perg.) and Leptothrips mali (Fitch) carry fig decaying organisms.

Bailey (1935) lists 50 references pertaining to thrips as vectors of plant diseases. Thrips are particularly well adapted for transmitting virus diseases and when the nature of the transmission of these diseases is better known, the writer believes that several species of thrips will be implicated.

In entomological literature there are a few scattered references to thrips attacking man in a transitory manner. Bailey (1936) has summarized the accounts together with his own observations. The first

report of this nature is by Artault de Vevy (1902) who wrote that a sick man with tubercular fever, was attacked in bed by Melanthrips fuscus (Sulz.) in France.

Ludwig (1912) reports that during the last of July and the first of August grain-infesting species, particularly Limothrips cerealium Haliday, often become very numerous near Kiel and crawl on all naked parts of the body, as well as getting in the hair. These adult thrips produce intolerable itching sensation, and in certain cases provoke an inflammation of the ears and nose. Of this same species Korting (1930) wrote that "these thrips crawl around on the skin from which it is believed they suck moisture, giving rise to an unpleasant itching sensation and appear, under these conditions, to provoke an inflammation. Laborers in the grain fields in the Schleswig-Holstein district frequently suffer such molestations." Korting reported that in August, 1925, the nuisance from the swarming thrips was so great at Timmendorfer Beach (Ludbecker Bay) that many bathers abandoned the health resort.

In 1921, C. B. Williams described a blood sucking thrips attacking Mr. F. W. Urich on the Island of Trinidad. The same specimen on the following day when placed on the wrist of Williams, "remained sucking in the same spot for over half an hour, causing a sudden sharp pain about once every minute. The blood within the thrips gave it a pale yellow color. A small white lump about 6 mm. in diameter was raised and an area about three-fourths inch by one-half inch appeared blotched. ---an hour after, the red blotched area had gone but the smaller white raised area was still visible; after two hours only a small red mark at the point of the bite was visible." J. D. Hood (1927) found among

the many slides left with him by C. B. Williams, "the identical specimen to which he (Williams, 1921) refers". The species was identified as Karnyothrips flavipes (Jones).

Bailey (1936) discusses his experiences thus: "During the past six years while engaged in studying thrips in California, the writer has had several experiences with "blood-sucking" species. It has been a common occurrence when working in experimental plots on onion thrips (Thrips tabaci Lind.) to feel slight pricks or "bites" on the arms, face and neck, both when perspiring and when not. It was observed that the larvae were more prone to "bite" than the adults and in an attempt to find out more about this reaction larvae were forced to feed on the inside of the forearm by confining them inside one-half of a celluloid capsule and in some instances in a cellophane cap taped on the arm. The attempts to feed by piercing the skin produced the pricking sensation mentioned above. The first instar larvae appeared unable to pierce the skin but the larger (second instar) larvae did so and the alimentary tract took on a reddish-brown appearance after feeding. Small pinkish dots appeared on the skin which disappeared in one to two days. There was no swelling and a slight itching sensation was the only discomfort. The larvae did not live longer than about 30 hours thus confined."

In summarizing thrips attacking man, it must be admitted that thrips should be placed among the possible accidental vectors of insect-borne diseases to man.

The predaceous habit is well developed in a number of species of thrips and at one time the entire order Thysanoptera was considered to

be essentially predaceous rather than phytophagous. It now has been established, however, that although the latter is the predominant habit, some species partake of both types of food and still others subsist solely on insect food. There is some evidence to indicate that members of the order may be of some importance as predators upon lepidopterous eggs, particularly those of small size which have a membranous chorion. Franklin (1909) describes the white fly thrips, Aleurodothrips fasciapennis Frankl. and reports that it is an important enemy of the citrus white fly, Dialeurodes citri Ashm. in Florida.

Two species of thrips occurring in Oregon are important as predators. Scolothrips sexmaculatus (Pergand.) is recorded from many parts of North America as feeding upon various species of red mites. Clausen (1940) states that it has been observed to attack the citrus thrips extensively, and this tendency to prey upon members of its own order has been noted in several other instances. Leptothrips mali (Fitch) is predaceous on the eggs and young of various scale insects such as the black scale, brown apricot scale, and similar species, and on other small insects found on many host plants in North America.

In Fiji a plant Clidemia hirta Don. was introduced from British Guiana about 1890. By 1910 thousands of acres were covered with it to the exclusion of nearly all other growth. Cultivating was impracticable and often not even possible in the older plantations or permanent pastures. Sweetman (1936) relates the introduction of Liothrips urichi Karny from Trinidad. This insect is specific on C. hirta Don., not even attacking other species of Clidemia. The thrips can definitely be said to have brought the weed under control over large areas, not by

directly killing it, but by so inhibiting its growth that it is no longer able to compete with the surrounding vegetation. Clidemia then is replaced by such plants as are dominant in the district. It appears that enough Clidemia plants will survive to maintain a light infestation of Liothrips, which apparently can cope with the situation.

### III. COLLECTING AND PRESERVING THYSANOPTERA

In order to make a collection of thrips the beginner will need a few simple pieces of collecting equipment. The writer has found the following items indispensable: (a) a small camel's-hair brush, (b) vials with corks, and (c) a solution termed "AGA" for preserving the specimens. The formula for the preserving solution is as follows:

95% ethyl (grain) alcohol . . . . .	8 parts
Water (distilled if possible) . . . . .	5 parts
Glycerine . . . . .	1 part
Glacial acetic acid . . . . .	1 part

The camel's-hair brush is moistened with the preservative and placed directly upon the insects. The insect will adhere to the moistened brush and can be placed directly in the preserving solution. The writer uses three dram, short style, patent lip vials. The material collected in the preservative remains perfectly relaxed and the appendages can be readily spread. Specimens collected in a solution of 70% alcohol are never fully relaxed and difficulty is encountered in spreading the appendages if they are not mounted within a few days. With this simple collecting equipment flowers may be tapped over a white cloth or handkerchief and the fleeing insects collected with a

moistened brush. Specimens on leaves and fruit may be collected directly from the host plants. If one wishes to make an extensive collection additional collecting equipment must be employed.

For grass inhabiting species a short-handled sweeping net with a muslin bag is very serviceable. The bag is swept rapidly over the grass and the contents of the net are then examined by slowly turning the net inside out. Flower thrips can be collected in this manner in pure stands, but usually several species of plants grow together and the collector is not sure from which plant the thrips came.

A piece of muslin about 30 inches square can be made into a "collecting sheet". The four corners are provided with pockets to hold the ends of two 3/8-inch dowels or small branches. The crossed dowels are inserted in the corners of the net and the point of intersection of the dowels serves as a handle. This net is then held under branches and dead shrubs, the limbs of which are stuck with a stick or small club. Many species of TUBULIFERA will be collected in this fashion.

The writer has employed what he terms a "concentrator", Figure 1, for collecting flower inhabiting forms. It consists of a sheet metal cylinder 12" tall and 6" in diameter. An 8-mesh wire screen diaphragm is soldered midway in the cylinder. From this diaphragm a funnel with a neck 2 5/16" outside diameter extends almost even with the base. A quarter pint "Sealright" container will just fit over the end of the funnel. A lid with a piece of absorbent cotton tacked to the inside completes the assembly. Flowers are carefully cut off with scissors, taking care not to jar the plant, and dropped into one quart cardboard "Sealright" containers, and penciled notes can be made on the covers.

Several of these containers may be carried in a large paper bag. The flowers are then emptied into the concentrator and all thrips adhering to the sides are easily dislodged by a few taps on the bottom of the inverted container. A few drops of methyl iso-butyl ketone are placed on the cotton and the lid put in position. This chemical has a decided repellent action and practically all the thrips fall through the screen into the quarter pint container at the bottom of the funnel. The thrips are easily collected as the methyl iso-butyl ketone anesthetized them, but not before they have escaped from the flowers.

This system has distinct advantages as one can collect from many species of plants in the daytime and at night return to the laboratory and run the various lots through the concentrator. The collector can be selecting the desired specimens with the aid of a binocular microscope while another lot of specimens are accumulating in the concentrator.

A Berlese funnel, Figure 2, has been employed for collecting species in moss, lichens, fungus, galls, sod, leaf mold, and hibernating species in dried inflorescences. The funnel consists of a sheet metal cylinder 14" tall by 14" in diameter. At the bottom of the cylinder a funnel is soldered. An inner cylinder 12" in diameter and 10" deep with the bottom of 8-mesh wire screen fits inside the larger cylinder. Material in which the thrips are hidden is placed in this inner container. This is kept level by two cross bars soldered to the inside of the larger cylinder. The cover in which an electric light socket has been inserted is placed over the apparatus. Heat generated by an electric light bulb drives the thrips into a jar of AGA placed at the end of the funnel.

The Berlese funnel is better than a sifter as the debris is held back and only active and undamaged thrips will be collected. The writer uses ten pound sugar bags for collecting the material. The collector can take an extended field trip, collect several bags of material, place them in a cool place and run the lots through at his leisure. Species rarely found when dispersed in the summer months have been collected in fairly large numbers in this fashion.

Many species which inhabit sod, moss, fallen foliage, or decayed bark may be collected by placing the material in a sieve. The sifting may be done on the spot over a piece of white paper or cloth, or samples may be taken home and examined at the collector's leisure.

#### IV. MOUNTING THYSANOPTERA

Thrips are among the most difficult of insects to mount and slides that are to be of value in taxonomy must be mounted with care and exactitude. Many of the important characters can be ascertained only by means of the higher magnifications of the compound microscope.

Specimens should be mounted within a few weeks, or at least within a year after collecting. The writer had several hundred vials of valuable material ruined during his three year's absence in the military service. This unusable material represented the combined collections of 1940 and 1941. While on military leave, the vials were checked and preservative replenished. However, upon return from military leave of absence the preserved thrips were covered with a black precipitate, and the appendages were so rigid that they would break off before they could be manipulated sufficiently to reveal necessary taxonomic characters.

Unlike other orders of insects, the joints of thrips become rigid after having been left for long periods and it is impossible to straighten the appendages. Specimens treated with sodium hydroxide still retain this objectionable rigidity.

In order to mount the specimens remove them from the alcohol or AGA solution and place them in a Syracuse watch glass about half full of 75% alcohol. Carefully punch a small hole between the abdominal terga or sterna. This facilitates dehydration by permitting a ready exchange of liquids and at the same time it prevents the specimens from collapsing should dehydration be carried too far. The writer uses a minuten nadeln inserted in a match stick both for puncturing the specimens and for manipulating the appendages. The point of this micro-needle is carefully sharpened with the aid of a carborundum stone under the binocular microscope.

With the aid of a low power binocular microscope spread the appendages and free the wings from any retaining setae. The wings are then moved forwards until they are at right angles to the body. Final minor adjustments are made just before the cover glass is placed on the specimen in balsam on the slide.

After the appendages have been spread, hold the specimens with a small camel's-hair brush in the left hand, and with a micro-needle in the right hand place the two basal segments of the antennae in a strictly horizontal position. This is the most important point in the entire procedure of making a good mount. Characters on the antennae are very important for the determination of species and unless kept level, they are difficult to examine and compare under high magnification. Most

of the mediocre slides encountered in insect collections are the result of the omission of this step. Now place a small cover glass fragment over the specimen in the watch glass. The writer uses a jeweler's engraving pencil with a carborundum point to cut cover glasses into pieces about  $3/8$ " square. As many as eighteen specimens may be placed in the same watch glass.

After the specimens have remained in the 75% alcohol about twenty minutes, add an equal quantity of 95% alcohol. In making this addition be careful that the turbulence of the mixing alcohols does not disturb the cover-glass fragments or the specimens. After twenty minutes remove most of the alcohol and add more 95% alcohol. Allow the specimens to remain in this solution overnight. The next morning remove half of the 95% alcohol and replenish with 100% alcohol. After five or ten minutes carefully remove the cover glasses. The writer uses a pair of "Boley BB" jewelers forceps for this procedure. Transfer the specimens to absolute alcohol by means of the camel's-hair brush. It is desirable to transfer only five or six specimens at a time to the absolute alcohol since specimens which remain in this concentration too long tend to become brittle.

The specimens to be mounted should now be transferred two or three at a time to the xylene (xylol). This may be done by using the brush, remembering that because of its brittleness, the specimen must now be handled with extreme delicacy. Almost immediately the specimens begin to lose their opacity due to the penetration of the xylol. If such a specimen, just beginning to clear, be transferred by means of a brush to a drop of balsam on the slide, it will still be flexible enough to

permit a few minor adjustments of the appendages.

The specimen is now ready for placement of the cover glass. The insect should be accurately centered on the slide, with its axis cross-wise of the latter, pressed carefully to the bottom of the drop of balsam, and a cover glass placed over it. In order to prevent the specimen from being carried away from the center of the slide, it is advisable to lower the cover in a horizontal position. Its first contact with the balsam will thus be at the center of the drop, directly over the specimen, and the flow towards the periphery of the cover glass will be equal in all directions. In order to pick up the cover glass in an absolutely horizontal position, it will be necessary to true up the points of the forceps under a binocular microscope using a fine oil-stone.

The use of sodium hydroxide (NaOH), often called caustic, removes all of the soft tissue within the body. In no other way can specimens be prepared for the full study by transmitted light of minute integumental detail. The fat bodies and other internal organs refract the light, and the exoskeleton is frequently very dark in color. Even pale insects, when treated with caustic, disclose sculpture and chaetotaxy previously obscured or quite obliterated by internal structures. It is a good rule to prepare at least one specimen of a species according to the method described below.

Remove the insect from preservative and puncture the abdomen to facilitate the transfer of liquids. Instead of placing the specimens in 75% alcohol, place them in Sodium hydroxide. For Thysanoptera it is advisable to use a caustic not exceeding 3%. Keep the caustic and

specimens at a temperature of about 100 degrees F. for an hour depending upon the size and opacity of the specimens. Then remove the specimens from the caustic and wash them in distilled water. After this, place them in a solution of 20% alcohol (4 parts) and glacial acetic acid (1 part). If the glacial acetic acid is not used, the specimens should undergo at least three changes of water before placing them in 15-20% alcohol. Allow the specimens to remain in this solution for twenty minutes and then spread the appendages, cover the specimens with a square cover glass fragment and gradually add higher concentrations of alcohol until the specimens are in 95% alcohol. The material may now be treated by the same process as described for non-caustic mounting.

Figure 3 illustrates the course of any specimen through reagents in making microscopical whole mounts, but 3% NaOH is recommended for thrips which are to be treated with caustic.

The only permanent mounting media are the resinous ones such as Canada balsam, dammar, euparal and diaphane. "Permanent" is a relative term, and microscopical knowledge is too brief in time to permit one to say any medium is truly permanent. Yet it seems clear to the writer that all aqueous media should be excluded from the category of those which give promise of being permanent. The writer's experience in making more than 5,000 whole mounts of insects over a period of 14 years, and his experience gained from examining slides from various collections has resulted in his exclusive use of Canada balsam. It has seemed worth while to state the reasons for this:

- (1) No surface film is formed during the period ordinarily required in arranging the specimen on the slide

preparatory to placing the cover glass in position.

Such a film is formed with euparal or diaphane and the delicate antennae and wings of thrips are easily and frequently broken.

- (2) Bubbles will not remain in balsam mounts. Large bubbles drift out to the edge of the cover glass and break, while smaller ones are absorbed.
- (3) Balsam rarely clouds or crystalizes.
- (4) With balsam, the shrinkage in the course of complete drying is usually about 30 per cent. This shrinkage is far less than that of euparal and diaphane, which lose about 50-55 per cent in volume. This one feature alone outweighs any possible advantages which these other media possess.

After the cover glasses have been placed over the specimens, the slides are marked with a wax crayon giving them an accession symbol which is also marked on the vial from which the specimens came. The slides are then placed in a drying oven for 7 to 10 days at a temperature of 100 to 105 degrees F. A home-made drying cabinet can be made of plywood with a 40-watt electric light bulb held in a socket in the bottom. When the slides are dry, they are removed and labelled and are ready for the permanent collection.

In the collection the slides should rest in a horizontal position, and if the color is to remain preserved, they must remain in the dark. The cardboard slide box with wooden cover with a capacity of 100 slides is certainly the most satisfactory container yet devised and the

cheapest means of storage. They are durable and may be conveniently shelved in ordinary book cases. The writer has taken the regular 3"x5" library cards and has made typewritten labels for the species in the collection. Figure 4 illustrates this system which the writer has employed for the Oregon State College collection of Thysanoptera and for slides in the reference collection. Lines are drawn  $1 \frac{3}{8}$  inches apart on the library cards. The names are then typed, the lines cut, and the typed borders crimped in the edge of a slide box.

## V. THYSANOPTERA OF OREGON

### A. INTRODUCTION

When the writer started taxonomic investigation on the thrips in 1940, there were 178 slides representing 14 species of Thysanoptera in the Oregon State College collection. About one-half of these slides were undetermined and forty were in such poor condition that they were subsequently discarded. There are now approximately 500 named slides in the collection. About 350 genera and 2,500 species of Thysanoptera are known. In this paper 34 genera and 71 species are listed from Oregon. Three species, a variety and a form, are described as new.

The taxonomic arrangement of the species and the divisions of the order Thysanoptera into tribes and higher groupings is based upon the opinions of Mr. Moulton. For the most part Mr. Moulton's classification follows that of Priesner (1926-1928), "Die Thysanopteren Europas", which is the latest complete work of a revisionary nature.

The existing keys to the species are often based on the characters of the male thrips. Unless one has both sexes of a species, it is

difficult to make a positive identification. The writer has selected those characters which are common to both males and females of the same species and the student should be able to determine any thrips that has been found in Oregon with the aid of the keys to the species in this paper.

## B. A LIST OF THE OREGON SPECIES OF THYSANOPTERA

Order THYSANOPTERA Haliday, 1836.Suborder TEREBRANTIA Haliday, 1836.Superfamily AEOLOTHRIPOIDEA Hood, 1915.Family OROTHRIPIDAE Bagnall, 1926.I. Genus OROTHRIPS Moulton, 1907.

1. O. kelloggii Moulton, 1907.
2. O. keeni Moulton, 1927.

II. Genus ERYTHROTHRIPS Moulton, 1911.

3. E. keeni Moulton, 1929.

Family AEOLOTHRIPIDAE Uzel, 1895.III. Genus AEOLOTHRIPS Haliday, 1836.

- |  |  |
|--|--|
| 4. <u>A. bicolor</u> Hinds, 1902.                  | 8. <u>A. melaleucus</u> Haliday, 1852. |
| 5. <u>A. brevicauda</u> Hood, 1935.                | 9. <u>A. nasturtii</u> Jones, 1912.    |
| 6. <u>A. fasciatus</u> Linne, 1761.                | 10. <u>A. oregonus</u> Hood, 1935.     |
| 7. <u>A. fasciatus justicei</u> , - new subspecies |  |

IV. Genus RHIPIDOTHRIPS Uzel, 1895.

11. R. brunneus Williams, 1913.

Family MELANTHRIPIDAE Bagnall, 1928.V. Genus ANKOTHRIPS Crawford, 1909.

12. A. robustus Crawford, 1909.

Superfamily HETEROTHRIPOIDEA Bagnall, 1923.Family OPADOTHRIPIDAE Bagnall, 1927.

VI. Genus OLIGOTHRIPS Moulton, 1933.

13. O. Oreios Moulton, 1933.

Superfamily THRIPOIDEA Hood, 1915.

Family THRIPIDAE Uzel, 1895.

Subfamily HELIOTHRIPINAE Karny, 1921.

VII. Genus HELIOTHRIPS Haliday, 1836.

14. H. haemorrhoidalis (Bouche), 1833.

VIII. Genus HERCOTHRIPS Hood, 1927.

15. H. fasciatus (Pergande), 1895.

IX. Genus HERCINOTHRIPS Bagnall, 1932.

16. H. femoralis (Reuter), 1891.

Subfamily CHIROTHRIPINAE Karny, 1921.

X. Genus CHIROTHRIPS Haliday, 1836.

17. C. aculeatus Bagnall, 1927.      19. C. manicatus f. pallidicornis  
Priesner, 1925.  
18. C. manicatus Haliday, 1836.      20. C. moultoni, - new species

XI. Genus LIMOTHRIPS Haliday, 1836.

21. L. cerealium Haliday, 1836.  
22. L. denticornis Haliday, 1836.

XII. Genus APTINOTHRIPS Haliday, 1838.

23. A. rufus (Gmelin), 1788.

Subfamily SERICOTHRIPINAE Karny, 1921.

Tribe "A" SERICOTHRIPINI Priesner, 1926.

XIII. Genus SERICOTHRIPS Haliday, 1836.

24. S. chrysothamni Hood, 1936.

Tribe "C" ANAPHOTHRIPINI Priesner, 1926.

XIV. Genus ANAPHOTHRIPS Uzel, 1895.

25. A. obscurus (Muller), 1776.      27. A. secticornis f. bicolor  
Moulton (manuscript species)  
26. A. secticornis (Trybom), 1896.

XV. Genus OXYTHRIPS Uzel, 1895.

28. O. zeae (Moulton), 1911.      30. O. pinicola Hood, 1937.  
29. O. ajugae Uzel, 1895.

Subfamily THRIPINAE Karny, 1921.

## (Group "A")

XVI. Genus ODONTOTHRIPS Amy. & Serv., 1843.

31. O. loti Haliday, 1852.

## (Group "B")

XVII. Genus SCOLOTHRIPS Hinds, 1902.

32. S. sexmaculatus (Pergande), 1894.

XVIII. Genus FRANKLINIELLA Karny, 1910.

33. F. gossypiana Hood, 1936.      38. F. occidentalis f. dubia  
Priesner, 1932  
34. F. helianthi (Moulton), 1911.      39. F. tenuicornis (Uzel) 1895  
35. F. minuta (Moulton), 1907.      40. F. terminalis, - new species  
36. F. occidentalis (Pergande), 1895.  
37. F. occidentalis' var. californica (Moulton), 1911.

XIX. Genus IRIDOTHRIPS Priesner, 1940.

41. I. iridis (Watson), 1924. (from Bregmatothrips)

XX. Genus TAENIOTHRIPS Amy. & Serv., 1843.

42. T. albus Moulton, 1911.      44. T. inconsequens (Uzel), 1895.  
43. T. frici Uzel, 1895.      45. T. simplex Morison, 1930.

XXI. Genus RHOPALANDROTHRIPS Priesner, 1922.

46. R. corni Moulton, 1927.



XXIX. Genus NEOHEEGERIA Schmutz, 1909

62. N. verbasci (Osborn), 1896.

XXX. Genus HAPLOTHRIPS Amy. & Serv., 1843.

63. H. leucanthemi (Schrank), 1781.

64. H. niger (Osborn), 1883.

XXXa. Subgenus XYLAPOTHRIPS Priesner, 1927.

65. Haplothrips (Xylapothrips) subterraneus Crawford, 1938.

Tribe PHLOEOTHRIPINI Priesner, 1927.XXXI. Genus HOPLANDOTHRIPS Hood, 1912.

66. H. armiger (Jones), 1912.

Subfamily MEGATHRIPINAE Priesner, 1927.Tribe MEGATHRIPINI Priesner, 1927.XXXII. Genus MEGALOTHRIPS Uzel, 1895.

67. M. picticornis Hood, 1927.      69. M. new species Crawford  
(Manuscript species)
68. M. spinosus Hood, 1908.

Tribe COMPSOTHRIPINI Priesner, 1927.XXXIII. Genus OEDALEOTHRIPS Hood, 1916.

70. O. jacksoni Hood, 1925.

XXXIV. Genus BOLOTHRIPS Priesner, 1928.XXXIVa. Subgenus BOTANOTHRIPS Hood, 1939.

71. Bolothrips (Botanothrips) lativerticis - new species

## C. KEYS TO THE HIGHER CATEGORIES AND GENERA.

1. Female with an ovipositor formed of two pairs of gonapophyses arising from segments VIII and IX of abdomen; terminal abdominal segments seldom tubular, that of female always longitudinally divided beneath and usually conical, that of male usually bluntly rounded, never tubular, fig. 25. Wings ordinarily clothed with microtrichia; forewing with ambient vein and at least one longitudinal vein attaining tip, fig. 6.

## Suborder I. TEREBRANTIA

- Female without ovipositor; terminal abdominal segment of both sexes always continuous beneath, almost invariably tubular, figs. 74, 79. Wings without microtrichia; forewing at most with a single abbreviated median vein, figs. 60, 73.

## Suborder II. TUBULIFERA

## Suborder I. TEREBRANTIA.

1. Antennae 9-segmented. Fore tarsi with a hook-shaped tooth, fig. 5  
----- 2
- Antennae 6- to 8- segmented. Fore tarsi without hook-shaped tooth  
----- Superfamily THRIPOIDEA.
2. Ovipositor curved upwards. Wings broad and rounded at ends, fig. 6  
Maxillary palpi 3- to 8-segmented; labial palpi 3- to 5-segmented.  
----- Superfamily AEOLOTHRIPOIDEA.
- Ovipositor turned downwards. Wings narrowed and pointed at ends,  
fig. 15. Maxillary palpi 3-segmented; labial palpi 2-segmented  
----- Superfamily HETEROTHRIPOIDEA.

## Superfamily AEOLOTHRIPOIDEA

1. From three to five terminal antennal segments firmly united,  
fig. 12. Labial palpi 4-segmented. Maxillary palpi 3-segmented.  
----- Family AEOLOTHRIPIDAE.
  - Terminal antennal segments freely movable and not firmly united,  
figs. 5, 13. Labial palpi with fewer segments than the maxillary  
palpi. ----- 2
  2. Maxillary palpi 7- to 8-segmented. Labial palpi 3- to 5-segmented.  
Fore wings with bands, fig. 6. Antennal segment II not drawn out  
distally, fig. 5. ----- Family OROTHRIPIDAE.
  - Maxillary palpi 3-segmented. Labial palpi 2-segmented. Fore wings  
without dark bands. Antennal segment II drawn out into a process  
distally, fig. 13. ----- Family MELANTHRIPIDAE.
- This family is represented in Oregon by one genus V. Genus Anko-  
thrips Crawford.

## Family OROTHRIPIDAE

1. Fore wings with dark transverse bands, fig. 6. - I. Genus Orothrips  
----- Moulton.
- Fore wings with a dark longitudinal band along posterior margins,  
fig. 7. ----- II. Genus Erythrothrips Moulton.

## Family AEOLOTHRIPIDAE

1. The terminal 4 to 5 antennal segments firmly united -----  
----- III. Genus Aeolothrips Haliday.
- Only the three terminal antennal segments firmly united,  
fig. 12, ----- IV. Genus Rhipidothrips Uzel.

## Superfamily HETEROTHRIPOIDEA

This superfamily is represented in Oregon by one family OPADOTHRIPIDAE and one genus ----- VI. Genus Oligothrips Moulton.

## Superfamily THRIPOIDEA

Represented by one family ----- Family THRIPIDAE.

## Family THRIPIDAE

1. Head produced in front of eyes into a triangular or rounded process upon which the antennae are inserted, figs. 19, 21. -----  
----- Subfamily CHIROTHRIPINAE.
- Head not produced in front of eyes into a process upon which the antennae are inserted, fig. 37.----- 2
2. Head and body with prominent, distinct reticulated sculpturing forming polygonal areas, fig. 16 ----- Subfamily HELIOTHRIPINAE.
- Surface of body without such prominent areas; at most with only partly confluent transverse striations ----- 3
3. Body, especially the abdomen, often covered with microscopic hairs or pubescence. Body massive, broad and compact. Fore wings, when present, with one longitudinal vein, fig. 27. -----  
----- Subfamily SERICOTHRIPINAE.
- Body without microscopic pubescence. Body not broad and compact. Fore wings, when present, with two longitudinal veins, figs. 41, 48. ----- 4
4. Mouth cone short, more or less rounded and not extending to mesosternum, figs. 47, 51. ----- Subfamily THRIPINAE.
- Mouth cone long and narrow, pointed, and extending to mesosternum, fig. 52. ----- Subfamily MYCETEROTHRIPINAE.

This subfamily represented by one genus in Oregon. XXV. Genus

----- Mycterothrips Trybom.

#### Subfamily HELIOTHIRIPINAE

1. Antennal segment VIII long and needle-like, at least four times longer than segment VII, fig. 16. Wings very broad in basal fourth and then abruptly narrowed with parallel sides distally, rounded at tips ----- VII. Genus Heliothrips Haliday.
- Antennal segment VIII not long and needle-like, less than four times longer than segment VII. Wings moderately stout at base and gradually reduced to pointed tips, figs. 17, 18. ----- 2
2. Costa with regular series of spines equal in length to weak anterior fringe, fig. 17. Prothorax with lateral margins not explanate. ----- VIII. Genus Hercothrips Hood.
- Costa with a double series of spines much shorter than strong anterior fringe, fig. 18. Prothorax with lateral margins explanate. ----- IX. Genus Hercinothrips Bagnall.

#### Subfamily CHIROTHIRIPINAE

1. Second antennal segment drawn out on outer angle, fig. 20. Prothorax trapezoidal, narrow anteriorly with sides greatly expanded posteriorly; posterior margin at least one and one-half times width of head, fig. 21. ----- X. Genus Chirothrips Haliday.
- Second antennal segment not drawn out on outer angle, fig. 22. Prothorax not greatly expanded posteriorly and not much wider than head. ----- 2
2. Dark colored. Spines on abdominal segments IX and X long, dark and very strong, fig. 25. Head produced in front of eyes into a

triangular process between antennae; sides of head arched posteriorly, fig. 24. ----- XI. Genus Limothrips Haliday.

- Color pale lemon yellow. Spines on abdominal segments IX and X pale and weak. Head rounded in front of eyes and not produced into a triangular process; sides parallel, fig. 26. -----

----- XII. Genus Aptinothrips Haliday.

#### Subfamily SERICOTHRIPINAE

1. Body, especially the abdomen, covered with red microscopic hairs or pubescence. Head very broad and constricted posteriorly. Body noticeably broad and compact, if not, the fore wings have but one longitudinal vein, fig. 27. -----

----- XIII. Genus Sericothrips Haliday.

- Body without microscopic hairs or pubescence. Head not particularly broad and not constricted posteriorly, fig. 28. Body not particularly broad and compact. Fore wings, when present, with two or more longitudinal veins. ----- 2

2. Prothorax without a long spine on each posterior angle, fig. 28. -

----- XIV. Genus Anaphothrips Uzel.

- Prothorax with a long spine on each posterior angle, fig. 30. ----

----- XV. Genus Oxythrips Uzel.

#### Subfamily THIRIPINAE

1. Fore tibiae armed at end with one or two teeth, fig. 31. -----

----- XVI. Genus Odontothrips Amy. & Serv.

- Fore tibiae unarmed. ----- 2

2. Anterior angles of prothorax on each side with a long, strong bristle, fig. 32. ----- 3

- Anterior angles of prothorax without a strong bristle. ----- 5
- 3. Prothorax with a rather long bristle in the middle of each lateral margin, fig. 32. ----- XVII. Genus Scolothrips Amy. & Serv.
- Middle of prothorax without bristles, fig. 35. ----- 4
- 4. Antennal segments III and IV with forked sense cones, fig. 38 -----  
----- XVIII. Genus Frankliniella Karny.
- Antennal segments III and IV with simple sense cones, fig. 40. ----  
----- XIX. Genus Iridothrips Priesner.
- 5. Antennae 8-segmented. ----- 6
- Antennae 7-segmented. ----- 7
- 6. Sides of head appreciably rounded and swollen behind eyes. Vertex elongated or with process between the eyes, fig. 43. -----  
----- XX. Genus Taeniothrips Amy. & Serv.
- Sides of head almost straight and not swollen behind eyes. Vertex nearly transverse between antennae, fig. 47. -----  
----- XXI. \*Females Genus Rhopalandrothrips Priesner.
- 7. Prothorax with two long setae on each posterior angle, fig. 50 -- 8
- Prothorax with one minor seta on each posterior angle, fig. 51. ---  
----- XXIV. Genus Microcephalothrips Bagnall.
- 8. Head flattened or projected into a process between antennae. Interocellar setae present, also series behind eyes. Wings not bowed in middle, not scythe-shaped, figs. 48, 49. -----  
----- XXII. Genus Thrips Linnaeus.
- Head broadly rounded in front, without prominent setae. Wings bowed in middle, scythe-shaped, fig. 50. -----  
----- XXIII. Genus Toxonothrips Moulton.

- \* (According to some authors the male forms have 6- or 7-segmented antennae and segment VI is elongated and cylindrical. The writer has never seen a male of this genus.)

## Suborder II. TUBULIFERA

There is no satisfactory key to the subfamilies or tribes as erected by Priesner (1927) in his monograph of the Thysanoptera of Europe. Moulton ('32) states that a more exhaustive study is necessary before there can be a proper classification of this suborder.

### Key to Genera:-

1. Ant-like in appearance, with swollen head, reduced thorax and enlarged abdomen, fig. 78. ---- XXXIII. Genus Oedaleothrips Hood.  
 -- Not ant-like in appearance. ----- 2
2. Size very large; more than 3.2 mm. (3.2 - 5 mm.) -----  
 ----- XXXII. Genus Megalothrips Uzel.  
 -- Size smaller; length not exceeding 2.8 mm. ----- 3
3. Cheeks with bristle-bearing warts, fig. 67. -----  
 ----- XXXI. Genus Hoplandothrips Hood.  
 -- Cheeks without bristle-bearing warts. ----- 4
4. Mouth cone rounded at end. ----- 5  
 -- Mouth cone sharply pointed at end, fig. 55. ----- 9
5. Light colored species, yellowish to yellowish brown. Posterior part of prothorax about as broad as the head. Abdomen with sides nearly parallel, narrowed at eighth abdominal segment, fig. 53. -  
 ----- XXVI. Genus Cephalothrips Uzel.  
 -- Dark colored species. Posterior part of prothorax clearly broader than head. Abdomen reduced from base to tip or narrowed from

- sixth abdominal segment. ----- 6
6. Anterior ocellus on the elongated vertex of head which projects over the bases of the antennae. Head elongate, nearly twice as long as wide, fig. 59. ----- XXVIII. Genus Leptothrips Hood.
- Anterior ocellus on a small elevation on the vertex of the head, which does not overhang the bases of antennae. Head not much longer than wide, fig. 66. ----- 7
7. Antennal segment III fully symmetrical, fig. 66. -----  
----- XXXa. Subgenus Xylaplothrips Priesner.
- Antennal segment III asymmetrical, fig. 77. ----- 8
8. Fore wings constricted in middle, fig. 64. -----  
----- XXX. Genus Haplothrips Amy. & Serv.
- Fore wings with parallel sides, not constricted in middle, fig. 80.  
----- XXXIV. Genus Bolothrips Priesner.
9. Fore wings not narrowed in middle, fig. 56. Antennal segment III with one sense cone. Fore tarsi unarmed. -----  
----- XXVII. Genus Liothrips Uzel.
- Fore wings narrowed in middle, fig. 60. Antennal segment III with two sense cones. Fore tarsi with small tooth in both sexes, fig. 61. ----- XXIX. Genus Neoheegeria Schmutz.

## D. DISCUSSION OF GENERA AND SPECIES

I. Genus OROTHIRIPS Moulton

1907, Moulton, D. A Contribution to Our Knowledge of the Thysanoptera of California. U. S. D. A. Bur. Ent. Tech. Ser. No. 12, Pt. III p. 45.

Genotype O. kelloggi Moulton

Head about as long as wide, cheeks with setae; ocelli present in both sexes. Antenna 9-segmented; all segments freely movable; III and IV of about equal length, each with two sense areas in distal half; maxillary palpi 7-segmented, labial palpi, 5-segmented.

Prothorax somewhat wider than long, with series of setae along posterior margin; fore femora thickened in both sexes; fore tarsus with hook-like tooth. Wings fully developed in both sexes, broader in distal third, narrower near base; fore wing with ring vein, two longitudinal and five cross veins; costa and longitudinal veins thickly and regularly set with spines, fringe vestigial on costa but fully developed on posterior margin; fore wings with darkened cross bands.

Ovipositor curved upward.

## Key to Species.

- 1. Hind wings clear, without cross bands.----- kelloggi Moulton.
- Hind wings with cross bands like fore wings. ----- keeni Moulton.
- 1. Orothrips kelloggi Moulton. Figs. 5, 6.

1907, Moulton, D. A Contribution to Our Knowledge of the Thysanoptera of California. U. S. D. A. Bur. Ent. Tech. Ser. No. 12, Pt. III. pp. 39-68.

Length 2.1 - 2.4 mm. General color dark brown, sometimes light brown, prothorax and abdomen shaded with orange.

The back of the head is transversely striated and clothed with small spines, a single pair posterior to the ocelli are the largest. The eyes are large, black, with light posterior margins, pilose, and with large facets. Ocelli orange colored granulated, and margined inwardly with dark orange brown crescents. Mouth cone short, reaching about halfway across the prothorax. Maxillary palpi geniculate, seven-segmented, first segment very large and almost as long as the other six. Labial palpi are five-segmented. The sense areas on the third and fourth antennal segments are especially characteristic of this species; these, two in number on each segment, are long, narrow and extend from the tip to near the center of each segment.

The dark cross bands on the wings are distinct and the white areas are almost transparent except for the veins and the setae. The average length of the specimens measure 2.1 - 2.4 mm. (original description gave the total body length as 1.8 mm.). This species was described from nine females and six males taken from Manzanita and Madrone blossoms from Santa Clara Valley, California. The adults appear only for a few weeks during the blossoming period. The larvae are also found within the blossoms and, like the adults, remain on the trees for only a short time. Both adults and larvae feed within the blossoms and do not appear to attack the foliage.

Oregon Record:-

10.2 mi. N.E. of Brookings, Ore. 17 May, 1940. Altitude 1925'.

Coll. Marshall Ross and R. L. Post on Manzanita Flowers.

2. Orothrips keeni Moulton

1927, Moulton, D. Thysanoptera - New Species and Notes. Bull.

Brook. Ent. Soc. 22: 183.

Length 1.6 mm. The color is very similar to kelloggi, almost uniformly dark brown with orange or reddish hypodermal pigmentation.

Antennal segments one and two are deep brown like the body; three light brown in basal third, distal two thirds of three and segments four to nine uniformly dark brown. Wing bands are less deeply colored than in kelloggi, and their margins fade into the somewhat grayish lighter areas.

Head with sense areas on antennal segments III and IV elongate, those on three about one-quarter the length of the segment, those on four two-fifths the length of the segment. These sense areas with their long flattened sense plates are distinctly shorter than in kelloggi.

This species was named in honor of the collector, Mr. F. P. Keen who found it on Prunus emarginata at Klamath Falls, Oregon, in May. The female holotype has a total body length of 1.6 mm. The holotype is in the author's collection.

Oregon Record:-

Klamath Falls, Oregon, May. Coll. F. P. Keen. Host: Prunus emarginata.

II. Genus ERYTHROTHRIPS Moulton

1911, Moulton, D. Synopsis Catalog and Bibliography of North American Thysanoptera. U.S.D.A. Bur. Ent. Tech. Ser. Bull. No. 21, pp. 1-56.

Genotype E. arizonae Moulton

Head longer than wide; eyes large, produced ventrally, ocelli present in both sexes. Antenna 9-segmented; segments VII to IX rather closely joined, VIII and IX together shorter than VII; sense areas on III and IV elongate, usually extending to near middle of segment. Maxillary palpi 8-segmented; the first segment large, the others small and of about equal length, labial palpi 3-segmented.

Prothorax about as long as head but wider, without strong spines; legs long and slender, fore femora somewhat thickened in both sexes; fore tarsus with hook-like tooth. Wings present in both sexes, slightly narrowed before the middle otherwise with almost parallel sides, with ring vein, two longitudinal and five cross veins, costa and longitudinal veins with scattered, inconspicuous setae, fringe vestigial along anterior margin; fore wings white with conspicuous longitudinal bands along posterior margins.

Abdomen elongate, broadly joined to thorax, segment IX longer and stronger than others, supporting the long upturned ovipositor.

Male smaller than female, abdominal segments VIII and IX longer than wide, without conspicuous clasping organs.

### 3. Erythrothrips keeni Moulton.

1929, Moulton, D. A Contribution to Our Knowledge of American Thysanoptera. Bull. Brook. Ent. Soc. 24: 226-227.

Female: Body length mounted and distended 2.37 mm. Body color blackish brown except third antennal segment which is abruptly yellowish-brown in basal two-thirds and fourth to sixth abdominal segments which are somewhat lighter. Basal third of fore wings whitish except for the dark brown scale, distal two-thirds with a dark longitudinal

band along the posterior margins, broadening somewhat in the middle and at the tips.

Total length of antennae 630 microns. Sense areas on antennal segments III 46-48 microns, IV 63-69 microns.

Male: Colored same as female. Total length of body (abdomen normal) 1.66 mm. The antennae were broken off the single male allotype specimen.

The type, allotype and one paratype were taken at Bly, Oregon, 15 August, 1927, by F. P. Keen on Chrysolamus and named in his honor. Two additional female paratypes, one from Markleyville, California, 31 July, 1926, Coll. D. Moulton on Mentzelia laevicaulis and one at Everett Pass, Alpine County, California, Coll. D. Moulton in blossoms of white yarrow, comprise the type series. Also recorded from Wells, Nevada, 26 July, 1936, on Soldiago.

### III. Genus AEOLOTHRIPS Haliday

1836, Haliday, A. H. An Epitome of British Genera in the Order Thysanoptera with Indications of a Few of the Genera. Entomological Magazine 3: 439-451.

Genotype Thrips fasciata Linn, 1761

Head about as long as wide, eyes usually produced ventrally, ocelli small and indistinct in wingless forms; maxillary palpi with three, labial palpi with four segments. Antennae 9-segmented; III and IV longest, each with an elongate, light-colored sense area near tip; VI and IX may be closely and compactly joined.

Prothorax without conspicuous spines; pterothorax normally large but small in wingless forms. Legs moderately long, fore femora usually

enlarged, second segment of fore tarsus with a small, backward curved hook joined at base with a triangular, stocky tooth. Wings when present broad, rounded at ends, with transverse longitudinal colored bands; fore wings with ring vein, two longitudinal and usually four or five cross veins; without fringe along anterior margin.

Abdomen elongate, terminal segments with long spines, ovipositor curved upwards.

Male smaller than female, first abdominal segment with two posteriorly directed and diverging sclerotized ridges on the dorsum; often with distinct clasping organs or other peculiar marks of distinction.

#### Key to Species.

1. Abdomen with a pale transverse band occupying segments II and III.  
----- bicolor Hinds.
- Abdomen without a pale transverse band. ----- 2
2. Forewings with the two dark transverse bands not united. ----- 3
- Forewings with the two dark transverse bands united along the  
posterior margin. ----- 6
3. Segment VI of antennae much less than half as long as V. ----- 4
- Segment VI of antennae slightly more than half as long as V. ----  
----- nasturtii Jones.
4. Segment I of antennae unusually short, less than half the length  
of II; V longer than IV. Ninth abdominal tergite shorter than  
half the width of head. ----- brevicauda Hood.
- Segment I of antennae longer than two-thirds the length of II; V  
shorter than IV. Ninth abdominal tergite longer than half the  
width of head. ----- 5

5. Segment I of antennae dark brown, as dark as head; II and III brown with III shading to yellowish brown basally, fig. 8. ---  
----- fasciatus Linnaeus.
- Segment I of antennae light brown, much lighter than head; II and III clear white except a weak shading of brown at extreme apical end of III, fig. 9. --- fasciatus subsp. justicei new subspecies.
6. Cross bands connected along the posterior margin of fore wings by a dark line exactly occupying the ambient vein. The white patch on tip of wing nearly circular in outline. ----- oregonus Hood.
- Cross bands on fore wings more broadly united, occupying at least the entire space between the cuoitus and ring vein. The white patch on tip of wing semi-circular in outline as the outer band is more or less truncate distally, fig. 10.-- melaleucus Haliday.

4. Aeolothrips bicolor Hinds

1902, Hinds, W. E. North American Thysanoptera. Proc. U. S. Nat. Museum 26: 79-242.

Length 1.9 mm. Color dark brown except abdominal segments II and III which are white.

Head with segment I of the antenna thickest, as long as wide; III to VI slightly narrower than II; VII to IX tapering; the last very minute and conical. All segments, except III, of uniform brown color; III is very pale yellowish white, except brown band around apex. Segments III-IX quite evenly clothed with fine hairs of uniform size; III and IV each bear a narrow light colored, membranous strip on outer part of underside, indistinct on III on account of its light color; a small elliptical spot of similar structure near the tip of V beneath.

The last four segments of antenna are much longer than segment V; which character distinguishes it from A. albicinctus Haliday, which has not been recorded from the Northwest.

This species is immediately recognizable by the pale transverse band occupying segments II and III of the abdomen. This character is discernible with the naked eye in both living and mounted specimens.

The type specimens were from Amherst, Mass., where they were collected on Brunella vulgaris, Panicum sanguinale, bindweed, and various grasses. Watson ('23) records it from "Mass. to Minn., to Texas to Fla.", and lists additional hosts: Plantago, corn, onions, rutabagas; Russel ('12) reports that it feeds on onion thrips.

#### Oregon Records:-

Brownsville, 8 August, 1932. Coll. Grant E. Mitsch. Host Gladiolus.  
In OSC Collection, no locality given, 25 April, on oats.

#### 5. Aeolothrips brevicauda Hood.

1935, Hood, J. D. Five New Thysanoptera of the Genus Aeolothrips.

Trans. Amer. Ent. Soc. 61: 103-110.

Length 1.55 mm. (partially distended 1.7 mm.) Color blackish brown with a reddish cast due to the presence of bright red pigmentation in the fat body of thorax and abdomen; similar pigmentation in head only around ocelli and at base of mouth cone, lacking from all appendages save a faint patch in the membranous areas at the apex of each femur and at the extreme base of each forewing. Antennae with segment IV dark brown, somewhat paler basally, its pedicel rather abruptly nearly black; V - IX about concolorous with I. Antennae fully 2.6 times as long as head; segment I unusually short less than

half the length of II; III and IV with the usual sense areas much reduced in size, that on III only 18  $\mu$  long, that on IV not hooked but of an elongate pointed-oval form, usually about 18  $\mu$  by 7  $\mu$  and extending slightly beyond the dorsal margin of the segment. V longer than IV, its sense cone attached to base only, the pale spot thus circular.

Abdomen of usual structure, but short tergum IX shorter than half the width of head and less than one-fifth times long as X; tergum I faintly sub-reticulate.

Though evidently allied to A. fasciatus, this little species is nevertheless readily recognizable by the short abdomen (particularly the 9th tergum), the short broad wings, the short first and the long fifth antennal segments, and the small sensoria on the third and fourth antennal segments.

This species was described from 4 females collected at Crater Lake National Park, Oregon, July 21, 1927, by J. D. Hood on Gooseberry, Ribes cereum. The writer has not seen this species.

6. Aeolothrips fasciatus (Linn.) Fig. 8

1761, Linnaeus C. Fauna Svecica. pp. 266-267.

This species was re-described by Hinds ('02) from seven females, no males were found.

Length 1.6 mm. The general color yellowish brown to dark brown. Head with eyes large, black, elongated downward; borders of eyes light; ocelli small well separated, orange-yellow with maroon crescents.

Maxillary palpi 3-segmented, labial palpi 4-segmented. Antennae brown except tip of II and all but tip of segment III nearly white; all

segments quite thickly and uniformly clothed with short spines; those around tip of II being much the stoutest. No sense cones present but both III and IV have an elongated, narrow membraneous sense area on the under side of the outer half, from which it can be distinguished from melaleucus; V bears a small rounded spot of similar texture near the tip below.

There is no fringe upon the costa of either wing, but the costal and longitudinal veins are set with a number of short, dark spines. The hind fringe of hairs short and straight, double row on fore wing. Fore wings with two dark bands; hind wings with similar areas, but the two darker bands are so pale that they can hardly be distinguished except under diffuse light.

Abdomen small at base enlarging to middle; spines upon the last two segments long, dark, and conspicuous. Entire body yellowish brown to dark brown; connective tissue red.

The immature forms based on Haliday's description, "Larva yellow, the abdomen behind deeper orange, a whorl of hairs on each segment, more conspicuous on the last two; prothorax elongate; antennae shorter than in the perfect insect, the number of joints similar; mouth nearly perpendicular, not inflected under the breast; joints of maxillary palpi not very unequal."

The male of this species was described for the first time by Treherne ('19) from two specimens in his collection; one taken off Lithospermum pilosum from Kelowna, B. C., on May 16, 1917; and the other off the bloom of cultivated dahlia from Agassiz, B. C., on July 14, 1914. The latter specimen taken with females of the same species.

This species is almost cosmopolitan in distribution and is usually associated with Thrips tabaci upon which it preys. Habitat; England (Haliday), Vienna (Heeger), Finland (Reuter), Germany (Jordan, Bohls, Uzel), and various localities in the United States.

The host plants as listed by Hinds are alfalfa, buckwheat, celery, clover, Compositae, oats, onion, tansy, wheat, and various grasses and weeds. Hinds ('02) states that "Fitch observed that it was abundant on wheat early in the season and afterward passed to later flowering plants such as tansy. Webster found it common on all stages on buckwheat in Ohio."

Treherne ('19) states that the distribution of this species in British Columbia must be widespread as it has been taken in localities varying from humid to arid. During the summer of 1918 females were abundant at Kelowna, B. C. in association with the Onion Thrips, (T. tabaci) upon which it is doubtless predaceous. Williams ('16) records this species as predaceous on the pea thrips in Europe, but also states that it feeds on pollen and plant juices. It was taken in California from April to July in blossoms of California buckeye, Aesculus californica, and monkey flower, Diplacus glutinosus, and on sugar beet foliage.

#### Oregon Records:-

J. C. Bridwell on Chrysanthemum leucanthemum (no additional data).  
Corvallis, 8 April, 1917. Coll. A. B. Black on loganberry.  
Salem, 26 August, 1932. Coll. J. E. Stansberry on gladiolus.

7. Aeolothrips fasciatus Subsp. justicei new subspecies. Fig. 9.

Length 2.0 mm. distended.

With the same general form and color as the species but with first antennal segment light brown, much lighter than the head and segments II and III clear white except a weak shading of brown at extreme apical end of segment III.

Type material:-

Type female taken at Cascade Locks, Oregon, 4 July, 1944. Coll. Leah J. Post in home from bouquet of cultivated flowers. In author's collection.

Paratype female Portland, Oregon 14 July, 1940. Coll. Joe Schuh from insect borer tunnel in lupine stem. Deposited in Moulton collection.

Three female paratypes, in poor condition, Troutdale, Oregon, 30 July, 1940. Coll. Joe Schuh on gladiolus. Deposited in Oregon State College Collection.

8. Aeolothrips melaleucus Haliday. Fig. 10.

1852, Haliday, A. H. List of the Specimens of Homopterous Insects in the Collection of the British Museum, Part IV, p. 1117.

Length 1.9 mm. distended. Color dark brown to blackish brown with antennal segments III and IV white, the tip of IV clouded with light brown. The cross bands on the fore wing are broadly united and the white patch on the tip of the fore wing is semi-circular in outline.

These characters will readily distinguish this species from all other Oregon Aeolothrips.

H. E. Morrison ('40) collected three specimens on hops in 1938 which were determined by F.C. Andre as A. melaleucus. This record was

published as the first report of this species in the United States. The writer found that these specimens did not agree with the original description of melaleucus nor with specimens loaned the author by Dudley Moulton. Moulton ('46) corrected the erroneous determination by Andre and identified the specimens as A. nasturtii Jones. A review of the literature shows that A. melaleucus has been taken twice previously in North America. Ross and Putnam ('33) observed a few nymphs attacking red spider in the field and under experimental conditions the nymphs fed also on Oriental Fruit Moth eggs. Moulton ('29) records this species of thrips from Vernon, B. C., on Virbunum sterile 3-VI-1927, Coll. H.H. Ruhman. An unpublished record in the collection of Moulton lists this species from Montana, collected 30 May, 1929, by J. R. Parker on apple.

Moulton believes that A. annectans Hood and A. auricostus Treherne are synonyms of melaleucus, but a comparison of types will be necessary to confirm this opinion.

#### Oregon Records:-

Corvallis, 4 June, 1941. Coll. Leah J. & R. L. Post from flowers of raspberry.

Portland, 16 July, 1940. Coll. Joe Schuh on Laburnum vulgare.

Portland, 30 July, 1940. Coll. Joe Schuh on gladiolus.

#### 9. Aeolothrips nasturtii Jones. Fig. 11.

1912, Jones, P. R. Some New California and Georgia Thysanoptera.

U.S.D.A. Bur. Ent. Tech. Series, No. 23, Pt. I. pp. 1-24.

Length 2.2 mm. Color uniform dark brown.

Head slightly longer than wide, sides parallel, transversely striated above, covered with numerous small spines; one spine on each

outer side and one on each inner side of the antennae near their base and five on each side of the head. Eyes large, extending back well on the ventral side nearly one-half the length of the head, coarsely faceted and sparsely pilose.

Prothorax a little wider than long, only slightly larger than the head, slightly emarginate near the center of each side, clothed with a number of short spines above. Metathorax abruptly narrower than the mesothorax, slightly wider than prothorax, edges parallel. Legs uniformly dark brown; front femora slightly thickened; tibiae armed at the tip with two strong spines, giving them a pitted appearance. Wings reaching to posterior margin of sixth abdominal segment. Microscopic hairs on light brown cross bands brown, on clear areas white and inconspicuous.

Abdomen uniform brown, elongate-ovate, narrow at base, gradually becoming wider until segment four, which is equally as wide as the segments V, VI, and VII; gradually tapering from segment VII.

In the original description of this species Jones states that nasturtii has wings without cross veins and uses this character in the key to the species. As this species was described from one female specimen taken on flowers of water cress at San Jose, California, and not accessible to Watson, Karny, and later workers this character is used in their keys. Specimens determined by Moulton show that the wings possess cross veins, although not as prominent as with other members of this genus. The writer has been forced to employ new and original characters which will enable one to accurately place the closely related species.

This species was described from one female specimen taken at San Jose, California, 23 May, 1910. Coll. P. R. Jones on flowers of water cress, Nasturtium officinale. It is in the Moulton collection from New York, Illinois, Iowa, California, and Idaho from various host plants.

Published Oregon records, Morrison ('40) on the occurrence of A. melaleucus should be attributed to A. nasturtii. This is the result of an error in the original description and consequent misidentification as explained under A. melaleucus.

Oregon Records:-

Corvallis, 23 April, 1942. Coll. Leah J. & R. L. Post on field buttercup, Ranunculus occidentalis.

Corvallis, 12 June, 1941. Coll. Leah J. & R. L. Post from flowers of yellow sorrel, Oxalis suksdorfii.

Corvallis, 23 June, 1941. Coll. Leah J. Post on arm after picking red raspberry blossoms.

Corvallis, 30 July, 1938. Coll. H. E. Morrison on hops.

Corvallis, 22 August, 1917. Coll. A. B. Black on beans.

Forest Grove, 9 and 10 August, 1926. Coll. S. E. Keen on Linaria and wild carrot, Daucus carota.

Gresham, 7 August, 1944. Coll. Joe Schuh from dahlia buds.

Portland, 30 July, 1940. Coll. Joe Schuh from gladiolus.

Troutdale, 30 July, 1940. Coll. Joe Schuh from gladiolus.

10. Aeolothrips oregonus Hood.

1935, Hood, J. D. Five New Thysanoptera of the Genus Aeolothrips. Transactions Amer. Ent. Soc. 41: 103-110.

Length 1.8 mm. (distended 2.21 mm.) The reddish cast similar to brevicauda. Antennal segment IV darker and more yellowish than III, its pedicel rather abruptly dark brown, its distal third or two-fifths shading to brown at tip and along sides; V - IX about concolorous with I. Fore wing with the usual dark bands, but these cross-bands connected along posterior border of wing by a dark line exactly occupying the ambient vein; the intervening white area constituting about one-sixth the length of wing and distinctly larger than the nearly circular white patch at tip; extreme base of wing including scale dark.

Antennae about two and four-fifths times as long as head; segments III and IV with the usual sense areas much reduced in size; that in III only 20 mu long, that on IV curved, not extending beyond dorsal margin of segment, and only 26 mu in length and 5 mu in width. In general appearance it is much like A. fasciatus (L.), though in wing pattern it more closely approaches A. melaleucus Haliday. The details of the wing coloration and the small antennal sensoria should, however, serve amply for its recognition.

This species was described from a unique female holotype taken at Crater Lake National Park, Oregon, July 21, 1927, by J. C. Bradley and Henry E. Guerlac on tobacco bush, Ceanothus velutinus.

The writer has not seen this species.

IV. Genus RHIPIDOTHRIPS Uzel

1895, Uzel, H. Monographie der Ordnung Thysanoptera. pp. 1-472.

Head longer than wide, cheeks usually with several short, stout, forwardly directed spines behind eyes; eyes somewhat produced ventrally, ocelli present in both sexes. Maxillary palpi 3-segmented, the last very small. Labial palpi 4-segmented. Antennae 9-segmented, VII to IX closely joined; large globular or semicircular sense areas at tips of segments III and IV.

Prothorax relatively small, with one prominent spine on each posterior angle; fore legs moderately stout, with fore femora enlarged in both sexes; fore tarsus with small hooked tooth. Wings broad, of almost even width but narrowed towards base, with ring vein, two longitudinal and five cross veins; costa and longitudinal veins with regularly placed setae; fringe developed only along posterior margin.

Abdomen elongate, ovipositor curved upward.

Male smaller than female.

11. Rhipidothrips brunneus Williams. Fig. 12.

1913, Williams, C. B. Records and Descriptions of British Thysanoptera. Journ. Economic Biol. 8:(4) 216.

Length about 1.75 mm. Color dark brown with the third and fourth antennal segments, the tarsi, and apical parts of the tibiae yellowish.

The head is as long as wide. Cheeks slightly arched, bearing four or five short, stout, forwardly directed spines in their anterior half just behind the eyes. Two small setae in front of the anterior ocellus, and two on each side of it near the margin of the eye; a longer seta between the anterior and each posterior ocellus. Several smaller hairs scattered over the posterior dorsal part of the head. Eyes dark, not prominent. Ocelli small, placed at the corners of a nearly

equilateral triangle; the two posterior ones close to the margins of the eyes, the anterior one directed slightly forward. The mouth cone reaches two-thirds across the prosternum. The maxillary palpi are three-segmented with the last segment very short. The antennae are almost twice as long as the head; the first segment short and stout, the second barrel-shaped, the third long and with a distinct pedicel, the fourth slightly shorter than the third; the fifth, sixth, and seventh are rather broadly articulated, while the seventh, eighth and ninth form a more or less complete whole; which is characteristic of the genus. A single sense cone near the distal end of the fifth segment ventrally, and another similarly situated on the sixth segment.

Prothorax shorter but wider than the head, its hind angles square. A very short, stout, curved spine at each front angle. A long spine just anterior to each hind angle and a small curved one at the hind angle. Two pairs of comparatively stout spines on the hind margin, each pair being close together. Legs dark with the outer half of the tibiae and all the tarsi a little lighter. The wings are reduced to small white pads.

The abdomen is stout, no long spines except on the last two segments where they are pale brown in color.

As there is but one species of this genus recorded from North America, the characters in the key separate this species from all other Aeolothripidae. This species was collected from grass 25 May, 1913, on the Coast at Bognor, Sussex, England.

The record of this species from the state of Oregon is extremely interesting as it represents the first time it was taken in the western

hemisphere and the only specimens in existence in addition to the type which is deposited in the Hope Department of the Oxford University Museums. The specimens collected in 1934 were discovered by the writer while examining miscellaneous preserved accessions in the Oregon State College collection in 1945. However, the first official report of this species is the 1936 record listed below. These specimens were sent to the United States National Museum and were determined by Floyd Andre.

Oregon Records:-

Albany, 12 April, 1940. Coll. R. L. Post on volunteer oats.

Corvallis, 22 March and 17 April, 1934. Coll. F. Hinman. Swept from grass.

Corvallis, 8 April, 1936. Coll. Geo. Ferguson on grass.

Corvallis, 15 April, 1936. Coll. Geo. Ferguson and Bud Crowell on reed canary grass and tall oat grass.

V. Genus ANKOTHRIPS Crawford

1909, Crawford, D. L. Some New Thysanoptera from Southern California.

Pomona College. Journal Ent. 1:(4) 100-108.

Genotype A. robustus Crawford

Head usually wider than long, produced in front between eyes, normally with series of three postocular spines; eyes prominent, protruding in front, ocelli developed in both sexes. Maxillary palpi 3-segmented. Labial palpi 2-segmented. Antenna 9-segmented; all segments freely movable, segment III drawn out into a process at end; sense areas on III and IV semicircular at tip.

Prothorax transverse, with prominent spines on both anterior and

posterior angles and along posterior margin; fore legs stronger than others, fore tarsus without hooked tooth; wings developed in both sexes, broad, rounded at tips, with two longitudinal veins and three to five cross veins, with regularly placed setae on costa and both longitudinal veins, fringe also present on anterior margin.

Abdomen broadly ovate, terminal spines prominent. Ovipositor curved upward.

Males with or without numerous stout setae or spurs on ninth segment.

12. Ankothrips robustus Crawford. The Robust Thrips. Figs. 13, 14. 1909, Crawford, D. L. Some New Thysanoptera from Southern California. Pomona College. Journal Ent. 1:(4) 100-108.

Females: Average length 1.46 mm. General color dark brown to black.

Head rounded and slightly narrowed anteriorly; with subrectangular projection over insertion of antennae bearing two spines. Cheeks arched. Back of head reticulate with several very long, stout spines around the eyes. Mouth cone reaching five-sixths the length of the prosternum. Antennae brown, concolorous with body; each segment with from six to ten small setae on distal end; small sense areas on segments IV to VII.

Prothorax twice as wide as long and shorter than head. Thorax broadest across mesothorax, metathorax tapering roundly from mesothorax to abdomen. Abdomen ovate; uniform brown.

Males: Somewhat smaller than females. Abdomen very dark brown to black, darker than the thorax; with a broad white intersegmental band

between segments I and II appearing as a white band across the abdomen. Ninth abdominal segment with four very long terminal setae and twenty shorter but very stout spines on dorsal surface. Four very long setae on tip of terminal abdominal segment.

This species was described from Canon near Claremont, California, from specimens taken by J. C. Crawford on California laurel, Umbellularia, and California lilac, Ceanothus. This species is generally distributed over California and has been taken on various hosts as squaw carpet, viburnum, and sweeping grass and clover.

#### Oregon Records:-

Forest Grove, 25 May, 1927. Coll. S. E. Keen.

Portland, 12 June, 1940. Coll. Joe Schuh from white clover heads.

#### VI. Genus OLIGOTHRIPS Moulton

1933, Moulton, D. Oligothrips oreios, A New Genus and Species of Thrips Belonging to the Family Opadothripidae Bagnall. Pan-Pacific Ent. 9:(3) 139-140.

#### Genotype O. oreios Moulton

Head wider than long, with two or three prominent setae on cheeks and behind eyes; eyes and ocelli well developed. Maxillary palpi with three; labial palpi with two segments. Antennae 9-segmented, all freely movable sense cones on III and IV lanceolate, two-segmented, short.

Prothorax longer and wider than head, with prominent spines on anterior and posterior angles and along posterior margin. Fore tarsus with a hook-shaped tooth. Wings broad at base, reduced gradually and pointed at tips, with two longitudinal veins which like costa, have

regularly placed spines; fringe developed on both anterior and posterior margins.

Abdomen elongate, with spines at each posterior angle of segments.

Ovipositor curved downwards.

13. Oligothrips oreios Moulton.

1933, Moulton, D. Oligothrips oreios A New Genus and Species of  
Thrips Belonging to the Family Opadothripidae, Pan-Pacific  
Ent. 9:(3) 139-140.

Length 1.0 mm. Color of body, antennae, and legs dark brown, with antennal segment III, fore tibiae, and tarsi yellowish; wings light brownish; crescents of ocelli orange.

Head with a pair of small setae behind each ocellus and a series of four behind each eye, the second and fourth longest. Antennal segments III and IV elongate ovate, only slightly enlarged toward tips, not conical or cylindrical; sense cones on these segments lanceolate, two-segmented, short.

Prothorax with setae on anterior angles directed forwards; a series of seven on either side along posterior margin, one and three on angles longest, inner pair (six and seven) with base of seven close but anterior to six. Wings broad at base, otherwise long, narrow, pointed at tips; costa with 28 setae and well developed fringe, fore vein with 21 and hind vein with 17 regularly placed setae.

Posterior margin of abdominal segments, including eighth, without fringe hairs.

This species was described from 9 specimens taken in blossoms of Madrone and Manzanita at Grass Valley, Nevada County, California, April

1932 by Dudley Moulton.

Oregon Record:-

Corvallis, 15 March, 1936. Coll. by Lapon on manzanita bloom ( in collection of Floyd Andre).

VII. Genus HELIOTHRIPS Haliday

1836, Haliday, A. H. An Epitome of British Genera in the Order Thysanoptera with Indications of a Few of the Genera. Entomological Magazine 3: 439-451.

Genotype Thrips haemorrhoidalis Bouche, 1833

Body, especially the head, prothorax, mesa and metanotal plates and sides of abdomen with prominent reticulated sculptoring.

Head wider than long, angular in front, cheeks roughened. Eyes prominent, protruding in front; ocelli present in both sexes. Maxillary palpi 2-segmented. Antennae 8-segmented, II broadest, intermediate segments elongate, style 2-segmented with terminal segment long and needle-like; III and IV each with one simple sense cone.

Prothorax shorter and broader than head, without prominent setae on angles. Legs moderately stout, fore tarsi unarmed. Wings broad in basal fourth, then narrowed and with parallel sides, rounded at tips; fore being fused with costa before middle of wing, hind vein enlarged and placed near posterior margin; major setae scattered, reduced and inconspicuous; fringe hairs wanting on basal third of wing.

Abdomen elongate, ovate, terminal hairs short; ovipositor curved downward.

14. Heliothrips haemorrhoidalis (Bouche) The Greenhouse Thrips. Fig. 16

1833, Bouche, P. F. Thrips haemorrhoidalis Naturgesch. d. Schädlichen und Nutzlichen Garten-Insecten.

1836, Heliothrips haemorrhoidalis (Bouche) Haliday, A. H. Entom.

Mag. 3: 443.

The female averages 1.23 mm. in length. Head and thorax dark brown; abdomen yellowish brown with the last two segments abruptly brownish yellow. Entire body and legs have reticulating thickenings which are heaviest on the head, thorax, and anterior sides of the abdomen. These reticulations give the head and thorax a serrated appearance in outline.

Head one-fourth wider than long; very rough. Dorsal surface of head bears a few small spines, the bases of which according to Hinds ('02), "appear like small air bubbles in the angles of reticulations". Eyes protruding three ocelli situated on the sides of an elevation between the eyes, pale yellowish.

Antennae twice as long as head. Second segment enlarged and bowl shaped; others slender and pedunculate; eighth is very slender, tapering and bears a very slender bristle at its tip. Color of I and II brown, III to V clear pale yellow; VI yellow in basal third and distally abruptly brown; VII and VIII pale gray. Spines upon antennal segments transparent, one especially long spine situated upon the outer angles of III and IV and inner angle of VI. Segments III to V slightly annulated.

Prothorax anteriorly transverse, three-fourths as long as head, but nearly twice as wide as long; rounded at the angles, sides slightly concave. Reticulation heavy, interrupted at middle. Mesothorax one and

one-fourth times wider than prothorax. A prominent metanotum that is triangular and strongly reticulated. Wings slender not attaining tip of abdomen; broadened abruptly at base. Anterior fringe very short and sparse; posterior long and heavy; no prominent spines on veins.

Abdomen ovate, elongated and pointed at tip. The dorsum is reticulated and with segments II to VIII with an irregular transverse brown line near anterior border of each.

Male: In spite of its abundance and the intensive studies made on this species the male was never found until described by Crawford (1940).

(Macropterous). Length 1.22 mm. Very similar to female in general structure and sculpture. Three basal segments of abdomen (except lateral margins of three) light brown, remaining abdominal segments yellowish; ninth abdominal tergite with a pair of discal bristles, a pair of postangulars and a pair of short, more or heavily thickened post marginals, all light yellow; mesocephalad of the post marginals, two pairs of thorn-like spines, one pair placed directly behind the other; of these two pairs the anterior pair is the heavier and longer, brown and pedicellate. Depressed areas on ventral abdominal segments II to VI, transverse, brown, and contrasting with the surrounding yellow. These depressed areas are successively shorter.

The Male was described from one specimen taken with one female from the calyx end of a Eugenia fruit from Santa Marta, Colombia. Collected at the Port of New York, April 5, 1939, by Mr. A. O. Plummer.

It is of interest to record that Fields and Crawford took this species on both rhododendrons and azaleas in the open at Sunken Meadows,

Long Island, N. Y., September 9, 1935, on an estate where it seemed unlikely that the species had become only established that year as there were no greenhouses.

This species is a greenhouse pest in many parts of the United States. It is a tropical and semitropical species which lives out-of-doors in warm and temperate regions and in greenhouses in less favorable areas. As far north as Redwood City, California, it overwinters outside and adults were taken at Redwood City, California, 2 March, 1946, by Dudley Moulton and R. L. Post on Oregon grapes and Christmas berry. In California, although taken in greenhouses, it is more often found outside on ornamental trees and shrubs including apple, avocado, azalea, calla lillies, fuschia, laurel, palms, and many others.

It is almost cosmopolitan and occurs in Europe, Asiz, South Sea Islands, and throughout North America. In Germany it is called "The Black Fly".

#### Oregon Records:-

Corvallis, 5 December, 1907, Coll. by Aura Thomson on fern in Greenhouse. Also on same date by Evaline Newkid in College Greenhouse. From 1905 to 1909 it is recorded from College Greenhouse from student collections.

Eugene, 15 January, 1934. Coll. by L. A. Reup on azalea.

Gresham, 29 June, 1945. Coll. J. Schuh on rhododendron seedlings.

31 August, 1945. Coll. J. Schuh on azalea in Greenhouse.

Portland, 26 March, 1940. Coll. R. L. Post on camellia.

8 November, 1942. Coll. J. Schuh on azalea in Greenhouse.

VIII. Genus HERCOTHRIPS Hood

1927, Hood, J. D. New Tropical Thysanoptera Collected by C. B.

Williams. Psyche 24:(6) 230-246.

Genotype Heliothrips striatus Hood, 1913

Body with head, thorax and sides of abdomen strongly reticulate or reticulate-striate.

Head wider than long, raised angularly in front, slightly constricted behind eyes, without prominent setae. Eyes distinctly protruding, pilose; ocelli approximate, placed on elevated vertex.

Maxillary palpi 2-segmented. Antennae 8-segmented, II broadest, III and IV constricted at either end and each with a forked trichome, VI to VIII closely united, VIII long and slender.

Prothorax strongly transverse, shorter than head, without strong setae. Legs moderately small and slender, hind coxae approximate, tarsi unarmed. Wings moderately stout, broader at base, reduced gradually to pointed tips; longitudinal veins often united with ambient vein; costa with regular series of setae equal in length to anterior fringe, posterior vein with several more or less regularly placed spines.

Abdomen rather broadly joined to thorax, with setae at posterior angles of segments and at tips.

Ovipositor curved downward.

15. Hercothrips fasciatus (Pergande) The Bean Thrips. Fig. 17.

1895, Heliothrips fasciata Pergande, The Observations on Certain Thripidae. Insect Life 7: 390-395.

1902, Heliothrips fasciatus Perg. Hinds, W. E. North American Thysanoptera. Prox. U.S.N.M. 36: 79-242.

- 1904, Caliothrips woodworthi Daniel S. M. New California Thysanoptera. Ent. News 15: 293-297
- 1907, Heliothrips fasciatus (Perg.) (=Caliothrips woodworthi Daniel) Moulton, D. Contribution to Our Knowledge of the Thysanoptera of California. U.S.D.A. Bur. Ent. Bul. Tech. Ser. 21: 23.
- 1927, Hercothrips fasciatus (Perg.) Hood, J. D. New Tropical Thysanoptera. Collected by C. B. Williams, Psyche 24: (6) 230-246.

Female: Length 1 mm. Body faintly reticulated. General color uniformly dark brown.

Head with anterior margin depressed at insertion of antennae; color uniformly dark brown. Eyes small, black, and not protruding; ocelli yellowish margined with a reddish tinge. Antennae two and one-half times longer than head. Segment I cylindrical; II rounded and wider than long; III and IV are modioliform; V is pedunculate and broadly cut off distally; VI is constricted at base and truncate distally; VII is almost cylindrical; VIII elongate and tapers distally, bearing one very long slender hair at tip that is as long as the segment itself. Segments I and II dark brown; III and IV with an indistinct light brownish ring around center of enlargements; basal half of V pale yellowish and rest of antennae brown. Setae around middle of segments III and IV and on two-thirds of V long, dark and conspicuous.

Wings present extending to tip of abdomen; two longitudinal veins, the second branching from the first near the broadened base; the fore vein then inclines toward the costal and runs contiguous with it to the tip of the wing; hind vein closely parallels hind edge. Wings grayish

brown being darker along veins; fore wings pale at base and with a pale band at three-fourths their length, the veins in these pale areas dark brown. Veins darkest brown on the distal terminal border. Femora and tibiae dark brown except distal ends of femora; both extremities of tibiae pale yellow; tarsi yellowish, brown at tips; hind tibiae bearing stout spines at their tips.

Abdomen broadly ovate and pointed at tip. Color uniformly dark brown; last two segments somewhat lighter.

The first record of this thrips is in 1895 when two specimens were collected in Yuba County, California, in November, 1894, by G. W. Harney on an orange leaf. It was on these specimens that Pergande's original description was based.

Bailey ('33) who has studied the life history and biology of this pest in California reports that the larva has two stages, moulting but once on the host. Upon maturing, the larva drops to the ground and seeks a suitable niche in the soil in which to pupate, the depth of penetration depending on the type and structure of the soil. Both the prepupal and pupal stage is mobile but takes no nourishment. The method of reproduction is both sexual and parthenogenic; fertilized eggs produce females and unfertilized eggs males. The normal sex ratio of females to males is 2 to 1. Winter is passed in the adult stage. In California on the undersides of leaves of plants remaining green. In Oregon the writer found this species overwintering on Mullein.

The distribution records include Brazil, China, Mexico and generally distributed throughout the United States and Canada. The host list includes many native plants and crops. The favorite wild host is

prickly lettuce, Lactuca scaricola, and the crops most commonly injured are beans, cotton, and pears.

Oregon Records:-

Corvallis, 4 January, 1928. Coll. Don C. Mote on Sunkist oranges.

The Dalles, 11 August, 1943. Coll. Joe Schuh on leaves of Clematis ligusticifolia.

Warren Creek, Columbia River Highway, Vic. Lindsay, 31 January, 1946.

Coll. R. L. Post on 1 yr. Mullein plants, Verbascum thapsus.

IX. Genus HERCINOTHRIPS Bagnall

1932, Bagnall, R. S. Annal. and Magazine Nat. Hist. 10: Ser. 10, p. 506.

Genotype Heliothrips bicinctus Bagnall

Body with head and thorax strongly reticulate or reticulate-striate.

Head wider than long, raised angularly in front, constricted behind eyes and at neck, with interocellar setae and a series of two or three behind each eye with a more or less distinct collar posteriorly before basal constriction. Eyes prominent, protruding; ocelli approximate, placed on elevated vertex; maxillary palpi 2-segmented. Antennae 8-segmented, II broadest, III to V elongate, constricted at either end and each with a forked trichome, VI to VIII closely united, VIII long and slender.

Prothorax strongly transverse with lateral margins apparently explanate; with several strong setae, a median pair near anterior margin, a series of about six across middle and a lesser series of four nearer posterior margin. Legs moderately slender, hind coxae approximate, tarsi unarmed. Wings moderately stout, broader at base, reduced

gradually to pointed tips; fore vein fused with costa over entire length, posterior vein approximate to hind margin; fused costa and fore vein with two regular series of setae and a fringe much longer than setae, hind vein also with a regular series of setae.

Abdomen elongate-ovate, surface more or less strongly reticulate, with setae at posterior angles of segments, which are longest on segments IX and X. Ovipositor curved downward.

This genus is very close to Hercothrips Hood but separated by the collar of the head, the explanate lateral margins of prothorax, the double series of setae on fused costa and fore longitudinal veins and by the more slender intermediate antennal segments.

16. Hercinothrips femoralis (Reuter) The Sugarbeet Thrips. Fig. 18.

1891, Heliothrips femoralis, Reuter, O. M. Meddal. af. Societas pro Fauna et Flora Fennica 17: 161-167.

1932, Hercinothrips femoralis (Reuter) Bagnall, R. S. Annal and Magazine Nat. Hist. 10: Ser. 10, p. 506.

Length 1.3 mm. General color dark brown to yellowish brown, lighter at extremities. Entire surface of body weakly but plainly reticulated.

Head with anterior margin depressed at insertion of antennae; vertex carinated; bases of antennae separated by a prominence as high and nearly as wide as first antennal segment. Two transverse wrinkles near back of head more prominent than others; spines upon the head scattered and minute. Eyes large, protruding anteriorly, coarsely granulated; eyes and margins of ocelli bright red by reflected light; ocelli placed on top and front of a distinct elevation between the eyes.

Antennae about three times as long as head; segment I cylindrical, three-fourths as broad as II, which is barrel shaped. The remaining segments are narrower and more elongate; three and IV fusiform; V and VI broader distally, VII and VIII cylindrical with the terminal segment slender and elongated and pointed at tip. Segments I and II light brown; III to VI light yellowish brown; VII and VIII light brownish-yellow.

Prothorax transverse anteriorly, one-fifth wider than head and twice as wide as long, sides rounded; without large spines. Mesothorax with prominent anterior angles with mesonotum having a deep incision on its posterior margin. Metanotum with four spines standing in a square near its center. Wings grayish brown; three lighter cross bands, one across base before branching of veins, another three-fourths length of wing and the third across the tip. The legs with all tibiae, tarsi, and fore femora yellow; middle and hind femora brown with the tips shading to yellow. Spines upon the legs small except on inner side of hind tibiae.

Abdomen ovoid, conical at tip. Color yellowish to dark brown; last two segments yellow but shading to brown at posterior margins.

This is a widely distributed species first recorded on sugar beets in Europe and on sugar cane in Puerto Rico. It occurs throughout the United States and has been taken on many host plants including begonia, cotton, gardenia, grape, hydrangea, sweet potato, string beans, etc. It has also been reported from Santo Domingo and East Africa.

Although known to be injurious out-of-doors where it is a pest of minor importance to sugar beets, this species is primarily a greenhouse pest in this country. The injury as evidenced by the silvering,

blotching and drops of excrements resembles that of the Bean Thrips and Greenhouse Thrips, Bailey (1938) states that the Sugarbeet Thrips transmits bacterial disease of beans.

Oregon Record:

Corvallis, 24 January, 1943, on sugar beets.

X. Genus CHIROTHRIPS Haliday

1836, Haliday, A. H. An Epitome of British Genera in the Order Thysanoptera with indications of a few of the Genera. Entomological Magazine 3: 439-451.

Genotype Thrips manicatus Haliday, 1836

Head small, body thickened. Head produced angularly in front of eyes; eyes flattened on sides of head, cheeks reduced; ocelli wanting in the male. Antenna 8-segmented, approximate at base, segment II usually drawn out on outer angle, intermediate segments moderately compact, sense cones on III and IV usually simple, sometimes forked. Maxillary palpi 3-segmented.

Prothorax with sides expanded posteriorly, with or without spines on posterior angles. Legs short, fore pair thickened, tarsi unarmed. Wings long and slender, with two longitudinal veins bearing a few small setae; fore fringe developed. Wings occasionally wanting; especially in the males.

Abdomen elongate-elliptical, pointed at end; ovipositor curved upward.

Species of this genus are usually found associated with various grass plants where they may be frequenting the heads, often in large numbers.

## Key to Species.

1. Process at tip of second antennal segment without a strictly terminal seta. ----- 2
- Process at tip of second antennal segment with a strictly terminal seta. ----- 3
2. Four minor setae anterior to ocelli, fig. 19. -----  
----- aculeatus Bagnall.
- Two minor setae anterior to ocelli, fig. 21. ----- moultoni n.sp.
3. All antennal segments uniformly dark brown, fig. 20. -----  
----- manicatus Haliday.
- Antennal segments II and III light yellow and much lighter than rest of antennae.----- manicatus form pallidicornis Priesner.
17. Chirothrips aculeatus Bagnall Fig. 19

1927, Bagnall, R. S. Contributions towards a Knowledge of the European Thysanopera. Ann. Mag. Nat. Hist. 19:(9) 564-575.

Length 1.4 mm. Color dark brown with abdomen light brown; tarsi yellowish brown.

Bagnall's description of this species is as follows, "Readily separated from similis by the long pointed end of the abdomen. The costal setae of the fore wing are very noticeably longer than in similis. Priesner records it from Austria, and Hungary, whilst I have found it in Italy, and Southern France; Moulton has taken it in North America. Navas has sent it to me from Spain."

This species is easily separated from manicatus as the process at the tip of the second antennal segment is without a strictly terminal seta. The setae at the posterior angles of pronotum are 40-60

microns long.

No males are available and a condensation of Andre's (1939) description follows: Male averages .97 mm. Color brownish and paler than female.

Head with total median length about equal to width. Eyes .5 as long as head. Ocelli wanting. Antennae much as in female, but with second segment much less produced and without a seta at extreme outer apex. Mouth cone extending 100 microns beyond posterior dorsal margin of head.

Prothorax 1.2 as broad as long and 1.8 as long as head; setae at posterior angles 30-40 microns. The sculpturing on pronotum is in smooth lines, not broken into scallops. Wing pads small 39 microns long.

Abdomen with glandular areas on sterna III - VIII dome-shaped with basal portion toward anterior end, rather large, that on III about 76 microns across and 46 microns long. Lateral setae on segment IX of abdomen about 92 microns. The specimens on which the description is based were collected at Davis, California, on wheat heads, 8 June, and at Gilroy, California, on tomato, 14 July, 1936, by S. F. Bailey.

Williams (1914) and Morison (1928) have both questioned the validity of C. similis Bagnall. They believe that it is synonymous with manicatus Haliday.

#### Oregon Records:-

Corvallis, 8 April, 1936. Coll. Geo Ferguson on grass.

Columbia River Hwy., Warren Cr., vic Lindsay, 31 January, 1946. Coll.

R. L. Post hibernating in dead blossoms of bull thistle.

Pitblado Ranch, 3 mi. S. Hood River, 31 January, 1946. Coll. by R. L. Post and Henry Pitblado. Hibernating in corn tassels and pigweed blossoms, Amaranthe.

18. Chirothrips manicatus Haliday. Fig. 20.

1836, Haliday, A. H. An Epitome of the British Genera in the Order Thysanoptera with Indication of a few of the Species.

Entomological Magazine 3: 439-451.

1838, Thrips longipennis Burmeister, H. Handb. d. Entomologie 2: 404-418.

1883, Chirothrips antennatus Osborn H. Notes on Thripidae with Descriptions of New Species. Canadian Ent. 3: 154.

Female: Length 1 mm. General color quite uniform dark yellowish-brown.

Head somewhat shorter than wide, almost conoid in shape, frequently hidden up to the eyes in the prothorax; prolonged into a triangular process in front of the eyes; a row of four small spines across the head between the front edges of the eyes and one small spine on each side of the anterior ocellus. Eyes large, black, rather coarsely faceted; ocelli almost white or pale yellowish with heavy maroon crescentic inner margins; placed in a low triangle far back between hind half of the eyes. Antennae uniformly dark brown with basal segments very broad and almost contiguous; II drawn out into a short blunt angle on outer side, process at tip of second segment without a strictly terminal seta; III and IV bear each a very stout, blunt sense cone on outer angle.

Prothorax dotted with numerous very small setae and marked with

tranverse, arched wrinkles, giving it a scaly appearance; numerous small spines on posterior border with two much longer spines at the posterior angles; these spines at posterior angles 30 - 40 microns in length.

Male: Length .83 mm. Antennal segments II and III pale yellowish; II with a small seta at extreme outer apex.

Sculpturing on pronotum in distinct prominent scallops. Wings lacking.

Abdomen more narrow than in female and bluntly rounded at tip. Ninth segment very large and tenth segment retracted therein; ninth with a short stout spine on each side of the hind edge above; genital apparatus protruding beyond the tip of tenth segment.

Although C. manicatus appears abundantly in the heads of timothy in some sections of this country almost every year, but slight damage so far has been attributed to it in North America. Andre (1939) states that very little is known on the biology of members of this genus in North America. Andre reports that he collected overwintering females from leaf mold, grass sod, and moss. So far no males have been found in the winter months, but often the males of some species appear in numbers late in the summer.

The unique record of a thrips on a bird was obtained by W. J. Chamberlin while combing feathers of recently killed birds in a study of Mallophagan parasites. For several years this specimen was placed with the unclassified slides of parasites in the OSC collection. In 1939 the author noticed the unusual record while rearranging the slide collection and forwarded the thrips to Dr. Andre for determination.

This is apparently the first record of a thrips as an incidental guest of birds.

This species has been recorded from England, Germany, Finland, Russia and various localities in North America from flowers of various grasses and cereals, clover, and wild carrot.

Oregon Records:-

Albany, 3 May, 1941. Coll. Joe Schuh on large camass, Camassia leichtlinii.

Bonneville, U. S. Coast Guard Base, 31 January, 1946. Coll. R. L. Post. Hibernating in dead flowers of western syringia, Philadelphus lewisii.

Bruce Station, 17 February, 1946. Coll. Leah J. and R. L. Post from dead flowers of hardhack, Spiraea douglasii.

Corvallis, 16 September, 1919. Coll. W. J. Chamberlin from feathers of short ear owl.

Corvallis, 23 April, 1942. Leah J. and R. L. Post from flowers of red sorrel, Rumex acetosella.

Forest Grove, 5 May, 1927. Coll. S. E. Keen from Douglas fir needles, Pseudotsuga taxifolia.

Gresham, 29 May, 1940. Coll. Joe Schuh on ninebark, Physocarpus capitatus.

Hood River, Pitblado Ranch, 31 January, 1946. Coll. Henry Pitblado and R. L. Post hibernating in dead panicles of orchard grass, Dactylis glomerata and dead flowers of red sorrel, Rumex acetosella.

Portland, 15 May, 1940. Coll. Joe Schuh from unopened buds of Vicia sp.

Portland, 12 June, 1940. Coll. Joe Schuh from white clover heads,  
Trifolium repens.

Rickreall, 31 May, 1940. Coll. Joe Schuh on spikes of lupine.

19. Chirothrips manicatus form pallidicornis Priesner.

1926, Priesner, H. Die Thysanoptern Europas 1: 1-242.

Length about 1.5 mm. Color dark yellowish-brown.

Priesner in his description of this form states that the antennae are clearer than in the typical form. The distal two-thirds of antennal segment II and all of III are light yellow and distinctly lighter than the remaining segments. This species is found on grasses in Germany.

The Oregon records are the first reports of its occurrence outside of Europe. The hibernating specimens were secured by means of a Berlese funnel.

Oregon Records:-

Corvallis, 17 January, 1946. Coll. by K. Hobbs and R. L. Post from dead panicles of orchard grass, Dactylis glomerata.

Pitblado Ranch, 3 mi. S. Hood River, 31 January, 1946. Coll. by Henry Pitblado and R. L. Post from dead panicles of orchard grass, D. glomeratus.

20. Chirothrips moultoni new species. Fig. 21.

Type female: Head, thorax and the last two abdominal segments blackish brown, abdominal segments brown shading darker toward apical end; antennae and legs blackish brown with third segment a shade lighter and fore tarsi yellow, middle and hind tarsi brown; fore wings uniformly brown with a cleared area near base, lower wings brown only

at extreme base otherwise clear.

Measurements: Total length with abdomen distended 1.89 mm.; head length 0.133 mm.; width across cheeks 0.118 mm.; length of cheeks 0.036 mm.; length of head projection anterior to eyes 0.016 mm.; thorax median length 0.226 mm., width near anterior margin 0.140 mm., near posterior margin including coxae 0.260 mm.; inner setae on posterior angles of prothorax, 43, outer 43 microns.

Head clearly longer than wide and distinctly produced in front of eyes, this projection from eyes to outer bases of antennae somewhat less than half the length of cheeks; broadly angular in front; eyes occupying approximately two-thirds the side of the head; posterior ocelli placed contiguous with posterior, inner angles of eyes; ocellar setae placed directly on a line passing through anterior ocellus; with only two minor setae anterior to ocelli; antenna with second segment produced, with blunt, not pointed tip and without terminal setae; segments III to VI broadly ovate, with simple sense cones. Thorax and body typical of the genus, with fore legs only slightly enlarged; fore wings with 3-4 basal, 1 median and 2 apical setae, lower vein with 5 widely spaced setae.

Terminal abdominal segments pointed much as in aculeatus.

Type Material:- Type female and one female paratype taken at Pitblado Ranch, 3 miles south of Hood River, Oregon, 31, January, 1946, by the writer from dried blossoms of pigweed, Amaranthe. Paratype deposited in collection of Dudley Moulton at Redwood City, California.

This species is most closely related to C. productus Hood known from North Dakota but immediately separated by its darker color and the

lesser number of minor setae anterior to ocelli; there being only a single pair in this new species, but five pairs in productus.

XI. Genus LIMOTHRIPS Haliday

1836, Haliday, A. H. An Epitome of British Genera in the Order Thysanoptera with Indications of a few of the Species. Entomological Magazine 3: 439-451.

Genotype (not selected) Haliday

Head large, as long or longer than wide, constricted and slightly produced in front of eyes; cheeks longer than eyes, slightly arched; only interocellar spines moderately long. Eyes flattened, only slightly rounded in front, occupying nearly the anterior half of sides of head; ocelli small. Antenna 8-segmented, sense cones on III and IV simple or forked. Maxillary palpi 2-segmented.

Prothorax shorter and only slightly wider than head, only one prominent spine on each posterior angle. Legs moderate, fore femora somewhat enlarged, unarmed. Wings long and slender, with two more or less indistinct longitudinal veins with scattered small and delicate spines; anterior fringe developed. Males without wings.

Abdomen elongate, last segment pointed; long spines on terminal segments only; either segment IX or X set with thorns.

Both of the species listed have been introduced from Europe.

Key to Species.

1. Antennal segments normal in form, fig. 22. --- cerealium Haliday.
2. Antennal segment III drawn out into a prominent, acute triangular process on the outer angle, fig. 23. ----- denticornis Haliday.

21. Limothrips cerealium Haliday. The Cereal Thrips. Fig. 22.

1836, Haliday, A. H. An Epitome of the British Genera in the Order Thysanoptera with Indication of a Few of the Species. Entomological Magazine 3: 439-451.

1902, Limothrips avenae Hinds, W. C. Contribution to a Monograph of the Insects of the Order Thysanoptera Inhabiting N. A. Proc. U. S. Nat. Mus. 26: 79-242.

Length 1.2-1.4 mm. Color light yellowish-brown.

This species is included as it undoubtedly occurs in Oregon. In the middle west it is called the "Oat Thrips". It is common and generally distributed throughout the United States and is found on grass, onion, rye and wheat heads. Moulton and Andre (1936) record it from Iowa as hibernating in leaves in December. The Cereal Thrips is a species of minor economic importance and causes no damage in the far west, probably because of the long, hot, dry season following harvest and the practice in some areas of burning the stubble. This species also occurs in Europe, North Africa and the Hawaiian Islands.

Before entering the armed forces the writer had tentatively identified preserved specimens collected near Corvallis in the spring of 1940 on grass as L. cerealium. This series was among those specimens rendered worthless from the long period in preserving solution during the war. Therefore, no Oregon specimens are in existence. Mr. Moulton assured the writer that early collecting on grasses or grain will undoubtedly result in obtaining this species from Oregon.

22. Limothrips denticornis Haliday. Figs. 23, 24, 25.

1836, Haliday, A. H. An Epitome of the British Genera in the Order

Thysanoptera with Indication of a Few of the Species.

Entomological Magazine 3: 439-451.

Length about 1.3 mm. Color dark brown with thorax orange-brown.  
Fore tibiae and all tarsi light yellowish-brown.

This species occurs throughout Europe. In the United States it is recorded from Iowa, hibernating in Andropogon furcatus and sod and from New York.

Oregon Record:-

Hwy. 99-W, 12 mi. S. Corvallis, Oregon, 17 February, 1946. Coll. M. Ross, Leah J. and R. L. Post. Hibernating in robin's nest and several specimens taken via Berlese funnel.

#### XII. Genus APTINOTHRIPS Haliday

1836, Haliday, A. H. An Epitome of the British Genera in the Order Thysanoptera with Indication of a Few of the Species. Entomological Magazine 3: 439-451.

Genotype Thrips rufa Gmelin, 1788

Body small and slender, clear colored, without conspicuous spines except on abdominal segments IX and X. Head longer than wide, rounded in front, cheeks straight and parallel. Eyes moderately small, ocelli wanting. Maxillary palpi 3-segmented. Antennae 6-8 segmented, III widest, III-V small, VI-VIII closely united and fused together; sense cones on III and IV simple.

Prothorax narrow, without conspicuous spines; legs short and thick, tarsi unarmed; wings lacking.

Abdomen long and narrow, without conspicuous spines or markings.

23. Aptinothrips rufus (Gmelin). The Rufous Thrips. Fig. 26.

1788, Thrips rufa Gmelin, J. F. Caroli a'Linne Syst. Naturae  
13th Ed., 1:(4) 2222-2224.

1836, Aptinothrips rufus (Gmelin) Haliday, A. H. An Epitome of  
the British Genera in the Order Thysanoptera with Indication  
of a Few of the Species. Entomological Magazine 3: 439-451.

Length 1.06 - 1.30 mm. Color clear pale lemon yellow except tip of  
antennae, mouth parts, and tip of abdomen shaded with brown.

No spines upon abdomen except segments IX and X; these are short  
and slender and stand out nearly perpendicular to the surface upon which  
they are borne.

Aptinothrips rufus is the only NorthAmerican representative of  
this genus and is a very abundant grass inhabiting species. Two forms  
occur. One (forma stylifera Trybom) has eight-segmented antennae, while  
in the other the last three segments are completely fused, thus producing  
an antennae of six segments. The evidence seems to indicate that the  
two forms breed true, and that they have a different seasonal distribu-  
tion. The typical form is more abundant than the other, and both have  
a wide distribution in the Nearctic and Palaearctic realms.

#### Oregon Records:-

Corvallis, 4 December, 1945. Coll. Leah J. and R. L. Post from lichen  
on oak via Berlese funnel.

Corvallis, 5 December, 1945. Leah J. and R. L. Post from moss on oak  
via Berlese funnel.

Corvallis, 7 January, 1945. L. G. Gentner and R. L. Post hibernating  
in Scotch pine cones on OSC campus.

Sandy River, 3 mi. E. of Troutdale, 30 January, 1946. Coll. R. L. Post.

Hibernating on leaves of mullein, Verbascum thapsus.

XIII. Genus SERICOTHRIPS Haliday

1836, Haliday, A. H. An Epitome of the British Genera in the Order Thysanoptera with Indication of a Few of the Species. Entomological Magazine 3: 439-451.

Genotype S. staphylinus Haliday

Body, especially sides of abdomen, covered with microscopic hairs or pubescence.

Head and thorax often with well developed cross wrinkles. Head very broad, constricted posteriorly, with an extension between the eyes upon which the antennae are placed; interocellar and postocular setae present. Eyes relatively large; ocelli sometimes small. Maxillary palpus 3-segmented. Antennae 8-segmented, with forked sense cones on III and IV.

Prothorax with long spines on posterior angles and with other spines on dorsum and along posterior margin. Legs moderately stout, fore tarsus unarmed. Wings either well developed or rudimentary in both sexes. When present, fore wings broadened at base, strongly narrowed, pointed at tip, with only one longitudinal vein which usually has regularly placed setae over its entire length; both setae and fringe present on fore margin.

Abdomen moderately massive, with a transverse series of setae on each tergite, spines at end of abdomen only moderately long; posterior margins of segments with closely placed, comb-like spines.

24. Sericothrips chrysothamni Hood.

1936, Hood, J. D. Nine New Thysanoptera from the United States.

Journ. N. Y. Ent. Soc. 44: 81-100.

Female (macropterous). Length about 1. mm (distended about 1.2 mm).

Color pale, with numerous brown markings; fat body pigmentation of pterothorax and last abdominal segment largely orange colored, of remainder of body whitish yellow (as seen by reflected light), duller and more grayish as seen by transmitted light.

Head pale brown, darkest in the ocellar region, along cheeks, and across back of the head, permitting the whitish internal pigmentation to show through the remaining portions, thus indistinctly encircling the eyes with whitish. Head broadest across eyes, cheeks rounded and slightly converging to base, ocellar area and posterior margin of head elevated, striate with anastomosing lines, the intervening portion forming a smooth transverse groove. Four subequal and nearly equidistant setae in front of median ocellus. Eyes prominent, protruding and pilose. Antennae about 1.74 times as long as width of head across eyes. Segments III and IV each with a short, U-shaped sense cone, that on III about 17 microns long; VI not pedicellate, its two long sense cones attached at sides and forming narrow pale lines, of which the inner originates near the middle of the segment and the outer somewhat beyond. Setae on III and IV and inner dorsal setae on II moderate in size and brownish, the outer dorsal on II minute and pale. Mouth cone extending to base of prosternum.

Prothorax cream-colored by reflected light, with a distinct unbroken, brown, pronotal blotch whose anterior margin is concave and

sharply defined, and whose posterior margin is bilobed. Pterothorax with an orange-yellow cast due to internal pigmentation. The front and sides of mesothorax shaded with dark brown, the metanotum bearing a brown blotch anteriorly which is nearly as wide as the pronotal one, and which is in the form of a transverse hexagon whose posterior side is emarginate and from each of its anterior and posterior angles there radiates a narrow brown spot. Prothorax with the pronotum about .7 as long as width of head across eyes; about 1.7 times as wide as long. The transverse anastomosing lines not prominent, more closely spaced in the area of the pronotal blotch than in front of it and nowhere tending toward reticulation.

Abdomen with last four segments brown or blackish brown, the posterior portions of VII and X having the whitish internal pigmentation. Abdomen pubescent, although lacking from median portions of terga I - V, excepting the extreme base of IV and V. Major abdominal setae brownish yellow.

Male (macropterous.) Length .78 mm. (distended .95 mm). Color and structure almost as in female, except that segment VII of abdomen is pale like VI. Abdomen more slender than in female.

The coloration of this species is highly adaptive. The delicate dorsal sculpture and the microtrichia of the abdomen and wings eliminate all shine, while the internal pigmentation, showing through the paler portions of the integument, aid in giving this insect a general grayish color which renders it almost invisible against the stems of the plant on which it lives.

This species was described from specimens taken at Galice, Oregon,

July 24, 1927, by J. D. Hood on stems and leaves of a species of Chrysothamnus growing in the flood plain of the Rogue River. The writer has not seen this species.

#### XIV. Genus ANAPHOTHRIPS Uzel

1895, Uzel J. Monographie der Ordnung Thysanoptera. 1-472.

##### Genotype A. ferrugineus Uzel

Body as a rule, without conspicuous spines, especially on the prothorax, spines at tip of abdomen usually short and rather stout.

Head about as long as wide or weakly transverse; eyes normal, ocelli often wanting in wingless forms. Maxillary palpi 3-segmented. Antenna 8-segmented in typical form, or 9-segmented when segment VI bears a complete suture.

Prothorax wider than long; legs normal, fore tarsus unarmed. Wings when developed, with two longitudinal veins which are often weak and inconspicuous; setae on longitudinal veins weak and not regularly placed; fringes developed on both margins.

Abdomen with a pair of closely placed spines on tergites II to VIII.

##### Key to Species.

1. Pale species abdomen yellow with segments I, II, and X shaded with light yellowish-brown.----- obscurus (Muller).  
-- Dark species with abdomen and appendages dark chestnut brown. -- 2
2. Thorax and abdomen uniform dark chestnut brown.-----  
----- secticornis (Trybom).  
-- Pterothorax and first abdominal segment clear yellow.-----  
----- secticornis f. bicolor Moulton, (manuscript species)

25. Anaphothrips obscurus (Muller) The Grass Thrips. Fig. 28.
- 1776, Euthrips obscurus Muller, O. F. Zoologiae Danicae Predromus. p. 96.
- 1875, Limothrips poaphagus Comstock, J. H. Syllabus of Course of Lectures Delivered at Cornell University. p. 120.
- 1883, Thrips striata Osborn H. Canadian Ent. 15: 155.
- 1895, Anaphothrips virgo Uzel, H. Monographie der Ordnung Thysanoptera. p. 148.
- 1895, Anaphothrips obscurus (Muller) Uzel, J. Monographieder Ordnung Thysanoptera. 1-472.
- 1902, Anaphothrips striatus (Osburn) Hinds, E. W. North American Thysanoptera. Proc. U. S. N. M. 26: 79-242.
- 1909, Anaphothrips striatus (Osburn) Shull, A. F. Some Apparently New Thysanoptera from Michigan. Ent. News 20: 220-225.
- 1914, Anaphothrips obscurus (Muller) Hood, J. D. On the Proper Generic Names for Certain Thysanoptera of Economic Importance. Pro. Ent. Soc. Wash. 16:(1) 34-44.
- 1923, Anaphothrips obscurus (Muller) Watson, J. R. Synopsis and Catalog of the Thysanoptera of North America. U. of Fla. Agr. Expt. Sta. Tech. Bul. No. 168.

Length varies 1 - 1.6 mm. General color yellow, with dusky or brownish shading.

Head rounded in front; surface back of eyes faintly striated; head yellow with brown posterior border; without long spines. Eyes small, rounded, black or very deep purplish red; ocelli yellow with orange-red margins. Mouth cone sharp and prominently tipped with black. Antennae

apparently nine segmented because of an oblique suture on the ventral surface of the sixth segment about three-fourths its length. Segments I and II rounded; III to VI fusiform; stylus tapering to broad point. Color of I yellow; II light brown; III lighter than II; III to V shading gradually to light brown; VI - VIII dark brown.

Prothorax with sides slightly rounded and without prominent spines. Mesothorax much wider than prothorax; fore angles obtusely rounded. Metathorax tapering gradually to base of abdomen. Wings present in summer generations; reduced to pads in hibernating females; when present as long as abdomen. Veins prominent, darker than rest of wing; bearing indistinct spines. Fringe on anterior margin well developed being nearly half as long as posterior fringe. Fore wings shaded with yellowish gray; hind wings being almost transparent. Legs pale yellow, shaded with light gray or brown above on femora and tibiae and with prominent dark spot at tip of tarsi; stout spines only on inner side and at tip of hind tibiae. Pterothorax darker yellow than rest of body, with row of dark spots on each side close to middle.

Abdomen cylindrically-elongate, widening at first two segments and tapering from eight to tip. Spines on IX and X short and weak but dark and conspicuous; other spines small, pale and indistinct. Abdomen pale yellow; segments I to VII dusky dorsally; X shading to dark brown at tip.

This species is very common on grasses and it is known as the Grass Thrips. It is the common grass and grain infesting species of the eastern states and is responsible for a whitening of the panicle which is known as Silver Top and causes sterility of the seeds of grasses, barley, oats, wheat, timothy, etc. In Montana it is sometimes a serious

pest to cereal crops but as a whole it is classed as a species of minor economic importance.

The Grass Thrips occurs throughout the United States and Europe and is recorded from Ontario and Australia.

Oregon Record:-

Two mi. S. Corvallis, 30 December, 1945. Coll. Leah J. and R. L. Post from moss and lichens on alder via Berlese funnel.

26. Anaphothrips secticornis (Trybom).

1896, Thrips secticornis Trybom F. *Einiger Nue oder Unvollständig Beschreibene Blassenfusse (Physapoda)*. Opv. Vet. Akad. Turh. No. 8, pp. 613-626.

1899, Anaphothrips secticornis Reuter. *Acta. Soc. Fauna Flora Fenn.* 17:(2) 43-44.

1904, Sericothrips apteris Daniel. *Ent. News* 15: 295.

1908, Apterothrips subreticulata Bagnall. *Trans. Nat. Hist. Soc. Northumb. N. S.* 3:(1) 185.

1926, Anaphothrips apteris Moulton. *Pan-Pac. Ent.* 3: 23.

Length about 1.2 mm. distended. Color uniform dark brown. Apterous forms.

Head brown; antennae with segment III often clear, II and IV somewhat lighter than the other segments. Ocelli lacking.

Thorax dark brown with tibiae and tarsi lighter.

Abdomen plump, more broadly ovate and the setae on abdominal segments IX and X darker and stronger than obscurus.

Dr. Trybom described this species in 1896 from specimens taken by himself in Portland and Albany, Oregon and in Russia.

Specimens in the Moulton collection from Canada, Colorado, California, Chile, and European Alps. Dudley Moulton and the writer found this species very common on buttercups at Redwood City, California, on 6 March, 1946.

Oregon Records:-

Carlton, 31 May, 1940. Coll. Joe Schuh on spikes of death camas,

Zygadenus venosus.

Forest Grove, 12 June, 1927. Coll. S. E. Keen on wooly clover, Trifolium eriocephalum.

Portland, 30 May, 1943. Coll. Joe Schuh on flowers of hedge mustard,

Sisymbrium officinale.

Waldport, 27 May, 1943. Coll. Joe Schuh on terminals on beach pea,

Lathyrus maritimus.

27. Anaphothrips secticornis f. bicolor Moulton Manuscript species.\*

Length 1.1 - 1.2 mm. Dark form like the species and separated from the species by having the metathorax and first two abdominal segments clear yellow.

Oregon Record:-

Corvallis, 23 April, 1942. Coll. Leah J. and R. L. Post on common dandelion, Taraxacum officinale.

\* This species was determined March 5, 1946, by Mr. Dudley Moulton who informed the writer that he was describing this form. Mr. Moulton told the writer to use the name in this thesis.

XV. Genus OXYTHRIPS Uzel

1895, Uzel, H. Monographie der Ordnung Thysanoptera. pp. 1-472.

1916, Hood, J. D. A Synopsis of the Genus OXYTHRIPS Uzel. Insecutor

Inscitiae Menstruus 4:(4) 37-44.

Genotype O. ajugae Uzel

Head about as wide as long, cheeks somewhat arched. Eyes normal, ocelli present. Antennae 8-segmented; sense cones on III and IV forked.

Prothorax normal with one long spine on each posterior angle. Legs moderately slender, fore tarsi armed or unarmed. Fore wings with two longitudinal veins, which however, are not prominent; fore veins with several basal spines and three or four scattered distally; setae on hind veins are placed regularly.

Abdomen elongate-ovate, rather noticeably constricted to sharply pointed at the end, with long spines on the terminal segments.

Ninth tergite of male with thorns.

#### Key to Species.

1. Ocelli with light brown crescents; head broadly rounded in front, fig. 29. ----- zeae (Moulton).
- Ocelli with bright red crescents; head not broadly rounded, vertex pointed and projecting between the antennae, fig. 30. ----- 2
2. Color deep orange-yellow; fore tarsus with a small terminal tooth ----- ajugae Uzel.
- Color yellowish brown; fore tarsus unarmed.----- pinicola Hood.
23. Oxythrips zeae (Moulton). Fig. 29

1911, Anaphothrips zeae Moulton, D. Synopsis, Catalog and Bibliography of N. A. Thysanoptera. U. S. D. A. Bur. Ent. Tech. Series No. 21, pp. 1-56.

1946, Moulton, D. In personal conversation advised the writer that the species zeae is a true Oxythrips.

Length 1.1 mm. Color yellow to grayish brown; wings gray.

Head broadly rounded in front. Eyes prominent, slightly protruding, with coarse facets. Ocelli widely separated, with light brown crescents. Head with prominent spines. Mouth cone broad at base pointed and dark brown at tip. Antennae as long as head; segment I yellowish gray; II light brown; III yellowish and transparent at basal half brown distally; IV and others light brown gradually shading to darker brown distally; without conspicuous spines and sense cones. Antennae sometimes almost uniformly dark brown, with segment II darker.

Prothorax as long as head and only slightly wider, with one transparent but prominent nearly straight spine on each posterior angle. Mesothorax largest, sides rounded; metathorax with sides almost parallel but constricted abruptly at the posterior margin; pterothorax darker than rest of body. Wings uniformly brownish gray with small semi-transparent elongate area near base; all veins transparent with spines prominent. Fringe on fore vein weak. Legs uniformly grayish-brown; hind tibiae only armed.

Abdomen cylindrically-ovate; uniformly brownish gray; without prominent spines except on terminal segments; all spines transparent.

Described from San Jose, Fresno, and Lindsay, Tulare County, California. Taken on grasses, leaves and ears of corn.

#### Oregon Records:-

Bruce Station, 17 February, 1946. Coll. M. Ross, Leah J. and R. L. Post from mossy rose gall, Rhodites rosae L. via Berlese funnel.

Corvallis, 17 January, 1946. Coll. K. Hobbs and R. L. Post from dead flowers of bull thistle, Cirisium lanceolatum via Berlese funnel.

Ontario, 18 July, 1940. Coll. H. A. Scullen on yellow sweet clover.

29. Oxythrips ajugae Uzel. Fig. 30.

1895, Uzel, H. Monographie der Ordnung Thysanoptera. pp. 1-472.

Female: Length 1.6 mm. Color deep orange-yellow.

Head with vertex projecting between antennae and bearing two small blunt spines. Ocelli with bright red crescents. Antennae with segments I, II and III yellowish; IV to VIII shading from gray-brown to brown. Segments II and III each bear a small, transparent, circular sense area near their tips.

Prothorax with a long, curved, yellowish spine on each posterior margin.

Male: Length 1.2 mm. distended. Color similar to female.

Head with antennal segments I and II yellowish; III to VIII brown. The sensory areas on antennal segments III and IV are more distinct than with the female.

This species was described from specimens collected in Bohemia on flowers of common bugle, Ajuga reptans, and on pine needles. Additional European records are Austria, British Isles, France, Germany, and Poland from flowers, pine branches, and hibernating in pine stumps. It is very local and scarce and apparently nowhere abundant.

One female of this species was taken at Albany, New York, 9 June, 1927, in the gutter along the roof of the State Museum by Dr. E. P. Felt. It was dead when found. This was the first record of this species from North America (Hood, 1931). The Oregon records are its first occurrence in western North America.

## Oregon Records:-

Corvallis, 8 December, 1945. Coll. Sereno Baldwin and R. L. Post from moss on Douglas fir, Pseudotsuga taxifolia, 160 feet from ground. 1 male and 1 female taken via Berlese funnel.

Corvallis, 17 January, 1946. Coll. R. L. Post from fallen Douglas fir cones via Berlese funnel. 1 male and 1 female.

30. Oxythrips pinicola Hood.

1937, Hood, J. D. On Some Thysanoptera from American Conifers.

Entomological News 48: 74-80.

Female (macropterous). Length about 1.2 mm. Distended 1.5 mm.

Color yellowish brown, somewhat paler anteriorly; the pterothorax with an orange cast, the abdomen overlain with gray.

Head broadest at basal third of cheeks, these tapering to eyes; very slightly narrowed to base. Antennae with segment I pale yellowish and concolorous with tibiae; II slightly darker and shaded with grayish; III a trifle darker than II; IV - VIII yellowish gray-brown, darker than abdomen, IV and V often yellowish basally. Ocellar pigmentation bright red.

Thorax with yellow setae at posterior angles. Fore tarsi not toothed. Fore wings pale yellowish gray, the veins just perceptibly darker; about 32 costal setae pale yellow in color; anterior longitudinal vein eight setae in groups of four each in basal third, 1 at middle and two near tip; hind vein with about nine equally spaced setae.

Abdomen of normal form and structure for the genus; setae on tergum IX brownish yellow.

Male (macropterous). Length 0.92 mm. Fully distended 1.13 mm.

Color light grayish yellow, decidedly paler than in female. The structure essentially the same as in female.

The female holotype and male allotype were described from 10 females and 1 male taken along Elk Creek, near Fraser, Colorado, 7 July, 1927. Coll. J. D. Hood in flowers of Pinus edulis. One female paratype from Crater Lake National Park, Oregon, 21 July, 1927. Coll. J. D. Hood on Ribes cereum Coult., growing among pines.

The writer has not seen this species.

XVI. Genus ODONTOTHRIPS Amy. & Serv.

1843, Amyot, C. J. & Serville, J. G. Hist. Nat. des Insectes, Hemipteres, pp. 9 and 637-646.

Genotype O. ulicis Amy. & Serv.

Head wider than long, flattened in front or only slightly angular between antennae, cheeks straight; interocellar and postocular setae present. Eyes normal, pilose; ocelli present. Maxillary palpi 3-segmented. Antennae 8-segmented, VI with a transparent scale-like sense cone which is broader at the base and adheres closely to the underside of the segment.

Prothorax wider than long, with two long setae on each posterior angle. Legs moderately stout, fore femora thickened; fore tibiae with one or two teeth at the end and on the inside, three rudimentary in some species, fore tarsi sometimes with two small, sclerotized thorns on the inside. Fore wings with two longitudinal veins which together with costa have regularly placed setae; fore fringes on both margins.

Abdomen elongate, with well developed setae along sides and especially long spines on IX and X; tip pointed.

31. Odontothrips loti Haliday. Fig. 31.

1852, Haliday, A. H. List of the Specimens of Homopterous Insects in the Collection of the British Museum, Part IV, p. 1108.

Female: Length 1.33 mm. Color dark-brown except tarsi and fore tibiae which are light brown or yellow.

Head noticeably square in front. Eyes prominent but not protruding; with light inner borders; pigment deep red to black. Ocelli large, separated, orange colored with orange-brown crescents; posterior ones almost contiguous with light borders around eyes. Antennae brown, unicolorous with body, except segment III which is yellow and IV which is light brown. Forked sense cones are found on segments III and IV and a pointed sense scale set in a transparent area near tip of segment VI. Segments III and IV constricted near their tips.

Prothorax larger than head. Mesothorax largest, anterior angles broadly rounded; posterior ones slightly constricted to meet the smaller metathorax. Sides of metathorax almost straight and parallel posterior angles rounded. Legs brown except fore tibiae which are yellow shading to brown on sides, and tarsi which are yellow to light brown.

Abdomen ovate; segments III to VI largest and about equal; VII to X tapering gradually to form the conical tip.

Males: Smaller than females; antennae, legs, and wings with similarly placed spines. Fore femora thickened and fore tibiae armed with teeth. Tip of abdomen with prominent spines; penis upturned. Antennae with segments I and V to VIII brown; segments II, III, and IV

yellow.

This species is recorded from Europe, California, Colorado and Washington from various flowers.

Oregon Records:-

Gresham, 29 May, 1940. Coll. J. Schuh from racemes of crimson vetch, and on same date from lupine, Lupinus sp.

Oak Grove, 29 May, 1940. Coll. J. Schuh from lupine, Lupinus.

Portland, 15 May, 1940. Coll. J. Schuh from unopened buds of Vicia sp.

XVII. SCOLOTHRIPS Hinds

1902, Hinds, W. E. Contribution to a Monograph of the Insects of the Order Thysanoptera Inhabiting North America. Proc. U. S. Nat. Mus. 26: 79-242.

Genotype Thrips sexmaculata Pergande

Body and wings with an unusual number of very long setae.

Head wider than long, angular in front, cheeks small, with both anteocellar and interocellar spines very long. Eyes prominent, ocelli placed well back on head. Maxillary palpus 3-segmented. Antennae 8-segmented, short and rather stout; sense cones on segments III and IV forked.

Prothorax wider than long, with long prominent setae placed as follows: four on anterior margin, one on each anterior angle, one in the middle of either side, two on each posterior angle and posterior margin with three on each side. Legs slender. Fore wings with ring vein and two longitudinal veins, the fore one following very close to costa; costa with small fringe but long, regularly placed spines, the longitudinal veins each with several of these long spines but not

regularly placed. Wings with dark cross bands.

Abdomen normal and with long spines on terminal segments only.

32. Scolothrips sexmaculatus (Pergande). The Six-spotted Thrips.

Fig. 32.

1892, Thrips sexmaculatus Pergande, T. Transactions Acad. Sci.

St. Louis 5: 539. (Manuscript name given as a footnote in a paper by J. C. Duffy on Transformations of a Carabid and Observations on a Coccinellid Enemy of the Red Spider.)

1896, Thrips pallida Beach, A. M. Contributions to a Knowledge of the Thripidae of Iowa. Proc. Iowa Acad. Sci. 3: 214-227.

1902, Scolothrips sexmaculatus (Pergande) Hinds, W. E. A Contribution to a Monograph of the Order Thysanoptera Inhabiting North America. Proc. U. S. Nat. Mus. 26: 79-242.

This species is the only member of the genus found in the United States. As a result of being distinct, due to the spots on the wings and the long bristles it has been easily identified and has few synonyms.

The adult female averages 0.8 mm. in length. Color varies from clear white to orange yellow. With the exception of the first two antennal segments which are pale yellow, the antennae are dusky gray. The eyes are large, dark red to purple.

Each fore wing has three brown spots; the basal one being the scale; the second located one-third the length of the wing from its base, and the third about half way between the central spot and the tip.

This is a beneficial species preying on the eggs and young of

orchard mites, particularly the Brown Mite, European Red Mite, Two-spotted mite and the common red spider. This insect is generally distributed throughout the United States, and in addition is recorded from Africa, Australia, Hawaiian Islands, India, and South America.

Oregon Records:-

Bailey(1939) and Essig (1926) list this species from Oregon. There are no Oregon specimens in the OSC collection. A specimen collected by H. A. Scullen in 1940 at Ontario, Oregon, on clover was ruined in the preserving solution during the war.

XVIII. Genus FRANKLINIELLA Karny

1910, Karny, H. Neue Thysanopteren der Wiener Gegend, Mitteil. d.

Naturw. Ver. an. d. Univ. Wien 8: 41-57.

Genotype intonsa Tryb.

Head wider than long; interocellar and postocular setae usually well developed; eyes normal, ocelli present in macropterous forms, sometimes wanting in brachypterous forms. Antennae with eight segments, III and IV with forked sense cones, VII and VIII smaller and forming a style. Mouth cones moderately stout, rounded, not drawn out and pointed; maxillary palpus 3-segmented, labial palpus 2-segmented.

Prothorax wider than long with well developed setae on anterior margin and angles, and two on each posterior angle; there is usually a series of five setae along posterior margin, the fourth of which is longer than the others. The interocellars, postoculars and setae on the angles of prothorax are sometimes greatly reduced in minuta. Legs normal, fore tibiae and tarsi unarmed. Wings nearly pointed, with fringes on both anterior and posterior margins; fore wings with two

longitudinal veins which like the costae have regularly placed setae.

Abdomen moderately long with short setae at the sides and long setae on the two terminal segments.

Male smaller than female and usually lighter in color; setae on abdominal segments IX and X more or less short and stout, those near posterior margin of segment IX vary in length, size and position, and are often conspicuous because of their darker color; sterna three to seven without sensory areas.

The genus Frankliniella is separated from the genus Taeniothrips by the presence of well developed setae on the fore angles of the prothorax and by the regularly placed setae on fore veins of fore wings. Major setae are not developed on the fore margin and angles of the prothorax. In Taeniothrips the setae on fore veins of fore wings are arranged in groups or scattered. The genus Thrips is similar to Taeniothrips, but has 7-segmented antenna. The genus Odontothrips resembles Frankliniella more closely, but the fore tibiae are armed at the end with claws or teeth.

#### Key to Species.

1. Interocellar setae minute, inconspicuous, normally less than 28 microns in length. ----- minuta (Moulton).
- Interocellar setae normally developed, 30 microns or longer. --- 2
2. Pedicel of third antennal segment with a clearly defined thickening which appears as a saucer-like ring, fig. 38 --- terminalis n. sp.
- Pedicel of third antennal segment simple with almost straight sides, without ring. ----- 3

3. Head produced into an angular process in front of eyes; cheeks narrowed posteriorly, fig. 36. ----- tenuicornis (Uzel).  
 -- Head normally flattened in front or weakly angular between bases of antennae; cheeks nearly straight or slightly arched but not narrowed posteriorly, figs. 33, 34, and 35. ----- 4
4. Third antennal segment short, 40-42 microns. ----- gossypiana Hood.  
 -- Third antennal segment longer, at least 43 microns. ----- 5
5. Third antennal segment 60 microns in length.-- helianthi (Moulton).  
 -- Third antennal segment 43-53 microns in length. ----- 6
6. Abdominal segments brown; general body color brown -----  
 ----- occidentalis var. californica (Moulton).  
 -- Abdominal segments mostly yellow; general body color yellow or yellowish orange. ----- 7
7. Abdominal segments yellow with a narrow dark line along anterior margins. ----- occidentalis (Perg.).  
 -- Abdominal segments with dark gray blotches in the middle of the terga. ----- occidentalis f. dubia Priesner.
33. Frankliniella gossypiana Hood. Fig. 33.

1913, Euthrips gossypii Morgan, A. C. New Genera and Species of Thysanoptera with Notes on Distribution and Food Plants. Proc. U. S. Nat. Mus. 46: 1-55.

1914, Frankliniella gossypii (Morgan) Hood, J. D. On the Proper Generic Names for Certain Thysanoptera of Economic Importance. Proc. Ent. Soc. Wash. 16:(1) 34-44.

1936, Hood, J. D. Frankliniella gossypiana, New Name. Proc. Biol. Soc. Wash. 49: 68.

Length 1.1 mm. General color yellowish gray.

Head with anterior margin nearly straight; back of head indistinctly transversely striate. Eyes occupying slightly more than half the width of the head; yellowish to transparent gray. Ocelli well separated, the posterior ones very close to inner margins of the eyes; transparent, whitish, not margined with crescents inwardly. Antennal segments I and II gray with II being yellowish gray at base; III - V brownish yellow; VI - VIII light brown.

Prothorax rounded, about three-fifths as long as wide. Mesothorax very bluntly rounded and tapering posteriorly. Metanotal plate bears four setae close together on the front margin, of which the inner pair is the stouter. Legs pale yellow, the fore femora thickened.

Abdomen almost cylindrical to eighth segment, thence tapering evenly to the rounded tip. A narrow brownish indistinct line across dorsum of segments II - VII.

This species was described as Euthrips gossypii Morgan (13) from four females taken at Yuma, Arizona, on leaves of cotton. This name was found to be preoccupied and the new name was erected by Hood (36). It is also recorded from California.

Oregon Records:-

Columbia River Hwy., Warren Creek, vic. Lindsey, 31 January, 1946.  
Coll. R. L. Post from dead mullein flower stalks, Verbascum thapsus.  
N. Portland, 30 January, 1946. Coll. R. L. Post from dead mullein flower stalks.

34. Frankliniella helianthi (Moulton). The Sunflower Thrips. Fig. 34.

1911, Euthrips helianthi Moulton, D. Synopsis, Catalog, and Bibliography of N. A. Thysanoptera. U. S. D. A. Bur. Ent. Tech. Series No. 21, pp. 1-56.

1914, Frankliniella helianthi (Moulton) Hood, J. D. On the Proper Generic Names for Certain Thysanoptera of Economic Importance. Proc. Ent. Soc. Wash. 16: (1) 34-44.

Total body length 1.25 mm. General color light yellowish-gray, shaded with brown.

Head only a little wider than long, cheeks straight and parallel; anterior margin elevated and rounded in front; back of head faintly cross striated. Head retracted into prothorax. Large brown spines in front of posterior ocelli and back of eyes. Eyes small occupying about half the width of head; pilose with purplish-black pigment. Ocelli whitish and translucent. Mouth cone pointed, dark-brown and nearly black at tip. Antennae about twice as long as head; segment I light yellowish gray; II dark brown; III, IV and V yellowish at base and brown distally; VI and style uniform dark brown. III has a forked sense cone on dorsal side near the tip, and a similar one near tip on ventral side of segment IV.

Prothorax about one-fourth wider than long; a long dark-brown spine on each anterior angle, two at each posterior angle. Mesothorax with angles broadly rounded in front and uniting almost evenly with metathorax. Sides of metathorax converge distally. Legs with fore femora thickened; light brownish gray; all tarsi with a dark-brown spot near tip. Wings uniform translucent whitish. Veins regularly set with

spines, and transparent microscopic hairs. Costal fringe short; posterior fringe long and wavy.

Abdomen cylindrically-ovate, with conspicuous brown spines on outer margin of each segment; six along posterior ventral margin of each ventral plate; longer and stronger ones at tip of segments IX and X.

Habitat of type Visalia, California, on wild sunflower. This species normally feeds in the blossoms of wild sunflower but is thought by Weldon (1921) and others to be the thrips often responsible for the scarring of the young fruit of peaches and apricots in many parts of California, usually attributed to the wheat thrips. This thrips occurs throughout California and is most injurious in the warmer interior districts. Specimens are in the Moulton collection from Arizona, Colorado, Utah, and British Columbia on various hosts.

Oregon Records:-

Corvallis, 23 July, 1925. Coll. D. G. Gillespie on Calandula officinalis.

Burnt Woods, 30 December, 1945. Coll. Leah J. & R. L. Post from moss on ash.

Eagle Valley, 19 July, 1940. Coll. H. A. Scullen on red clover, Trifolium pratense.

Grants Pass, 21 August, 1935. Coll. C. A. Cole on gladioli.

Klamath Falls, 8 May, 1926. Coll. F. P. Keen from bitter bush, Purshia tridentata.

Obrien, 24 March, 1940. Coll. J. Merkle, M. Ross, and R. L. Post on Oregon grape, Berberis aquifolium.

35. Frankliniella minuta (Moulton). The Small Thrips.

1907, Euthrips minutus Moulton, D. A Contribution to Our Knowledge of the Thysanoptera of California. U.S.D.A. Bur. Ent. Tech. Series No. 12. Pt. III, pp. 1-68.

1909, Euthrips minutus var. setosus Crawford, D. L. Some New Thysanoptera from Southern California I 1: (4) 100-108.

1914, Frankliniella minuta (Moulton) Hood, J. D. On the Proper Generic Names for Certain Thysanoptera of Economic Importance. Proc. Ent. Soc. Wash. 16: (1) 34-44.

Total body length 0.83 mm. Color uniform dark brown, wings gray brown.

Head one and one-half times as wide as long, retracted into prothorax; anterior margin of head almost straight, being slightly elevated in front. Cheeks diverging posteriorly. A small seta in front of each posterior ocellus and one behind each eye; all other setae very inconspicuous. Eyes not protruding and with a deep red pigment. Ocelli widely separated, posterior ones contiguous with light inner margins of eyes; orange yellow. Antennae slightly more than twice as long as head and uniformly brown; segments short and compact, pedicel of segment III simple.

Prothorax without conspicuous markings; anterior angles straight, posterior broadly rounded. A large spine on each anterior angle and a second on anterior margin on either side about half way between the first spine and the median line; three large spines on posterior margin on either side and about equidistant. Mesothorax widest; sides arched; evenly united with metathorax. Metathorax with sides straight and

widening toward abdomen. Thorax orange colored. Legs brown except fore tibiae and all tarsi which are light yellowish brown. Hind tibiae and tarsi armed with a sharp spine. Wings gray brown, with a small white transparent area about one-fifth the wing's length from the base; attaining end of abdomen. Fore vein extending from base almost to tip; hind vein appears just after the white area and fades before the end of the wing. Fore margin and longitudinal veins set regularly with short, sharp, brown spines.

Abdomen with prominent spines only on last few segments; a weak comb-like arrangement of spines on the posterior margin of segment VIII.

This species was described from one female taken at Berkeley, California, on grass. It occurs throughout California on the foliage and in the blossoms of cherry, pear, prune, grasses, yarrow, grease-wood, and buttercup. In the Moulton collection from Arizona, Colorado, Idaho, and Montana.

#### Oregon Records:-

Bly, 15 August, 1940. Coll. H. A. Scullen on red clover, Trifolium pratense.

Bonneville, U. S. Coast Guard Base, 31 January, 1946. Coll. R. L. Post in dead flowers of pearly everlasting, Anaphalis margaritacea.

Bruce Station, 17 February, 1946. Coll. Leah J. and R. L. Post from mossy rose gall, Rhodites rosae L., via Berlese funnel.

Hood River, Pitblado Ranch, 31 January, 1946. Coll. R. L. Post from dead flowers of red sorrel, Rumex acetosella.

Malheur County, 15 July, 1940. Coll. H. A. Scullen from red clover blossoms, Trifolium pratense.

Sheppherds Dell, Columbia R. Hwy., 30 January, 1946. Coll. R. L. Post from dead flowers of pearly everlasting, Anaphalis margaritacea.

36. Frankliniella occidentalis (Pergande). The Western Thrips.

1895, Euthrips occidentalis Pergande Th. Observations on Certain Thripidae. Insect Life 7: 390-395.

1902, Euthrips occidentalis, Hinds, W. E. Contribution to a Monograph of the Order Thysanoptera Inhabiting North America. Proc. U. S. Nat. Mus. 26: 79-242. (Redescription of the species.)

1914, Frankliniella occidentalis (Pergande) Hood, J. D. On the Proper Generic Names for Certain Thysanoptera of Economic Importance. Proc. Ent. Soc. Wash. 16:(1) 34-44.

Female: Length 1.1 - 1.4 mm. General color deep yellow, in immature forms clear pale lemon yellow.

Head yellow; ocelli pale yellowish margined with reddish orange crescents. Interval between posterior ocelli more than twice their diameter. Antennal segment I concolorous with head, II brownish yellow, III - V mostly yellow shaded with brown distally, or V only at extreme tip, VI - VIII gray brown. Antennal segment III length 40-50 microns, VII 10 microns, VIII 13 microns.

Thorax orange with prothorax usually lighter than meso- and meta-thorax.

Abdomen with abdominal segments yellow with a dark line along the anterior margins or there may also be a narrow brownish gray band with

the dark line. The eighth abdominal segment is without a comb on the ventral surface or it is so weak that it can seldom be seen. It is only weakly developed at the sides of the posterior margins if it is present.

Male: Length .65 mm. Lighter than females; nearly a uniform lemon yellow; slightly darker on thorax.

Apex of abdomen blunt; terminated on sides by two pairs of long, stout, inwardly curving spines; brown bands across abdomen lacking and they have fewer spines on the sides of the segments. The bright orange colored testes are very prominent.

This species is very common on many flowers, weeds, and trees. At times it has been reported as a serious pest to potatoes and thought to spread early blight. Essig ('45) reports that the fruits of oranges and lemons are scarred by it.

The Western Thrips has been recorded from Arkansas, Arizona, Colorado, Connecticut, Florida, Texas, Utah, Washington and British Columbia. It is very common throughout Oregon from March to September on many host plants. Hibernating adults have been taken at Bonneville, Oregon, 31 January, 1946, by the writer from burdock burrs and at Talent, Oregon, 12 December, 1945. Coll. L. G. Gentner on leaves of mullein, Verbascum thapsus.

Specimens of F. occidentalis are often confused with F. tritici, the Wheat or Flower Thrips. The latter species occurs east of the Rocky Mountains and is not found in Oregon.

37. Frankliniella occidentalis var. californica (Moulton)\* 1946

1911, Euthrips tritici californicus Moulton, D. Synopsis, Catalog and Bibliography of N. A. Thysanoptera. U. S. D. A. Bur.

Ent. Tech. Series No. 21, pp. 1-56.

1914, Frankliniella moultoni Hood, J. D. Notes on North American Thysanoptera Insecutor Inscitiae Menstruus 2:(2) 24.

1914, Frankliniella tritici moultoni Hood, J. D. On the Proper Generic Names for Certain Thysanoptera of Economic Importance. Proc. Ent. Soc. Wash. 16:(1) 34-44.

Length 1.2 - 1.4 mm. (1.5 in distended specimens). Color brown.

This variety is very similar to occidentalis in structure except that the eighth abdominal segment has a well developed comb which extends across the entire ventral margin of the segment. The microsetae are widely separated and each seta of the ventral comb arises from a triangular base.

It is readily distinguished from the species by its general brown color. The thorax is a deep orange to brownish orange. Abdominal segments are brown or shaded with brown.

This species is a color phase found in company with the true species in the far west. Specimens in the Moulton collection from Arizona, Colorado, California, Idaho, Montana, Utah, Washington, Texas and from various localities in Canada.

The variety californica is the most abundant thrips in Oregon and is found on many flowers and plants throughout the state from March to October. It hibernates as an adult and has been taken from the following situation in Oregon via the Berlese funnel:

Bonneville, U. S. Coast Guard Base, 31 January, 1946. Coll. R. L. Post in dead goldenrod flowers.

Bruce Station, 17 February, 1946. Coll. M. Ross, Leah J. and R. L. Post

from mossy rose galls, Rhodites rosae L.

Corvallis, 18 December, 1946. Coll. Leah J. and R. L. Post from lichen, Usnea barbata on apple tree.

Corvallis, 30 December, 1945. Coll. Leah J. and R. L. Post from moss and lichens on alder.

Corvallis, 6 January, 1946. Coll. R. L. Post from galls of Adelges cooleyi (Gill.) on Picea sitchensis.

Corvallis, 17 January, 1946. Coll. K. Hobbs and R. L. Post from Douglas fir cones, 100 ft. from ground and from fallen Douglas fir cones.

Columbia River Hwy., Warren Cr. vic. Lindsay, 31 January, 1946, Coll.

R. L. Post from dead flower stalks of mullein, Verbascum thapsus.

Oregon Coast Hwy., 4 mi. S. Otter Crest Park, 31 December, 1945. Coll.

Leah J. and R. L. Post from dead flowers of pearly everlasting,

Anaphalis margaritacea.

Pitblado Ranch, 3 mi. S. Hood River, 30 January, 1946. Coll. H. Pitblado and R. L. Post from corn tassels.

N. Portland, 29 January, 1946. Coll. R. L. Post from one year plants and dead flower stalks of mullein, Verbascum thapsus. Same date from dead flowers of St. Johnswort, Hypericum perforatum.

Talent, 8 December, 1945. Coll. L. G. Gentner from mullein, Verbascum thapsus.

\*In a conversation with Mr. Dudley Moulton, March, 1946, it was his opinion that this variety is valid. The synonymy of Frankliniella moultoni Hood is based on his belief.

38. Frankliniella occidentalis form dubia Priesner. Fig. 35.

1932. Priesner, H. Wiener Ent. Zeitg. 49(October) p. 182.

Length 1.35 mm. Color yellowish orange; abdomen yellow.

This form is intermediate between the species and the form californica. It is darker than the species and a transitional form to the dark var. californica. In dubia the abdomen is mostly yellow but with dark gray blotches in the middle of the terga. Antennal segment II is yellowish brown, III brown in apical half, IV brown in apical two-thirds, V pale only at base, remaining segments brown.

This species is in the Moulton collection from western and southern United States and Mexico on several host plants.

Oregon Record:-

Pitblado Ranch, 3 mi. S. Hood River, 30 January, 1946. Coll. Henry Pitblado and R. L. Post hibernating in corn tassels.

39. Frankliniella tenuicornis (Uzel). Fig. 36.

1895, Physopus tenuicornis Uzel. H. Monographie der Ordnung Thysanoptera. pp. 1-472.

Length 1.5 mm. distended. General color uniform gray brown with pterothorax yellowish brown.

Head angularly produced in front of eyes; sides straight and somewhat narrowed behind eyes. Ocelli without colored crescents; widely separated, posterior ocelli contiguous with inner margins of eyes. Antennal segments dark gray brown with the exception of III and IV which are clear yellow.

The males, as described by Uzel, are smaller and have the head, prothorax, and abdomen yellowish; pterothorax deeper yellow to yellowish

brown. Antennal segments I - IV yellow, sometimes II and IV grayish yellow; V - VIII dark gray.

This species was described from specimens taken on barley, oats, various flowers and overwintering females in moss in Bohemia. The males occur from June to September. It is recorded in North America from Iowa on grasses and corn and from California.

Oregon Record:-

Lake Labish, 15 September, 1942. Coll. Joe Schuh from leaf sheath of cat-tail, Typha latifolia.

40. Frankliniella terminalis new species. Figs. 37, 38, and 39.

Holotype female: Head and thorax light orange yellow, abdominal segments I - VIII light brownish yellow, shading from yellow at base to light brownish yellow, segments IX and X rather abruptly blackish brown; antennal segment I brownish yellow, darker than head, II blackish brown at sides, lighter through median portion, III mostly yellow shading to dark brown in apical third, IV and V yellowish in basal third, otherwise dark brown, VI - VIII blackish brown; legs nearly clear yellow; wings weakly shaded yellow; prominent setae dark.

Total body length with abdomen distended 1.44 mm.; head length 0.117 mm., width 0.147 mm.; antennal segments length (width): II, 36 (23); III, 53 (16); IV, 43 (16); V, 33 (15); VI, 46 (16); VII, 10; VIII, 16 microns; length of setae; interocellars 23, postoculars 20; on anterior margin and angles of pronotum 43, on posterior angles 56; on ninth abdominal segment median 86, midlateral and lateral 100; median pair on tenth segment 110, lateral 93 microns.

Head somewhat wider than long, cheeks nearly straight, slightly

constricted posteriorly; interocellar and postocular setae prominent, the interocellars placed on a line connecting anterior with posterior ocelli, their interval 30 microns; antennae slender, segment II slender, the prominent setae placed immediately at apical end as in cephalica but the segment is not drawn out or overhanging base of third segment; pedicel of segment III with a distinct but weak angulation, apical end of third segment briefly constricted; segment VIII clearly longer than VII; legs normal, inner, apical inner margin of hind tibiae with a series of about five short, dark setae; fore vein of fore wing with 20, lower vein with 17 setae; abdomen normal, posterior margin of eighth segment with comb; pronotum with four minor setae between antero-marginals.

Type Material: Holotype female taken at Bruce Station, Oregon, 17 February, 1946. Coll. Leah J. Post and the writer from galls of beaked willow gall, Phytophaga rigidae O. S. via Berlese funnel. Two paratypes taken at Corvallis, Oregon, 2 December, 1945. Coll. Leah J. Post and the writer from moss on oak via Berlese funnel. Paratype deposited in Moulton collection at Redwood City, California.

This species is placed in the Tritici section of the Tritici-cephalica group. The angulation on the pedicel of segment III is weak but the prominent setae on segment II are at the extreme apical end of the segment as in cephalica. It is most closely related to bicolor Moulton from Brazil but separated from that species by the darker colored basal segments of the antennae and the absence of a comb on the eighth abdominal segment. F. extremitata Hood also with darkened terminal abdominal segments, has much longer antennae, the third segment

being 73 microns, and there are only two minor setae on the anterior margin of the pronotum between the antero-marginals; there are four of such minor setae in the present new species.

The terms "Tritici section" and "Tritici-cephalica group" are based on terms that Mr. Dudley Moulton will employ in a future revision of the genus Frankliniella. The writer obtained this information from Mr. Moulton during a conversation in March, 1946.

XIX. Genus IRIDOTHRIPS Priesner

1940, Priesner, H. Philadelphia Journal of Science 9: 403.

Genotype Iriodthrips iridia (Watson)

Head heavy, much produced anteriorly, distance between antennal fossae comparatively great; ocelli small, far apart, interocellar bristles situated at sides of front ocellus; mouth cone large, broadly rounded. Maxillary palpi 3-segmented. Antennae 8-segmented; segments III and IV with simple sense cones.

Prothorax with one long bristle which is adpressed and directed backward at each fore angle, and two long bristles at each posterior angle; second postmarginal bristle of pronotum largest; inner antero-marginals short. Setae on fore wings arranged on veins in uninterrupted rows. Abdomen normal, bristles at apex long, dorsals on tergite nine short. Male brachypterous, female macropterous or brachypterous.

Bregmatothrips iridis Watson cannot remain in the genus Bregmatothrips, as the fore angles of the pronotum are provided with long setae which have escaped notice. These bristles are adpressed and directed backward. The insect is closely allied to Frankliniella, particularly on account of the dense rows of bristles on the wings and the

chaetotaxy of the hind margin of the pronotum. It is distinguished from Frankliniella by the simple sense cones and the shorter antennae.

41. Iridothrips iridis (Watson). The Iris Thrips. Fig. 40.

1924, Bregmatothrips iridis Watson, J. R. A New Bregmatothrips from England. Entomologists Monthly Magazine 60: 253-254.

1940, Iridothrips iridis (Watson) Priesner, H. Phila. Journ. Sci. 9: 403.

Macropterous Female: Length 1.3 - 1.4 mm. Color almost uniform brown; thorax a little lighter than the head and abdomen; bases of the middle and hind femora, the fore tibiae, all tarsi and antennal segments III and IV light brown to brownish yellow.

Head a little wider than long, vertex swollen, produced anteriorly, covering almost half the first antennal segment, broadly emarginate in dorsal view; cheeks nearly straight, parallel, roughened immediately behind the eyes by prominent bristle bearing warts; dorsal surface reticulated, a conspicuous interocellar bristle situated in front of a line from the front ocellus to each posterior ocellus; a faint one behind each posterior ocellus and another (in addition to the postoculars) behind each eye. Eyes small, occupying only one-third the lateral margin of the head; triangular in outline, protruding, facets large. Posterior ocelli situated near the middle of the inner margin of the eyes and barely separated from them, yellow, scarcely larger than one of the facets of the eyes. Anterior ocellus minute, about the size of the base of one of the largest bristles. Mouth cone large and extending three-fourths the distance across prosternum. Antennae slightly less than twice the length of head; segments I and II brown,

as dark as head with II dark at apex; III varies from brownish yellow to light brown with pedicel transparent; IV varies from a little darker yellow than III to light brown; V light brown shaded with dark brown; VI - VII dark brown. Spines weak and transparent; sense areas robust and colorless. Segment I spherical; II cup-shaped with a broad base; III clavate with a narrow pedicel which is deeply constricted at about one-sixth the length of the segment above base; IV and V barrel shaped with broad pedicels; VI ellipitical with a broad base and sharply truncated at apex; VII short, cylindrical; VIII conical.

Prothorax slightly longer than head and wider than long; along anterior margin is much wider than head. Two short bristles at each anterior angle; two pairs along anterior margin; one slightly beyond middle of lateral margin; row of four across middle of pronotum; all pale and inconspicuous. Two long pale bristles at each posterior angle. Pronotum with a few inconspicuous striations along posterior margin. Pterothorax slightly wider than prothorax, anterior angles rounded, sides nearly straight and converging slightly posteriorly. Wings lacking.

Abdomen short, wide, segments II - VIII with a stout, short, dark, curved bristle at each posterior angle. Segments V - X with additional long slender, brownish yellow bristles which become progressively longer towards posterior end. Apex of abdomen conical; segment X with a dorsal longitudinal suture.

This species was described from specimens collected by inspectors at the Port of New York. Type specimens collected from Iris kaempferi from Bassenheim, Holland, by E. I. Smith, February, 1923. Paratypes

collected from iris from Holland and England by E. I. Smith, Schiller, and Hunt of the Federal Horticultural Board, February, March, and November, 1923, and May, 1924.

The Iris Thrips is a pest of very minor importance known on the Atlantic coast and from Oregon and Washington on the west coast.

Oregon Records:-

Gresham, 1 August, 1935. Coll. C. F. Doucette from Japanese iris.

Gresham, 14 August, 1935.

XX. Genus TAENIOTHIRIPS Amy. & Serv.

1843, Amyot, C. J. & Serville, J. G. Hist. Nat. des Insectes Hemipteres, pp. 637-646.

Genotype Physapus atratus Amy. & Serv.

Head wider than long with cheeks slightly arched. Interocellar setae developed, also a series of smaller setae behind eyes. Eyes fairly prominent sometimes protruding, pilose; ocelli present. Maxillary palpus 3-segmented. Antennae 8-segmented, fairly long, with forked sense cones on segments III and IV.

Prothorax wider than long, with pair of strong spines on each posterior angle, without prominent setae on anterior angles. Legs moderately slender, unarmed. Wings well developed, rudimentary or completely wanting, especially in the males; when present, fore wings have a complete series of setae and fringe on costa; the setae on the fore vein are variously arranged but never in complete and regular series like those on the hind vein.

Abdomen with spines at sides and long prominent setae on terminal segments. Tip of abdomen usually pointed.

Males often with spurs on ninth abdominal segment.

Key to Species.

1. Anterior longitudinal vein of fore wing with basal series of setae extending about one-third its length followed by a wide intermission with two occasionally one distal setae, fig. 41-  
----- albus Moulton.
- Anterior longitudinal vein of fore wing with basal series of setae extending at least two-fifths its length; with more than two distal setae, figs. 45, 46. ----- 2
2. Anterior longitudinal vein of fore wing with five or more distal setae, fig. 46. ----- simplex Morison.
- Anterior longitudinal vein of fore wing with three distal setae occasionally four and rarely two in aberrant specimens,  
----- fig. 45. -- 3
3. Cheeks very strongly arched; fore tarsus with tooth, fig. 43.---  
----- inconsequens Uzel.
- Cheeks not strongly arched; fore tarsus unarmed, fig. 42. -----  
----- frici Uzel.
42. Taeniothrips albus (Moulton). The White Thrips. Fig. 41.  
1911, Euthrips albus Moulton D. Synopsis, Catalog and Bibliography of North American Thysanoptera. U.S.D.A. Bur. Ent. Tech. Series No. 21, pp. 1-56.  
1912, Euthrips costalis Jones, P. R. Some New California and Georgia Thysanoptera. U.S.D.A. Bur. Ent. Tech. Series No. 23, Pt. I, pp. 1-24.

- 1914, Physothrips albus (Moulton) Hood, J. D. On the Proper Generic Names for Certain Thysanoptera of Economic Importance. Proc. Ent. Soc. Wash. 16:(1) 34-44.
- 1926, Taeniothrips albus (Moulton) Priesner, H. Die Thysanopteren Europas. p. 269.
- 1933, Taeniothrips albus Moulton, Steinweden, J. Key to all Known Species of the Genus Taeniothrips. Trans. Amer. Ent. Soc. 49: 269-293.

Total body length about 1 mm. General color of body and wings clear white except outer half of antennae which are dark brown.

Head about as wide as long, noticeably square, cheeks nearly straight, and only very slightly arched; front angular between antennae. Eyes prominent, black with light outer borders, coarsely faceted. Ocelli lacking. Antennae with segments I - III whitish; IV - VIII brown. Forked sense cone on dorsal side of segment III and a similar one on ventral side of IV.

Prothorax somewhat wider than long. A weak spine at each anterior angle and a pair of prominent ones on each posterior angle. Mesothorax largest; front angles rounded. Legs concolorous with body. Setae prominent only on hind tibiae; each tarsus with black spot at tip. Wings broad and tapering gradually from base to tip; anterior longitudinal vein with nine regularly placed setae, these beginning immediately below where the group of six setae on fore vein ends.

Abdomen elongate-ovate, tapering gradually from third segment to tip; without prominent setae on outer posterior angles of all segments except the first.

This species was described from one female taken at Redbluff, California, 19 June, 1908. Coll. Dudley Moulton on peach foliage. Specimens in Moulton collection from Auburn, Placer County, California, 4 April, 1933. Coll. H. R. Plank.

Oregon Record:-

Corvallis, 16 March, 1919. Coll. A. Lovett in moss.

43. Taeniothrips frici (Uzel). Fig. 42.

1895, Physopus frici Uzel, H. Monographie der Ordnung Thysanoptera. pp. 1-472.

1919, Physopus blacki Watson, J. R. A New Physopus from Oregon. Fla. Buggist 3:(2) 32.

1926, Taeniothrips frici (Uzel), Priesner, H. Die Thysanopteren Europas. p. 269.

Body length 0.9 mm. Color yellowish-brown; abdomen darker distally at tip dark brown.

Head about as long as wide; somewhat narrower behind. Transversely striated behind eyes. Antennal segment I shorter than II; II concave at base and broadly attached to I; III and IV of equal length and slightly pedunculate; V slightly shorter than IV diverging from base to distal third; VI uniformly dark brown, broadly rounded at base and narrowing distally; stylus with terminal segment slightly longer than VII, tip truncate and bearing two terminal bristles. Color of I yellowish brown; II dark brown and the darkest of segments; III and IV yellowish gray; V slightly darker than IV in distal half; VI, VII and VIII uniformly dark gray-brown; eyes prominent, protruding, coarsely faceted; a mass of internal dark pigmentation that is red with direct

light.

Thorax orange-brown. Prothorax as long as head; on posterior angles bears two stout bristles; both sides of posterior border has four small spines, of which the first is the smallest and the fourth is the largest. The spines on the hind tibiae are weaker than with most species of this genus. Femora grayish olive-brown; somewhat lighter distally. Fore tibiae yellow-gray; remainder brown somewhat lighter distally. All tarsi yellowish-brown. Fore wings yellowish gray. The anterior longitudinal vein has three bristles in second half of which the third is removed from the basal two; hind wings transparent. Last two abdominal segments provided with strong brown bristles of which the ones on IX are the longest and stoutest.

This species was described from specimens collected in Bohemia. It occurs commonly in California and Oregon on the flowers of many host plants.

Oregon Records:-

Bonneville, U.S.C.G. Base, 30 January, 1946. Coll. R. L. Post from Burdock burrs and dead flowers of St. Johnswort, Hyperica perforatum.

Brookings, 16 March, 1940. Coll. Marshall Ross and R. L. Post from flowers of calendula and calla lilies.

Bruce Station, 17 February, 1946. Coll. M. Ross, Leah J. and R. L. Post from mossy rose gall, Rhodites rosae L. and dead flowers of hardhack, Spiraea douglasii.

Corvallis, 6 January, 1946. Coll. R. L. Post from galls of Adelges cooleyi on Picea sitchensis via the Berlese funnel.

Corvallis, 17 January, 1946. Coll. K. Hobbs and R. L. Post from dead

flowers of bull thistle, Cirsium lanceolatum, and dead teasel flowers, Dipsacus sylvestris.

Eight mi. N. Corvallis, 12 February, 1946. Coll. M. Ross and R. L.  
Post from robin's nest via Berlese funnel.

Twelve mi. S. Corvallis, 17 February, 1946. Coll. Leah J. and R. L.  
Post from robin's nest via Berlese funnel, and same date from branch  
of dead apple tree.

Corvallis, 23 April, 1942. Coll. Leah J. and R. L. Post from buttercup.

Corvallis, 17 and 22 August, 1917. Coll. A. B. Black on California  
poppy, Eschscholtzia californica.

Corvallis, 6 September, 1917. Coll. A. B. Black from dandelion.

Corvallis, 20 October, 1917. Coll. A. B. Black from flowers of squash.

Corvallis, 28 August, 1940. Coll. J. Schuh under needles of cypress.

Corvallis, 4 December, 1945. Coll. Leah J. and R. L. Post from lichens  
on oak via Berlese funnel.

Corvallis, 18 December, 1945. Coll. Leah J. and R. L. Post from Usnea  
barbata on apple tree via Berlese funnel.

Forest Grove, 10 August, 1926. Coll. S. E. Keen from wild carrot, Daucus  
carota.

Forest Grove, 9 September, 1927. Coll. S. E. Keen from flowers of fire-  
weed, Epilobium angustifolium.

Gaston, 8 August, 1927. Coll. S. E. Keen on thistle.

Gresham, 31 August, 1945. Coll. J. Schuh on dahlia.

Pitblado Ranch, 3 mi. S. Hood River, 30 January, 1946. Coll. R. L.  
Post from corn tassels via Berlese funnel.

North Portland, 29 January, 1946. Coll. R. L. Post from dead flowers

of St. Johnswort, Hypericum perforatum.

Eleven mi. E. Tidewater, 1 January, 1946. Coll. Leah J. and R. L.

Post from dead flowers of red sorrel, Rumex acetosella.

44. Taeniothrips inconsequens (Uzel). The Pear Thrips.

Figs. 43, 44, and 45.

1895, Physopus inconsequens Uzel, H. Monographie der Ordnung  
Thysanoptera. p. 1-472.

1904, Euthrips pyri Daniel, S. M. New California Thysanoptera.  
Entomological News 15:(9) 293-297.

1926, Taeniothrips inconsequens (Uzel) Priesner, H. Die Thysan-  
opteren Europas. p. 269.

Female: Length 1.26 mm. Color dark brown, tarsi light brown to  
yellow.

Head slightly wider than long, cheeks arched, anterior margin  
angular, back of head transversely striate and bearing a few minute  
spines and a pair of very long prominent spines between posterior ocelli.  
Eyes prominent; oval in outline; black with light borders; coarsely  
faceted and pilose. Ocelli yellow, margined inwardly with orange-brown  
crescents; posterior ones approximate to but not contiguous with light  
inner borders of the eyes. Mouth cone pointed and tipped with black.  
Antennae two and one-half times longer than head; uniform brown except  
segment III which is light brown; spines pale; a forked sense cone on  
the dorsal side of segment III, with a similar one on ventral side of  
segment IV.

Prothorax about as long as but wider than head; a weak spine at  
each anterior and two large, strong ones on each posterior angle.

Mesothorax with sides convex; angles rounded; metanotal plate with four spines near front edge, inner pair the largest. The mesonotal and metanotal plates are faintly striate. Legs uniform brown except tibiae and tarsi which are yellow. Fore tarsus with claw. Several strong spines on hind tibiae; spines on tip of fore and middle tibiae weak. Wings extending beyond abdomen; pointed at tips; costa of fore wings thickly set with long spines; fore vein with spines arranged in two groups of three and six respectively on basal half of wing, and three, occasionally two or four on distal part; hind vein with fifteen or sixteen regularly placed spines; costal fringe on fore wing about twice as long as costal spines.

Abdomen sub-ovate, tapering abruptly toward the tip from the eighth segment; longest spines on segments IX and X; abdomen uniform brown; connective tissue yellow.

Male unknown.

The pear thrips, except for one collection in Ontario, Canada, occurs only on the Atlantic and Pacific coast states. On the east coast it has been found in New York, Pennsylvania, and Maryland. Only in New York does it occasionally cause damage. In the west it is known in Oregon, Washington, California, and British Columbia. In all the Pacific Coast areas the injury is severe. It was originally supposed to be a native insect but it is now believed that it was imported from Europe on nursery stock. There are more bulletins, articles and illustrations on this species than any other thrips and a complete discussion of this pest is not necessary here.

This thrips differs in its life history from all others of

economic importance in that there is only one generation and that ten months of the year is spent in the soil under the host plants. The adults normally emerge in March as the soil begins to warm up. The emergence may continue for three to six weeks, according to the temperature. The young drop from the trees in May and June, enter to a considerable depth below the surface and remain in a quiescent pupal stage in small cells. Transformation to the adult takes place in late October or November. The adults begin to emerge about the time that the first buds of the prune trees begin to swell and often a week or more in advance of the blooming period. The pear thrips had never been taken in Oregon during January or February until the writer collected specimens from moss and leaf mould by means of the Berlese funnel. Apparently adults emerge during warm spells in the winter and remain hiding in moss and leaf mold. These specimens are lighter colored than the darker forms normally found in the blossoms later in the season.

Although many plants are listed as hosts of pear thrips, not all are important. Aside from deciduous fruit trees, the most common are willows, madrone, California laurel, and various weeds and grasses in and near the infested orchard districts. The principal trees attacked are prune, pear, plum, cherry and occasionally apple.

#### Oregon Records:-

Bonneville, U. S. Coast Guard Base, 31 January, 1946. Coll. R. L. Post in moss from alder via Berlese funnel.

Corvallis, 23 April, 1942. Coll. Leah J. and R. L. Post from wild cucumber, Echinocystis oreganus.

Crown point, 22 April, 1940. Coll. R. L. Post from flowers of dogwood.

Hood River, 12 April, 1929. Coll. Leroy Childs from cherry blossoms.

Portland, 21 March, 1940. Coll. Joe Schuh blasting buds of Hawthorne, crab-apple, and plums.

Portland, 10 April, 1940. Coll. Joe Schuh from flowers of flowering cherry and European mountain ash.

Salem, 17 March to 30 May, 1927. Coll. E. G. Davis on pear, prune, and cherry.

Salem, 12 April, 1919. Coll. A. L. Lovett on prune.

Peoria Ferry, 1 February, 1940. Coll. R. L. Post from lichens, Usnea barbata and from deciduous leaf mold via the Berlese funnel.

45. Taeniothrips simplex Morison. The Gladiolus Thrips. Fig. 46.

1930, Morison, G. D. On a Collection of Thysanoptera from South Australia. Bul. Ent. Res. 21: (1) 12-13.

1931, Taeniothrips gladioli Moulton, D. and Steinweden, J. A New Taeniothrips on Gladiolus. Canadian Ent. 63: 20-21.

Female: Length 1.65 mm. General body color dark brown with a reddish tinge; this tinge is due to the grayish brown cuticle covering a reddish subcuticular color. Legs concolorous with body except the tarsi and distal ends of fore tibiae which are light yellowish brown.

Head wider than long; cheeks arched; eyes large, prominent, slightly protruding and occupying one-half the side of head. Head with dorsal surface marked with transverse striae behind eyes. Ocelli prominent with dark reddish brown crescents; anterior ocellus lying closer to each lateral ocellus than they are to one another; interocellar spines small, located midway on a line connecting anterior ocellus with posterior ocellus. A row of five small setae behind each

eye. Antennae somewhat slender and slightly more than twice the length of head. Antennal segments I almost rectangular but wider at base; II barrel shaped, constricted at base which has a small annulus; III with short pedicel which expands rapidly; IV fusiform, base constricted, broad apex; V barrel shaped; VI elongate-ovoid with broad base with sides tapering into those of VII and VIII, which ends in a blunt apex. A forked curved trichome on the dorsal surface of III near apex and another is similarly placed on IV. All segments bear a few hairs. All antennal segments brown except III, which is a paler yellowish brown. IV and V each with a pale ring near base.

Pronotum with fine cross striations and sparsely set with small setae; spines on the posterior angles short and stout, a series of three small spines on each side along the posterior margin, the inner of which is slightly longer than the others. Fore wing with brownish hue except for a pale area in basal quarter; anterior longitudinal vein with five or more distal setae. Hind wing paler brown with a dark longitudinal vein. Legs dark brown except for yellowish coloring on apices of fore tibiae and apices and middle of all other tibiae; tarsi paler yellowish brown.

Male: Body length 1.2 mm. Numbers and placement of spines on head, thorax and wings as in female. Ninth abdominal segment with two pairs of median dorsal spines, the second being somewhat posterior and outward from the inner apir and each with a blank pit above. There is a third smaller pair of spines somewhat anterior and lateral from the blank pits. Depressions on sternites two to six broad and sole-shaped. The male description was obtained from Moulton and Steinweden (1931)

where the species was described from numerous females and two males taken from Vineland Station, Ontario, Canada and from gladiolus at Cleveland, Ohio.

This species was described from five females on carnation from Australia and has one year priority over T. gladioli M. & S. with which it is confused. Dustan (1936) in Canadian Entomologist Vol. LXVIII, p. 141, calls attention to the synonymy and priority of simplex. Until 1937 all American literature refers to this species as T. gladioli.

The first authentic record of the pest in this country is from Cleveland, Ohio, during the summer of 1929. Since its first discovery it has spread rapidly. It is recorded from most of the states and from many widely separated foreign countries, including Africa, Australia, Bahamas, Hawaiian Islands, New Zealand, and Canada.

This thrips is the most severe pest of gladiolus. If no control measures are practiced in infested fields, the entire crop may be ruined. On the basis of 75,000 corms per acre with each corm producing one salable spike and the flowers selling at 50 cents per dozen, the loss per acre on cut flowers alone may mount to over \$3,000. In addition, excessive injury to the leaves and flowers results in stunted corm growth. To the grower attempting to build up a stock of valuable varieties or to maintain a large stock of corms, this loss is serious.

In storage the activity of the thrips continues and corm injury is common where a field infestation has previously occurred. The effect of this feeding in storage is a retarding and stunting of growth after planting.

The number of generations of the gladiolus thrips in the field depends on the temperature and the availability of hosts. Apparently six or seven generations can develop.

In comparison with many other thrips the gladiolus thrips has a very limited range of true host plants. The principal and preferred host is gladiolus, on which extensive reproduction takes place. Minor infestations have been reported on various types of iris, calla lily, poker plant, carnations, montbretia(Tritonia), and tiger flower (Tigridia). In the greenhouse this thrips can reproduce on amaryllis, narcissus, and freesia. The adults (incidental) have been taken on about thirty other plant species.

#### Oregon Records:-

Brownsville, 8 August, 1932. Coll. Grant E. Mitsch on gladiolus.

Eugene, 20 August, 1934, on gladiolus.

Medford, 23 August, 1934, on gladiolus.

Portland, 30 July, 1940. Coll. Joe Schuh on gladiolus.

Salem, 23 July, 1932. Coll. T. R. Kendall from gladiolus corms.

#### XXI. Genus RHOPALANDROTHRIPS Priesner

1922, Priesner, H. Sitzgsh. Ak. Wiss. Wien. 81: 68.

#### Genotype Thrips (Euthrips) consociatus Targ.-Tozz

Very similar to and with most of the characters of Taeniothrips.

The principal difference is in the development of the antennae in male forms, here the antenna is 6- or 7-segmented and segment VI is greatly elongated and nearly cylindrical. Also the maxillary palpus in the female is 3-segmented and in the male either 2- or 3-segmented. The abdomen of the male is without spines. Males sometimes wingless.

46. Rhoplandrothrips corni Moulton. Fig. 47.

1927, Moulton, D. Four New California Thysanoptera. Pan-Pacific Entomologist 4:(1) 30-35.

Female: Total body length .83 mm. Color pale yellowish white.

Head transverse, eyes prominent, protruding. Ocelli well developed with red crescents. Interocellar setae prominent, 39 microns in length and placed near anterior margin of posterior ocelli. Antennae with segments I, II, and basal half of III and basal third of IV yellowish white; distal half of III and two-thirds of IV and V- VIII dark grayish brown. Antennae almost three times as long as head, segment V smallest and VI largest of the intermediate segments. Mouth cone long, pointed, reaching posterior margin of prosternum.

Prothorax with well developed wings reaching tip of abdomen, veins clearly defined, with three cross veins between costa and fore vein. Fore wings with costa bearing seventeen to nineteen setae; fore longitudinal vein with five at base and two at extreme tip; posterior longitudinal vein with nine to ten evenly placed setae.

Abdominal segment IX bearing a row of six long setae (60 microns) along posterior margin; X with a pair of long median setae near tip (69 microns) and a shorter pair on the sides (45 microns).

Male: Total body length .56 mm. Color as in female.

Head with antennal segment VI four times as long as V and nearly three times as long as segments III and IV.

Thorax with prothoracic setae as in female but shorter. Wings fully developed and surpassing tip of abdomen; veins and setae as in female.

The elongated sixth antennal segment clearly places this species in Priesner's Rhopalandrothrips.

This species was described from specimens taken at Big Trees, Calaveras County, California, August, 1926, by Dudley Moulton on the foliage of dogwood, maple and Bromus sp. Specimens in Moulton collection from Mariposa County, California, August, 1926. Coll. D. Moulton on tall grass and maple leaves.

Oregon Records:-

Corvallis, 2 December, 1945. Coll. Leah J. and R. L. Post from Usnea barbata on oak, Guercus garryana, via Berlese funnel.

Corvallis, 4 December, 1945. Coll. Leah J. and R. L. Post from lichens on oak via Berlese funnel.

Corvallis, 8 December, 1945. Coll. Sereno Baldwin and R. L. Post from moss on Douglas fir, Pseudotsuga taxifolia, 160 ft. from ground.

Hood River, Pitblado Ranch, 30 January, 1946. Coll. Henry Pitblado and R. L. Post from corn tassels via Berlese funnel.

XXII. THRIPS Linnaeus

Genotype Thrips physapus Linne

Head usually wider than long, more or less flattened in front, cheeks slightly arched; interocellars present also a series behind eyes. Eyes relatively large, pilose; ocelli present. Maxillary palpus 3-segmented. Antennae 7-segmented, occasionally with a 2-segmented style and 8-segmented in abnormal forms. The 8-segmented forms have all the characters of Taeniothrips.

Prothorax wider than long, with two long spines on each posterior angle, without prominent setae on anterior angle. Legs usually

moderately slender, hind tibia with two short, stout setae at tip within and a small series on distal inner margin. Wings with two longitudinal veins, costa with regular series of spines and fringe; posterior vein also with regular series; fore vein with several basal setae and usually two or three distal ones, occasionally as in T. tabaci there are three or four spines near middle, but the series is never a complete one.

Abdomen normal, with long setae at tip.

#### Key to Species.

1. Color dark brown. ----- 2
- Color yellow or light yellowish brown. ----- 4
2. All antennal segments uniformly dark brown, none yellowish; thorax with an orange brown tinge. ----- tabaci f. atricornis Priesner.
- Antennal segments not uniformly brown; thorax brown. ----- 3
3. Antennal segments brown except III which is light yellowish brown. ----- madroni Moulton.
- Antennal segments III and IV pale yellow. --- fuscipennis Haliday.
4. Uniformly clear whitish yellow including legs and wings ----- mucidus Moulton.
- Color dark yellow to light yellowish brown. ----- 5
5. Anterior longitudinal vein of fore wing with four, rarely five, setae in apical half, fig. 49. ----- tabaci Lindeman.
- Anterior longitudinal vein of fore wing with two or three setae in distal half, fig. 48. ----- nigropilosus Uzel.

47. Thrips fuscipennis Haliday.

1836, Haliday, A. H. An Epitome of the British Genera in the  
Order Thysanoptera with Indications of a few of the Species.

Ent. Mag. 3: 439-451.

Length variable but averaging 1.32 mm. General color nearly uniform dark brown.

Head with eyes protruding, rounded; margins light. Ocelli light colored with dark crescents; well separated, but posterior ones not contiguous with margins of eyes. Segments I and II of antennae lighter brown than head, III and IV pale yellow; V - VIII brown. Segment VI longer than III.

Posterior margin of pronotum with two or three pairs of small bristles between the two large pairs at posterior angles. The fore wings are shaded with gray but are not abruptly pale in basal portion.

Specimens in the Moulton collection from Oregon are the true European T. fuscipennis. This species is not represented in the Oregon State College collection.

Oregon Records:- (Moulton Collection)

Josephine County, 13 September, 1935. Coll. Charles A. Cole on gladiolus.

Grants Pass, 21-30 August, 1935. Coll. Charles A. Cole on gladiolus.

48. Thrips madroni Moulton. The Madrona Thrips.

1907, Moulton, D. A Contribution to Our Knowledge of the Thysanoptera of California. U.S.D.A. Bur. Ent. Tech. Ser. No. 12, Pt. 3, pp. 1-68.

Length 1.25 mm. Color uniform dark brown; wings gray brown; lighter at base; tibiae and tarsi often light brown.

Head as long as wide, front of head angular; basal segments of antennae set in concave depressions in front of head; cheeks arched, sides roughened; posterior portion of head transversely striate. A row of small spines on each side of head immediately back of eyes. Eyes prominent slightly protruding, pilose, margined inwardly with light borders; black pigmentation. Ocelli light orange colored and margined inwardly with deep orange-red crescents; with a circular thickening connecting anterior ocellus with outside of posterior ones, and included within this, on either side of the anterior ocellus is a small spine. Mouth cone long and pointed. Antennae with all segments of uniform width and color, except II, which is somewhat wider and III which is light yellowish brown.

Prothorax as long as head but slightly wider; all angles rounded; a pair of prominent spines on each posterior angle with a smaller pair on posterior margin near center. Mesothorax largest; metathorax with sides straight, posterior angles rounded. Legs brown; hind tibiae with several stout spines. Wings broad at base and narrowing at tip; light brown, except basal fourth which is light grayish-brown. Costal and longitudinal veins prominent only on basal half of wing.

Abdomen dark-brown, with a darker brown line across anterior margins of segments II to VII; spines on sides of all segments progressively becoming longer near the tip; stoutest and longest on IX and X.

Males: Much smaller than the females; with light colored oval

areas on ventral sides of segments III to VI.

Originally described from blossoms of Madrone, California laurel and California lilac from Santa Clara Valley, California.

Oregon Records:-

Seventeen mi. S. Bandon, 5 June, 1941. Coll. Joe Schuh on rhododendron, Rhododendron occidentalis.

1.5 mi. W. Burnt Woods, 30 December, 1945. Coll. Leah J. and R. L. Post on moss from ash.

Corvallis, 23 April, 1942. Coll. Leah J. and R. L. Post from flowers of dogwood, Cornus nuttallii.

Corvallis, 18 May, 1941. Coll. R. L. Post from flowers of thimbleberry, Rubus parviflorus.

Corvallis, 8 December, 1945. Coll. Leah J. and R. L. Post from moss and lichens on oak 60 feet from ground via Berlese funnel.

Forest Grove, 5 May, 1927. Coll. S. E. Keen on Ceanothus sanguineus.

Hume Trail, Sugarloaf Mountain, Range 13W, Township 36 S, Sec. 33, 20 March, 1940. Coll. Marshall Ross and R. L. Post from myrtle blossoms, Myrica sp.

Portland, 12 June, 1940. Coll. J. Schuh from racemes of ocean spray, Holodiscus discolor.

49. Thrips mucidus Moulton.

1936, Moulton, D. New Thysanoptera Belonging to the Genus Thrips

Linn. Pan-Pacific Entomologist 12:(3) 104-110.

Length 1.05 mm. Color uniformly whitish yellow including legs and wings.

Head with first antennal segment transparent and whitish; II concolorous with head; III light grayish; IV - VII uniformly dark grayish brown. Ocellar crescents orange.

Thorax with fore vein of fore wing with three distal setae, hind vein with ten or eleven setae.

Comb on ventral surface of eighth abdominal segment complete

This species was described from a single female taken at Hood River, Oregon, 3 July, 1929. Coll. Leroy Childs from apple leaf mold.

50. Thrips nigropilosus Uzel. Chrysanthemum Thrips. Fig. 48.

1895, Uzel, H. Monographie der Ordnung Thysanoptera. pp. 1-472.

Length 1.1 mm. General body color yellow; thorax and terminal abdominal segment deeper yellow.

Head with antennal segment I light yellow, almost transparent; II yellow; III - VII dark blackish brown; III and IV somewhat paler basally.

Abdomen with comb on ventral surface of eighth abdominal segment entire, not interrupted at median line. Dorsum of thorax and abdomen with gray blotches (best visible by reflected light).

This species is of minor importance economically, occurring mostly on ornamentals and in greenhouses.

Specimens in Moulton collection from California, Iowa, New York, Montana, Washington, Hawaii, and Russia.

Oregon Records:-

Corvallis, 12 March, 1919. Coll. A. B. Black on plantain. (This specimen was incorrectly determined in OSC collection as T. aureus Hood.)

Bruce Station, 17 February, 1946. Coll. Marshall Ross and Leah J. and R. L. Post from mossy rose gall, Rhodites rosae L.

1.5 Mi. W. Burnt Woods, 30 December, 1945. Coll. Leah J. and R. L. Post on moss from ash.

Seaside, 22 June, 1927. Coll. S. E. Keen on Lupinus sp.

51. Thrips tabaci Lindeman. The Onion Thrips. Fig. 49.

1888, Thrips tabaci Lindeman, K. Die Schädlichensten Insekten des Tabak in Bessarabien. pp. 61-75.

1894, Thrips allii Sirrine & Lowe. Bull. 83 N. Y. Expt. Sta. pp. 680-683.

1895, Thrips communis Uzel, H. Monographie der Ordnung Thysanoptera. pp. 1-472.

Female: Length 1.1 mm. Color quite uniformly light yellowish varying to light brownish yellow.

Head one-fifth wider than long; cheeks slightly arched behind the eyes; occiput indistinctly transversely striated; hairs upon the head few and minute. Eyes not protruding, coarsely granulated, very dark red by reflected light, black by transmitted light; weakly pilose. Ocelli placed well back to the line of the posterior edge of eyes; posterior ocelli not contiguous with margins of eyes; color light yellow, margined inwardly with light brown crescents. Antennae with segment I short and globose; II barrel shaped; III to V pedunculate, elongate-ovoid; V joined broadly to VI, which tapers from its middle to apex; VII tapering slightly and blunt at apex. I lightest in color being clear yellow; II, VI, and VII light grayish brown, III light brownish yellow; IV and V light brownish yellow at bases and darker at apices.

Prothorax as long as head, one and one-half times wider than long; pronotum indistinctly transversely striated and lightly clothed with minute spines. Each hind angle bears a pair of stout conspicuous spines; between these pairs, along the posterior border of pronotum there is a row of three smaller spines on each side. Metanotal plate bears a few small spines. Wings yellowish; costal fringe of fore wings composed of short, stout bristles intermixed with a row of shorter spines. Fore longitudinal vein usually has two post median and two apical setae. Hind vein arises from fore vein at about the middle of the second group of spines. Hairs of the posterior fringes of both wings long, slender, and light colored. Legs light yellowish; sparsely clothed with fine hairs; spines on inner side of hind tibiae weak except the pair at extremity.

Abdomen slightly wider than mesothorax; twice as long as wide; each dorsum of segments II to VIII marked on anterior border with a narrow brownish transverse line. End of segment IX bears a circlet of eight, long, stout spines; X bears six spines which are almost as long as those on IX.

Male: Head and abdomen yellowish white; thorax yellow. The first two antennal segments white; III faintly gray distally, IV and V shaded with gray; VI light at base and gray distally, VII gray.

The onion thrips is one of the most widely distributed thrips in the world having been collected from Siberia to the equator, from New Zealand to Sweden. In this country, although not actually recorded from all states, it undoubtedly occurs everywhere, since some specimens can usually be found on onions in storage, feeding on the leaf sprouts

or moist surface of the bulbs. It was first described from Bessarabia but had been known in the eastern United States since 1872. The first record from California is 1889. There are several hundred hosts, the majority of which are incidental and on which no reproduction takes place. Aside from onions, the chief crops on which they breed and cause injury, are carrots, carnations, cotton, cucumbers, garlic, melons, peas, roses and tobacco. The injury to onions is known as "blasting" or "silvering". Seed onions and carrots are reduced by the activities of the onion thrips in the flower heads. In years of severe infestation onion seed crops have been reduced as much as 50 per cent.

McWhorter and Milbrath (1938) state that although other species of insects may be able to transmit tipblight, Thrips tabaci is the only species of insect prevalent enough in the tomato fields to account for the rapid spread of tipblight disease of tomato in southern Oregon.

#### Oregon Records:-

This species is so common everywhere throughout the state during the growing season that only the hibernating records are listed.

Bonneville, U. S. Coast Guard Base, 31 January, 1946, in dead golden-rod flowers, Solidago elongata.

Corvallis, 17 February, 1946. Coll. M. Ross, Leah J. and R. L. Post from robin's nest via Berlese funnel.

Oregon Coast Hwy. 4 mi. S. Otter Crest Park, 31 December, 1945. Coll. Leah J. and R. L. Post from dead flowers of pearly everlasting, Anaphalis margaritacea.

Tidewater, 1 January, 1946. Coll. Leah J. and R. L. Post from flowers of Ox-eye daisy, Chrysanthemum leucanthemum.

Troutdale, 4 December, 1945. Coll. R. L. Post from cauliflower head.

Waldport, 1 January, 1946. Coll. Leah J. and R. L. Post from moss on Pinus contorta, 50 ft. from ground. (4 mi. S. Waldport)

52. Thrips tabaci f. atricornis Priesner.

1927, Priesner, H. Die Thysanopteren Europas. Pt. III, pp. 344-570.

Length about 1.2 mm. and similar to tabaci in structure. Color uniform dark brown except thorax which is orange brown.

Priesner states, "as with f. nigricornis the antennae are entirely dark, at most with the first segment light gray". Priesner gives the distribution of this form as North America, Eurasia, Guam, Juan Fernandez, and Australia.

Oregon Record:-

North Portland, 29 January, 1946. Coll. R. L. Post from leaves of mullein, Verbascum thapsus.

### XXIII. Genus TOXONOTHRIPS Moulton

Genotype Toxonothis gramineae Moulton, 1927

Head broadly rounded in front, without prominent setae; ocelli fully developed in female, absent in male. Antenna seven-segmented. Maxillary palpus 3-segmented.

Prothorax with two long setae on each posterior angle, without setae on anterior angles. Wings fully developed in female, bowed backward in the middle, scythe-shaped, with two longitudinal veins. Wings wanting in the male.

The members of this genus are extremely rare and only four specimens of this genus are known. The two specimens upon which the genus

was founded were taken at Lake Tahoe, California, July, 1926. Coll.

Dudley Moulton by sweeping grass.

53. Toxonothrips gramineae f. fuscus, new form. Fig. 50.

Length 1.6 mm. General color brown, except antennal segment III and tibiae and tarsi which are yellow.

An examination of the holotype of Toxonothrips gramineae Moulton in the Moulton collection shows the third and fourth antennal segments nearly clear yellow and segment V yellowish at base and shading to light brown apically; legs are mostly brown with fore tibiae yellowish but shaded on outer margin, middle and hind tibiae brown but lighter at apical ends. In this new form only antennal segment III is yellow, faintly shaded at the sides and IV is lighter at extreme base; femora are brownish yellow and all tibiae and tarsi nearly clear yellow.

Type and one paratype collected 1.1 miles east of Tidewater, Oregon, 1 January, 1946. Collected by Leah J. and R. L. Post on dead flowers of red sorrel, Rumex acetosella. Type in authors collection. Paratype deposited in collection of Dudley Moulton, Redwood City, California.

XXIV. Genus MICROCEPHALOTHRIPS Bagnall

1926, Bagnall, R. Brief Descriptions of New Thysanoptera. Annals and Magazine of Natural History. 18: 98-114.

Genotype Thrips abdominalis Crawford

Head small, much shorter and narrower than prothorax, wider than long, cheeks nearly straight, without prominent spines. Eyes relatively large, occupying half the side of head; ocelli present. Maxillary palpus 3-segmented. Antenna 7-segmented, sense cones on III

and IV forked.

Prothorax much larger than head, fore margin almost straight, sides diverging posteriorly with posterior angles broadly rounded; without conspicuous setae, but with a series of about eight setae along posterior margin on either side, the outer two of which seem a little larger. Legs small, slender. Wings fully developed, fore pair long, pointed, each with two longitudinal veins; costa with small setae but long, sparsely placed fringes; fore vein with several basal and three distal spines, hind vein with several which are scattered, all of these wing setae are very small.

Abdomen with tergites II to VIII serrate along posterior margins, the teeth on VIII produced to hair-like points, forming the comb peculiar to this segment; setae on IX and X moderately short.

54. Microcephalothrips abdominalis (Crawford). Fig. 51.

1910, Thrips abdominalis Crawford, D. L. Thysanoptera of Mexico and the South. Pomona College Journal of Entomology 2:(1) 153-170.

1923, Thrips microcephalus Priesner, H. Entom. Mitt. 12:116-117.

1925, Stylothrips brevipalpis Karny, H. Ramakrishna Aiyar. Journal Bombay Nat. Hist. Soc. 30: 871.

1926, Paraphysopus burnsi Girault, A. Insecutor Inscitiae Menstruus. 14: 188.

Length 1.0 to 1.3 mm. General color light brown; body surface reticulated with all setae being very inconspicuous.

Head reticulated posteriorly; several very small inconspicuous setae near the eyes and ocelli. Eyes large, prominent, bulging,

finely faceted and finely pilose. Ocelli red; large; approximate; anterior ocellus on frons; posterior ocelli on sides of an elevated portion between the eyes and approximate to inner borders of eyes. Mouth cone short, blunt; reaching one-third the length of prothorax. Antennae more than twice as long as head; segments stout with short and inconspicuous setae; II distinctly stouter than others; short tuberculate sense cone on segments III and IV; III pedunculate; IV bluntly ovoid; V broad at apex; VI broadly attached to V and has several small sensory areas; VII triangular and blunt at tip. Segments III and IV somewhat lighter brown than others.

Thorax with fore wings light brown with a transparency at basal fifth; hind wings almost clear with a light brown stripe in center extending almost to tip.

Abdomen elongately-ovate; broad at base and pointed at tip; a row of distinct sharp serrations on posterior margin of segments one to seven; VIII with longer and sharper teeth; almost no spines on abdomen except on last two segments.

Described from several females found on various compositae at Guadalajara, Mexico.

Bailey (1937) has studied the type slide No. 328 Canadian National Museum and on this slide are eight specimens of M. abdominalis and two F. moultoni Hood. No individual specimen has been designated as type and these specimens become cotypes. Thrips femoralis Jones (1912) has been recognized as a synonym by several workers and the excellent description and illustrations of Jones enables one to definitely place femoralis in synonymy with abdominalis.

Bailey (1938) reports that it is a pest of minor importance in California where it is found on zinnias, marigolds, calendulas, and other flowers. Flower seeds of these hosts, particularly those with a thin coat, are injured by the composite thrips in the summer and late fall.

This species is common and has a wide distribution in North America having been taken from many plants, especially the Compositae. The exotic records are from Africa, Australia, Cuba, Egypt, Fiji, Hawaiian Islands, India, Japan, Java, Mexico, Palestine, and Sumatra.

Oregon Record:-

Portland, 26 March, 1940. Coll. Joe Schuh on camellia leaves.

XXV. Genus MYCETEROTHRIPS Trybom

1912, Trybom, F. Ent. Tijdschrift. p. 138.

Genotype M. laticaula Trybom

Head transverse, interocellar setae present. Eyes prominent, somewhat protruding; ocelli present. Mouth cone very long, pointed; maxillary palpus 3-segmented. Antenna 8-segmented, moderately slender; segments III and IV with forked sense cones.

Prothorax longer than wide and much longer than head, with two prominent spines on each posterior angle and two smaller spines on either side along posterior margin. Legs slender, unarmed. Fore wings thickened at base, moderately wide, pointed at tips; with two longitudinal veins; costa with a regular series of setae and fringe; fore vein with several basal setae and two or more distal setae, hind vein with a series of regularly placed setae.

Abdomen moderately stout, pointed at tip, with setae along the

sides and longer setae on distal segments.

55. Myceterothrips longirostrum (Jones). Fig. 52.

1912, Euthrips longirostrum Jones, P. R. Some New California and Georgia Thysanoptera. U.S.D.A. Bur. Ent. Tech. Series, No. 23, Pt. 1, pp. 12-14.

1923, Myceterothrips longirostrum (Jones) Watson, J. R. Synopsis and Catalog of the Thysanoptera of North America. Univ. Fla. Tech. Bull. 168, pp. 1-100.

Body length 1.08 - 1.40 mm. General color brown; head, thorax, legs and antennae tinged with yellow.

Head retracted considerable within prothorax; cheeks arched; back of head transversely striate. Ocelli light yellow; posterior pair widely separated. Mouth cone long, pointed, exceeding prosternum, tipped with black or dark brown. Antennae light yellowish gray-brown except segments I and III which are yellowish. A forked sense cone on dorsal side of antennal segment III; a similar one on ventral side of IV; a short, simple, sense cone on lateral side of V near apex. Antennal setae pale brown.

Thorax with wings yellowish white with veins indistinct. Setae of fore wing arranged as follows: Costa with 21 setae; fore longitudinal vein with 11; seven on basal half and four scattered setae in apical half; hind longitudinal vein with ten regularly placed setae beginning where basal group ends on fore longitudinal vein.

Abdomen subovate, tapering posteriorly from segment VII.

This species was described from four females taken at Los Gatos, California, May, 1910. Coll. P. R. Jones from flowers of a perennial

lupine.

Oregon Record:-

Otter Crest Park, Oregon Coast Hwy., 30 December, 1945. Coll. Leah J. and R. L. Post from moss and lichens on fallen Douglas fir log via Berlese funnel.

XXVI. Genus CEPHALOTHRIPS Uzel.

1895, Uzel, H. Monographie der Thysanoptera. pp. 1-472.

Genotype C. monilicornis Reuter, O. M.

Body small, head large; without conspicuous markings.

Head considerably longer than wide, also much longer than the prothorax, broadly rounded in front; cheeks nearly straight or somewhat constricted posteriorly; post ocular setae small and placed near side margins of head, cheek setae inconspicuous. Eyes large, elongate-ovate drawn out a little posteriorly on ventral side; ocelli present or wanting. Mouth cone short, broadly rounded, labrum blunt, overreaching labium. Antennae 8-segmented, relatively short, segments III - VI pediculate-ovate, VII slightly constricted at base but broadly joined to VI, VII - VIII closely joined, almost as a unit; III with one sense cone.

Thorax small; setae on prothorax small, blunt; epimeron not fused with pronotum posteriorly. Legs short, fore femora only slightly enlarged, fore tarsus of female with small tooth or unarmed. Wings when developed narrow, with parallel sides, fringe hairs rather sparsely placed, fore wings with double fringe hairs.

Abdomen relatively long, with sides almost parallel and reduced at eighth segment; two pairs of sigmoid setae; tube about two-thirds as

long as head, very slightly swollen at base, then gradually reduced with almost straight sides, not constricted at tip.

56. Cephalothrips elegans Moulton. Fig. 53.

1929, Moulton, D. Contribution to Our Knowledge of American Thysanoptera. Bull. Brooklyn Ent. Soc. 24: 224-244.

Length 1.5 mm. Color yellowish brown with the tube and distal three-quarters of head dark brown. In fresh and preserved specimens there are two internal lateral stripes of diffused orange-red pigmentation. This beautiful pigmentation is vividly exhibited by direct light on mounted specimens under higher magnification; pigmentation viewed through light from substage mirror grayish-brown.

Head with the distal three-fourths dark brown, basal fourth yellowish. Antennae uniformly brown with segments II and basal half of III yellowish. Head 1.2 longer than wide and 1.5 longer than prothorax, without conspicuous markings. Postocular spines as long as eyes, with dilated tips. Eyes moderately small. Ocelli present. Mouth cone short, extending two-thirds over prosternum. Antennae 1.5 times longer than head; segment III "V" shaped, III to VII each with a pedicel; VIII is broadly and compactly joined with VII.

Prothorax slightly wider than head; spines on anterior, mid-lateral and posterior margins present and all with dilated tips. The wings are vestigial and reduced to short pads. Legs yellow except tips of tarsi which are dark brown.

Abdomen yellowish-brown with the tube dark brown and concolorous. Spines clear yellow; wing-holding setae lacking. Tube .66 length of head.

Dr. Moulton appropriately named this species elegans, with the vivid orange-red internal pigmentation, abruptly contrasting colors of head, and tips of yellow tarsi deep dark brown.

This species as described from two females taken at Clarkesville, Tennessee, 5 April, 1926. Coll. J. W. Gilmore under maple bark. It has been recorded from Iowa (Moulton & Andre, 1940) in December and January from clumps of Andropogon furcatus Muhl. and hibernating in moss.

#### Oregon Records:-

Corvallis, 8 December, 1945. Coll. Leah J. and R. L. Post from moss and lichens from oak, Quercus garryana, 60 ft. from ground.

Corvallis, 17 January, 1946. Coll. K. Hobbs and R. L. Post from bark of dead oak 30 ft. from ground via Berlese funnel.

#### XXVII. Genus LIOTHRIPS Uzel

1895, Uzel, H. Monographie der Ordnung Thysanoptera. pp. 1-472.

#### Genotype L. hradecensis Uzel

Head clearly longer than wide, normally 1.2 or more longer, not produced in front of eyes, cheeks straight not constricted posteriorly. Postocular setae prominent, placed well back behind middle of eyes; cheek setae minute. Eyes large, ovate, not protruding, with moderately small facets; ocelli anterior in position, fore ocellus on swollen vertex. Mouth cone drawn out, pointed. Antenna 8-segmented, intermediate segments elongate, VII clearly separated from VIII, just noticeably narrowed at base, III with one sense cone.

Prothorax with all normal setae present, usually well developed; epimeron not fused with pronotum posteriorly. Legs slender, fore femora

not enlarged, fore tarsus unarmed. Wings usually well developed, with parallel sides, fore pair with double fringe hairs.

Abdomen usually slender, with long setae on terminal segments. Tube moderately long and slender but noticeably shorter than the head.

#### Key to Species.

1. Prominent setae with pointed tips; antennal segments IV, V, and VI partly yellows, fig. 55. ----- vaneeckei Priesner.
- Prominent setae with blunt or dilated tips, antennal segments IV at most partly yellow; V and VI dark brown to black, fig. 58. -  
----- 2
2. Fore wings brown in basal half lighter distally; fore wings with 12-14 double fringe hairs. Antennal segment III clear orange yellow, IV yellow in basal third, fig. 54.----- montanus Hood.
- Fore wings brown at extreme base, almost clear in basal quarter and washed with brown in distal three-quarters; fore wings with 9-11 double fringe hairs. Antennal segment III yellowish basally and light brown distally, IV not yellow in basal third. -----  
----- dumosa (Moulton).

#### 57. Liothrips montanus Hood. Fig. 54.

1913, Hood, J. D. Nine New Thysanoptera from the United States  
Proc. Biol. Soc. Wash. 26: 161-166.

Length 1.9 mm. Color dark brown to black.

Head about 1.2 times as long as wide; cheeks rounded, converging to base; eyes not protruding, one-third as long as head. Antennae with segments I and II nearly black; III clear orange yellow; IV - VIII nearly black, with IV yellow in basal third and along outer surface.

Prothorax about .55 times as long as head and about 2.5 times as wide as long; setae dark and blunt or rounded. Legs black. Fore wings dark in basal half, light distally; posterior fringe with about 14 double fringe hairs.

Abdomen stout with all setae nearly black.

This species was described from specimens taken at Bozeman, Montana, by Prof. R. A. Cooley and Mr. J. R. Parker. It is a minor pest to the tender shoots of black currant, red currant, and gooseberry bushes.

Oregon Record:-

Peoria Ferry, 1 February, 1940. Coll. R. L. Post from Usnea barbata via Berlese funnel. Specimens sent to U. S. Nat. Museum in 1940 for identification and retained by Floyd Andre.

58. Liothrips vaneeckei Priesner. The Lily Thrips. Figs. 55, 56, and 57.

1920, Priesner, H. Ein neuer Liothrips aus den Niederlanden. Zool.

Meded. R. Mus. Nat. Hist. Leiden 4: 211-212.

Length about 2.5 mm. General color glossy black with silvery white wings; distal portion of tibiae and tarsi as well as median antennal segments yellow.

Head 1.3 - 1.5 longer than wide. Antennal segments III - VI yellow. Setae with pointed tips. This species would probably not be confused with any other thrips if taken from bulbs.

This species was described in 1920 by Priesner from the Netherlands (from specimens collected in 1915) in bulbs of Lilium paradalinum. The first published record of the lily thrips from the United States is

that of Watson(1924) who wrote that he had recently received from Prof. Harry S. Smith of California specimens of a thrips infesting lily bulbs in Los Angeles County, California. This species was L. vaneeckei hitherto known only from Europe. Herrick (1925) reported it from the New York Botanical Gardens, October, 1923, on Lilium canadense. Moulton (1927) stated that he had obtained many specimens of this thrips which were found on lily bulbs from North Carolina and intercepted in Portland, Oregon.

Schopp and Doucette, who studied the biology of this species at Sumner, Washington, reported that native bulbs of Lilium washingtonianum in the Santiam National Forest, Oregon, carried infestation. All explanations of the presence of L. vaneeckei in this isolated region, several miles from highways and at an elevation of 3500 to 4500 feet, seem to prove that the thrips are native in this section. In the light of present information, it is impossible to say whether or not the lily thrips was introduced from North America to Europe or vice versa.

The distribution of this thrips in North America includes the Pacific Coast states, North Carolina, New York, Mexico and Canada. Its world distribution includes Austria, Belgium, England, Ceylon, China, France, Holland, India, Italy, Japan, and Russia.

The entire life cycle is spent on the lily bulbs at or below the ground level. As the winter is passed in both the adult and mature larval stage, two overlapping groups of thrips develop in parallel during the growing season. Each group passes through one and one-half generations annually. The lily thrips feeds on the epidermis of the

outer scales near the base. This injury is usually not serious in the northwest; the injured area tends to turn rusty brown and presents a sunken or flabby appearance. Hodson (1935) in Europe, however, states that "heavily infested bulbs may fail entirely to grow, and every graduation from a complete failure to a lightly infested and superficially healthy plant is to be met with in the field."

Oregon Records:-

Corvallis, 5 December, 1928. Coll. J. C. Wilcox on lily bulbs imported from France.

Corvallis, 26 August, 1930. Coll. W. J. Chamberlin from Easter lily bulbs.

Corvallis, 1 October, 1941. Coll. Joe Schuh from bulbs of Lilium hansonii.

Oregon City, 12 November, 1930. From Mount Hood Lily.

59. Liothrips dumosa (Moulton). Fig. 58.

1907, Trichothrips illex dumosa Moulton, D. A Contribution to Our Knowledge of the Thysanoptera of California. U.S.D.A. Bur. Ent. Tech. Ser. No. 12, Pt. 1, pp. 39-68.

1918, Liothrips dumosa (Moulton) Hood, J. D. New Genera and Species of Australian Thysanoptera. Memoirs of the Queensland Museum. pp. 121-150.

Length about 1.7 mm. Color dark brown to brown.

Head 1.05 - 1.3 times longer than wide. Antennae brown; only segment III yellow basally and light brown distally. In some specimens the third antennal segment is almost entirely yellowish brown, but unlike montanus segment IV is not yellow in basal third and along margin.

Thorax with fore wings brown at extreme base, beyond this lighter almost clear in basal quarter and washed with brown in distal three-quarters. Fore wing with 6 to 8 double fringe hairs. Setae with blunt or dilated tips.

Abdomen broadly ovate with segment VIII tapering abruptly to meet the smaller ninth and very narrow tenth segment.

In the brachypterous form the wings do not exceed the first abdominal segment and size and coloration is similar to macropterous form.

This species was described from Saratoga, Santa Clara County, California, on scrub oak, Quercus dumosa.

#### Oregon Records:-

Corvallis, 14 December, 1945. Coll. Leah J. and R. L. Post from lichen, Usnea barbata, on oak 50 ft. from ground via Berlese funnel.

8 mi. N. of Corvallis, 12 February, 1946. Coll. M. Ross, Leah J. and R. L. Post from Cynipid galls, Andricus californicus (Bass.) on oak, via Berlese funnel. Same date and location from Cynipid galls,

Disholcaspis simulata vancouverensis Kinsey on oak via Berlese funnel.

Gresham, 23 May, 1942. Coll. Joe Schuh from tips of ocean spray,

Holodiscus discolor. Both macropterous and brachypterous forms.

Portland, 12 June, 1940. Coll. Joe Schuh from racemes of ocean spray,

Holodiscus discolor. Brachypterous forms.

#### XXVIII. Genus LEPTOTHRIPS Hood

1909, Hood, J. D. A New Genus and a New Species of North American

Phloeothripidae. Ent. News 20: 249-252.

Genotype Phloeothrips mali Fitch

Body slender, usually with rather conspicuous, closely placed

transverse striations on head, pronotum, mesanotum, and longitudinal striations on metanotum.

Head nearly twice as long as wide, vertex roundly produced and overhanging bases of antennae. Post oculars small and placed rather close behind eyes. Eyes relatively large, sub-ovate, somewhat longer on ventral surface with small facets; ocelli anterior in position, placed on swollen vertex. Mouth cone moderately short, sub-acute. Antenna 8-segmented, moderately stout, segments III - VII sub-pediculate, VIII broadly joined to VII. III with one, IV with three sense cones.

Prothorax relatively small, about half as long as head and only a little wider; all spines relatively short, blunt, midlaterals wanting, pair at posterior angles longest; epimeron fused with pronotum posteriorly. Legs slender, fore tarsus unarmed in both sexes. Wings slender, narrowed in the middle, without veins; anterior pair with or without double fringe hairs.

Abdomen long and reduced rather gradually from base to tip, with two pairs of curved wing-retaining spines on segments II to VI, posterior angle spines conspicuous only on distal segments, terminal setae short. Tube short, not over half as long as head, with sides reduced evenly and not constricted before the tip.

#### Key to Species.

1. Head 1.5 times longer than greatest width across cheeks. Antennae with segments IV and V yellowish brown. Pronotum smooth.  
----- oregonensis Hood.

- Head about 1.7 times longer than greatest width across cheeks.  
Antennae with segments IV yellowish brown in basal third, dark

brown distally; apical two-thirds of V dark brown. Pronotum with fine transverse striations, fig. 59. ----- mali Fitch.

60. Leptothrips mali (Fitch). The Black Hunter. Fig. 59.

1854, Phloeothrips mali Fitch, A. First Report of Noxious Insects of the State of N. Y. p. 102.

1902, Cryptothrips asperus Hinds, W. Contribution to a Monograph of the Insects of the Order Thysanoptera Inhabiting N. A. Proc. U. S. Nat. Mus. 26: 79-242.

1904, Criptothrips californicus Daniel, S. M. New California Thysanoptera. Ent. News 15: 293-298.

1909, Leptothrips asperus Hood, J. D. A New Genus and a New Species of North American Phloeothripidae. Ent. News 20: 249-252.

1910, Liothrips mcconnelli Crawford, D. L. Thysanoptera of Mexico and the South. Pomona Journal of Entomology 2:(1) 153-170.

1913, Leptothrips asperus macro-ocellatus Watson, J. R. New Thysanoptera from Florida. Ent. News 24: 145-148.

1921, Cryptothrips adirondacks Watson, J. R. New Thysanoptera from N. Y. Bull. Brooklyn Ent. Soc. 16: 78-86.

1923, Leptothrips mali (Fitch) Watson, J. R. Synopsis and Catalog of the Thysanoptera of North America. U. of Fla. Tech. Bull. 168, pp. 1-100.

Length 1.68 mm. (1.45 - 2 mm.) Color dark brown to black with purplish pigmentation.

Head about one and 7/10 as long as broad. Cheeks almost straight and nearly parallel. Antennae with segments I and II concolorous

with head; III yellow shaded with brown apically; IV yellowish brown in basal third, darker brown apically; V - VIII dark brown; V lighter at pedicel.

Prothorax about twice as wide as long; two-fifths as long as head. Pronotum with fine transverse reticulation. Fore wings with 3 to 6 double fringe hairs.

Abdomen long and slender and tapering evenly from second segment to tip; segment III not broadest. Tube about half the length of head; its sides straight and converging slightly posteriorly.

This is a common predaceous species which feeds on thrips, eggs and young of scale insects, mites, aphids, and other small insects.

It commonly occurs on leaves of grape and hickory in the east although it occurs on almost any plant. It is widespread being found in the northeastern United States, Wisconsin, Florida, British Columbia, California, and Oregon as well as Mexico, Panama, and Barbados.

A specimen in the Moulton collection collected in Oregon in 1896 is one of the earliest records of a thrips from Oregon.

#### Oregon Records:-

Bonneville, Ore. U. S. Coast Guard Base, 30 January, 1946. Coll. R. L. Post from dead flowers of St. Johnswort, Hypericum perforatum.

Bruce Station, 17 February, 1946. Coll. Leah J. and R. L. Post from Eryophyid mite galls, on poplar via Berlese funnel.

Corvallis, 17 January, 1912. Under bark of pear.

8 mi. N. of Corvallis, 12 February, 1946. Coll. Leah J. and R. L. Post from robin's nest and from Cynipid galls, Disholcopsis simulata van-couverensis Kinsey via Berlese funnel.

Corvallis, 6 March, 1896. Under peach bark.

Corvallis, 18 December, 1945. Coll. Leah J. and R. L. Post from lichen, Usnea barbata, on apple tree limbs, via Berlese funnel.

Crater Lake, August, 1935. Coll. J. Stanley Brode.

Columbia River Hwy. Mitchell Point, 31 January, 1946. Coll. R. L. Post from galls of Disholcaspis simulata vancouverensis Kinsey via Berlese funnel.

The Dalles, 31 January, 1946. Coll. R. L. Post from galls of Andricus californicus (Bass.) on oak and from galls of Disholcaspis simulata vancouverensis Kinsey via Berlese funnel.

61. Leptothrips oregonensis Hood.

1938, Hood, J. D. Seven New Phloeothripidae from the United States.

Bull. Brook. Ent. Soc. 33: (5) 206-218.

Female length about 1.8 mm. (fully distended, 2.3 mm.) Color dark brown or blackish brown with purplish pigmentation.

Head about 1.5 times as greatest width across cheeks. Cheeks rounded, slightly rounded and narrowing to a very slight basal collar. Antennae with segments I and II concolorous with body; III yellow and shaded with brown apically; IV and V yellowish brown; V darker than IV; VI - VIII brown, VII darker than VI.

Prothorax about 0.47 the length of head, its dorsal surface without distinct striation; meso- and metanota with the usual fine striations. Fore wings with 6-8 double fringe hairs.

Abdomen typically broadest at segment III. Tube about one-half the length of head; sides slightly concave.

This species is readily distinguished from mali by the smooth

pronotum.

Oregon Record:-

Described from three females taken at Crater Lake National Park, 21 July, 1927, by J. D. Hood, two from Ribes cereum and one under bark on a stump, probably spruce.

The writer has not seen this species.

XXIX. Genus NEOHEGERIA Schmutz

1909, Schmutz, K. Zur Kenntnis einiger neuer Thysanopteren-genera und Thysanopteren-species. Teil II. Ann. Nat. Hist. Mus. Wien 23: 341-347.

Genotype N. dalmatica Schmutz

Body moderately stout, spines long, conspicuous, usually bent. Head somewhat longer than wide, cheeks very slightly arched and narrowed only a little posteriorly; vertex swollen but not overhanging; cheek setae present, post oculars long, curved, placed moderately close to eyes. Eyes relatively large, sub-ovate; ocelli anterior in position, the posterior pair bordering anterior inner margins of eyes. Mouth cone rather strongly pointed, labrum almost pointed. Antenna 8-segmented, moderately slender, segments III with two, IV with four sense cones; VIII slightly constricted at base, not closely joined to VII.

Prothorax somewhat shorter than head; all normal setae present, long and conspicuous. Pterothorax large. Legs moderately slender, fore tarsus with a small tooth in both sexes. Wings clearly narrowed in the middle, without venation.

Abdomen strong, reduced gradually, lateral setae conspicuous, segments II to VII each with two pairs of well developed wing-retaining

setae. Tube about .8 as long as head, noticeably slender and constricted before the end.

Males similar to females but with stronger tooth on fore tarsus; also the spines on posterior angles of ninth abdominal segment are reduced to spurs.

62. Neoheegeria verbaschi (Osborn). The Mullein Thrips. Figs. 60, 61.

1895, Phloeothrips verbaschi Osborn, H. Note on a New Species of Phloeothrips, with Description. Proc. Iowa Academy of Sciences 3: 298.

1902, Anthothrips verbaschi (Osborn), Hinds, W. E. Contribution to a Monograph of the Order Thysanoptera Inhabiting North America. Proc. U. S. Nat. Mus. 26: 79-242.

1907, Trichothrips femoralis Moulton, D. A Contribution to Our Knowledge of the Thysanoptera of California. U.S.D.A. Bur. Ent. Tech. Ser. No. 12, Pt. III, pp. 39-68.

1912, Haplothrips verbaschi Karny, H. H. Zoological Annals 4: 325.

1928, Neoheegeria verbaschi (Osborn), Priesner, H. Die Thysanopteren Europas. 4: 569-755.

1939, Neoheegeria verbaschi (Osborn) Bailey, S. F. The Mullein Thrips. Pan Pacific Entomologist 15:(3) 111-116.

Length 1.8 mm. Color dark brown with intermediate antennal segments, fore tibiae, and all tarsi yellowish.

As there is but one species in this genus found in the Northwest the characters of the genus readily distinguish the mullein thrips.

Antennae with segments I and II dark brown; II and VI yellowish; VI with apical half yellowish brown; VII and VIII light gray brown.

The specimens from Oregon have a slight concavity on the posterior border of the cheeks although the description and drawings of the species show the cheeks straight and parallel.

This species is common on mullein, *Verbascum*, throughout the eastern United States, Iowa, Kansas, Illinois, Michigan and the far west. Specimens from France are in the Moulton collection. Although this species is recorded from mullein the writer obtained other host records for hibernating adults. These winter hosts were probably due to the mullein being mowed down along the roadsides and the adults migrating to other plants.

Oregon Records:-

Bonneville, Ore., U. S. Coast Guard Base, 31 January, 1946. Coll. R. L. Post from burdock burrs via Berlese funnel.

Corvallis, 23 April, 1946. Coll. Leah J. and R. L. Post from mullein, *Verbascum thapsus*.

Columbia River Hwy., Warren Creek, Vic. Lindsey, 31 January, 1946.

Coll. R. L. Post from dead mullein flower stalks, *Verbascum thapsus*, via Berlese funnel. Same date from dead flowers of St. Johnswort, *Hypericum perforatum*.

North Portland, 29 January, 1946. Coll. R. L. Post from lyr. plants of mullein, *Verbascum thapsus*.

Shepherds Dell, Columbia River Hwy., 30 January, 1946. Coll. R. L. Post from dead flowers of yarrow, *Achillea millefolium*.

Talent, 8 December, 1945. Coll. L. G. Gentner on 2 yr. old plants of mullein.

3 mi. E. Troutdale, 30 January, 1946. Coll. R. L. Post from mullein,

Verbascum thapsus.XXX. Genus HAPLOTHRIPS Amy. & Serv.

1843, Amyot, C. J. & Serville, J. G. Hist. Nat. des Insectes Hemipteres, pp. 637-646.

Genotype Phloeothrips albipennis Burmeister

Head longer than wide, sometimes much longer and as long or longer than the prothorax; vertex slightly swollen but not overhanging; without markings or sculptoring other than very fine transverse and broken lines; post oculars well developed, placed rather close behind eyes; cheek spines minute. Eyes sub-ovate, with small facets, occupying almost one-third the side of head; ocelli anterior in position, on slightly swollen vertex. Mouth cone not very long, reaching to middle or just beyond middle of prosternum, either slightly narrowed toward the end or broadly rounded; labrum blunt to shortly pointed. Antenna 8-segmented, segment III fully symmetrical or assymetrical, with or without sense cones; VII and VIII usually rather closely joined but clearly defined.

Prothorax normally widened behind, with normal setae although the anterio-marginals may be minute, epimeron not fused with pronotum. Legs normally slender with fore femora somewhat enlarged or greatly enlarged, fore tarsus armed or unarmed. Wings when present, narrowed in the middle, fore pair with or without double fringe hairs.

Abdomen normally elongate and reduced beyond sixth segment; lateral setae inconspicuous, segments II to VII usually with two pairs of wing retaining setae. Tube shorter than head and moderately slender, with straight sides gradually reduced; terminal hairs moderately long, sometimes as long as tube.

## Key to Species.

1. Tube 2.8 - 3.3 (mostly 3) times as long as wide at base; prothoracic setae rudimentary, scarcely visible, never more than 23 microns long, fig. 63. ----- leucanthemi (Schrank).
- Tube shorter, 2.3 - 2.8 (mostly 2.6) times as long as wide at base; prothoracic setae while small, yet always distinct, about 30-40 microns long, fig. 65. ----- niger (Osborn).

63. Haplothrips leucanthemi (Schrank). The Statice Thrips. Figs. 62 and 63.

1781, Thrips leucanthemi Schrank. Insectorum Austriae Indigenorum. p. 297.

1836, Phloeothrips statices Haliday, H. An Epitome of the British Genera in the Order Thysanoptera with Indications of a Few of the Species. Entomological Magazine 3: 439-451.

1923, Haplothrips leucanthemi (Schrank) Watson, J. R. Thysanoptera of North America. Univ. Fla. Tech. Bull. 168. pp. 1-100.

Length varies from 1.50 to 1.80 mm. Color dark brown to black with some of the middle segments of the antennae yellowish.

Head with postocular setae extremely small, scarcely visible; antennae dark brown with segments III and basal half of IV and pedicel of V yellowish. In females antennal segment III is 1.7 - 1.9 times as long as broad, in males 2 - 2.3.

Thorax with prothoracic setae rudimentary, scarcely visible, in males more distinct and never more than 23 microns long. Wings strongly clouded, smoky-brown nearly to tip, with 6 - 9 double fringe hairs.

Abdomen with tube 2.8 - 3.3 (mostly 3) times as long as wide at base; tube a little shorter or slightly longer than width of head.

This species is confused with H. niger and has been separated on the characters given in the key.

The statice thrips is a European species introduced into America and now found all over the United States as well as Manitoba, British Columbia, and Ottawa in Canada. It is a pest of minor importance and has been reported as being destructive to the red clover seed crop in Montana and Idaho. It infests many plants being most common on grasses, but also on apple, plum, spirea, tomatoes and corn.

Oregon Records:-

Albany, 7 May, 1941. Coll. Joe Schuh from camass, Camassia leichtlinii.

Corvallis, 4 June, 1941. From flowers of ox-eye daisy, Chrysanthemum leucanthemum.

Corvallis, 16 July, 1925. Coll. D. G. Gillespie from dandelion, Taraxacum officinale.

Corvallis, 3 June, 1912. Coll. H. F. Wilson.

Coquille, 10 August, 1918. Coll. A. B. Black from plantain.

Gresham, 29 May, 1940. Coll. Joe Schuh from plantain, Plantago lanceolata.

Oak Grove, 29 May, 1940. Coll. Joe Schuh from flowers of milfoil, Achillea millifolium.

64. Haplothrips niger (Osborn). Figs. 64, 65.

1883, Pholeothrips nigra Osborn, H. Notes on Thripidae with

Descriptions of New Species. Canadian Ent. 3:(8) 151-157.

1918, Hood, J. D. New Genera and Species of Australian Thysanop-

tera. Memoirs of the Queensland Museum. pp. 121-150. In this paper Hood lists Phloeothrips nigra Osborn as a synonym of P. statices Haliday.

1923, Watson, J. R. Synopsis and Catalog of the Thysanoptera of North America. Univ. of Florida Agr. Expt. Sta. Bull. 168. pp. 1-100. (Anthothrips niger (Osborn) is listed as a synonym of Haplothrips leucanthemi (Schrank).

1927, Priesner, H. Die Thysanopteren Europas. pp. 344-570. Restores Haplothrips niger (Osborn) to specific status.

Length 1.5 (1.1 - 1.8 mm.). General color more or less a dark reddish brown.

Head with postocular setae more distinct than with leucanthemi, never more than 20 microns long. Antennae brown; three and base of IV yellowish brown. However, some forms have the color of the antennae intergrading to that of leucanthemi.

Thorax with wings glass clear, rarely with extremely slight shading in basal half; double fringe hairs 5 - 9, rarely 10. Setae on prothorax while small, yet always distinct, about 30 - 40 microns long.

Abdomen with tube 2.3 - 2.8 (mostly 2.6) times as long as broad at base; tube shorter than width of head.

This species had been placed in synonymy as a synonym of H. leucanthemi (Schr.). Priesner (1927) has restored it to its correct status as a true species on the characters as given in the key to the species. It is very close to H. leucanthemi in coloration and the antennal coloration as used by Osborn in describing the species is

not always reliable.

This species has been recorded from Iowa, Michigan, and Massachusetts on yarrow, ox-eye daisy, red clover, white clover and various grasses.

Oregon Records:-

Gresham, 29 May, 1940. Coll. Joe Schuh on red clover, Trifolium pratense; white clover heads, Trifolium repans, and Wils rose.

Gresham, 7 August, 1944. Coll. Joe Schuh on dahlia buds.

Richreall, 31 May, 1940. Coll. Joe Schuh on flowers of white cluster lily, Brodiaea hyacinthina.

XXXa. Subgenus XYLAPLOTHRIPS

1927, Priesner, H. Die Thysanopteren Europas. pp. 344-570.

The subgenus Xylaplothrips as erected by Priesner is distinguished by the third antennal segment being symmetrical; whereas other subgenera have the third antennal segment more or less unsymmetrical.

65. Haplothrips (Xylaplothrips) subterraneus Crawford. Fig. 66.

1938, J. C. Crawford. Some New or Little Known Thysanoptera.

Proc. Ent. Soc. Wash. 40:(2) 41-4

Length (distended) 2 mm. General color dark brown, including legs, but with fore femora at apices and all tibiae at bases yellowish; fore tibiae only lightly darkened medially.

Head with anastomosing transverse lines; a pair of short (15 microns) postocellar setae; another similar pair in front of posterior ocelli, and a shorter pair close to and on line with posterior margin of anterior ocellus. Antennae with segments I and II concolorous with head; remaining segments lighter brown with bases of

segments II - VI yellowish. Antennal segment I very broad tapering to tip, where it is about as broad as greatest width of segment II; segment III obconical, symmetrical; IV and V sides almost evenly rounded; VI slightly obconical; VII cylindrical; VIII acute, with base narrowed; segments III to VII pedicellate.

Thorax with fore wings only slightly narrowed medially with 5 - 8 double fringe hairs, usually 6 or 7. Fore femora with numerous short bristles, those within at base shorter and darkened, spinelike; fore tarsi with small tooth.

Abdomen with segments II to VII with two pairs of wing-retaining setae, the posterior pair doubly arcuate. Segments with transverse anastomosing lines, almost reticulate. Tube length 152 microns, basal width 73 microns, apical width 36 microns. Abdominal setae on segment IX, inner 163 microns, outer 181 microns; on apex of X setae 145 microns.

This species was described from many specimens taken at New York, N. Y., 6, 14, and 26 October, 1926, by Inspectors R. Shemin, R. W. Woodbury, and M. A. McMaster of the Bur. Ent. & Plant Quar. on lily bulbs from England. It was taken in company with many Liothrips vaneeckei but was usually found in more decayed sections of the bulbs.

Oregon Record:-

Taken in Canada on lily bulb from Oregon. This record from specimen in U. S. National Museum.

XXXI. Genus HOPLANDOTHRIPS Hood

1912, Hood, J. D. Descriptions of New North American Thysanoptera.

Proc. Ent. Soc. Wash. 14: 129-160.

1923, Watson, J. R. Synopsis and Catalog of the Thysanoptera of N. A.

Univ. Florida Agr. Expt. Sta. Bull. 168. pp. 1-100.

Genotype Phloeothrips (Hoplandothrips) xanthopus Hood

Dorsal surface, at least of pronotum, not deeply roughened. Vertex subconical, more or less produced. Genal setae directed anteriorly from the apices of prominent tubercles. Prothorax evenly trapezoidal, with straight sides; bristles long, normal in position. Femur of male with two subapical teeth on inner side; tibia of male with similar tooth near base.

66. Hoplandothrips armiger (Jones). Fig. 67.

1912, Phloeothrips armiger Jones, P. R. Some New California and Georgia Thysanoptera. U.S. Dept. Agr. Bur. Ent. Tech. Series No. 23, Pt. 1, pp. 23-24.

1923, Hoplandothrips armiger (Jones) Watson, J. Synopsis and Catalog of the Thysanoptera of N. A. Univ. of Fla. Bull. No. 168, pp. 1-100.

Length 2.46 mm. General color dark reddish brown.

Head with five warts on each side from each of which there arises a small seta, the posterior one the largest and stoutest; vertex projecting considerably between the basal segments of the antennae. Eyes each with a long, prominent, knobbed postocular seta. Ocelli reddish yellow with dark red crescents. Antennae with segments I and II dark reddish brown; remaining segments uniformly dark brown, somewhat lighter at the bases and apices except the last which is uniform dark brown. Sense cones dark on segment II where the sense area is large and conspicuous and the sense cones short and thick; long but

transparent sense cones on segments III - VII.

Prothorax about one and two-thirds as wide as long and about five-sixths as long as the head. Prothoracic setae prominent, long and rounded at tips; one each at anterior angle, midlaterally, posterior angle, and just inside the one on posterior angle. Fore coxae each with a long knobbed seta and each armed with four short, stout, pointed setae. Wings long, slender and transparent; three long clubbed setae on the anterior margin of the fore wings near the base. A very light brown stripe in the center of the posterior pair of wings extending slightly past the middle. Legs long and stout and set with setae; fore femora greatly enlarged, one-half as wide as long. Fore femora with two sharp, tooth-like projections at the tip within, and a groove between them, evidently a sheath for the tibiae; fore tibiae with a small tooth near the base within. Fore tarsi with a large angular tooth on the inner side. Fore tibiae and all tarsi light brownish yellow.

Abdomen long and slender, tapering gradually from the first segment. Abdominal segments with clubbed setae on posterior margins; one pair on ninth abdominal segment; segments VI, VII and VIII with several pointed setae in addition to the rounded setae. Tube one-half as long as head.

This species was described from one specimen taken at Alum Rock Creek Canyon, San Jose, California, 10 July, 1910. Coll. P. R. Jones from gall on laurel leaf.

Oregon Record:-

Corvallis, 11 March, 1941. Coll. R. L. Post on willow, Salix sp.

XXXII. Genus MEGALOTHRIPS Uzel

1895, Uzel, H. Monographie der Ordnung Thysanoptera. pp. 1-472.

Genotype M. bonannii Uzel

Body large, head approximately twice as long as wide, with sides almost parallel, with a pair of fairly well developed interocellar spines; cheek spines small. Eyes relatively small, ocelli equidistant, posterior pair close to middle, inner margins of eyes. Mouth cone short, broadly rounded. Antenna 8-segmented, long and slender, segment III thickened, with uneven sides and approximately four times longer than greatest width, with two moderately short sense cones, IV with three such sense cones; VIII narrowed toward base and clearly separated from VII.

Prothorax approximately one-fourth as long as head, clearly transverse, with normal setae, the mid-laterals placed far forward, setae on posterior angles longest; pterothorax large and strong. Legs long and slender; fore femora not enlarged; fore tarsus unarmed. Wings fully developed, without venation, fringes placed closely, with a long series of double fringes on fore wings.

Abdomen large, narrowed gradually beyond fifth segment, lateral setae conspicuous, segments II to VII with two pairs of wing retaining setae. Tube clearly shorter than head, and shorter than in Megathrips.

Male with side appendages on sixth abdominal segment, without bumps or swellings on the sides of segment VIII.

## Key to Species.

1. Antennae entirely brown. ----- spinosus Hood.
- Antennae not entirely brown. ----- 2

2. Third antennal segment yellow in basal two-thirds, brown distally; fourth lighter to yellowish in basal third, five dark brown. ----- picticornis Hood.

-- Third antennal segment yellow, only faintly shaded apically; fourth yellow in basal two-thirds, light brown in apical third; fifth yellow in basal third, dark brown in apical half. -----  
----- new species (See text).

67. Megalothrips picticornis Hood, Figs. 68, 69.

1927, Hood, J. D. New Western Thysanoptera. Proc. Biol. Soc.

Wash. 40: 204.

1929, Docessissophothrips animus, Moulton, D. Contribution to

Our Knowledge of American Thysanoptera. Bull. Brook. Ent.

Soc. 24: 242-243.

Female 4.3 mm. (length distended). Color dark brown with head and tip of abdomen beyond seventh segment blackish. All legs and segments of antennae dark brown except basal two-thirds of III and basal third of IV which are yellowish.

Head 1.7 times longer than wide, narrower in front, swollen and elevated in the middle and somewhat reduced toward posterior margin. A pair of prominent setae on either side in front of each posterior ocellus and a pair immediately behind and a little inward from the posterior ocelli. The postocular setae are placed well back from the eyes and another pair near the median dorsal part of the head. Cheek setae small. Eyes with small facets. Ocelli large, anterior ocellus directed well forward; posterior ocelli approximate to inner posterior angles of eyes. Antennae with sense cones short, pale, slender, and

pointed.

Prothorax .2 as long as head and four times as wide as long, deeply concave in front. Pterothorax with sides almost parallel. Wings broad with parallel sides extending to sixth abdominal segment; fore pair with about 18 double fringe hairs.

Abdomen about as wide as pterothorax to fifth segment; reduced gradually from sixth segment to base of tube. Tube .6 as long as head and three times as long at width at base.

Male length 3.32 mm. Similar in color to female. The sixth abdominal segment with a pair of inwardly curved appendages which extend to beyond the middle of the seventh segment.

The type series were collected at Blue Lake, California on a dead willow branch (no additional data given), and from Salt Lake City, Utah, 28 May, 1879 at an elevation of 4340 feet. The specimens upon which Moulton's synonym, D. animus, was based were collected at Mt. View, California, 11 July, 1925. Coll. by Dudley Moulton while sweeping nettles in the hills and from Corvallis, Oregon, by J. C. Bridwell, host plant and date not given. Specimens in Moulton collection from Puyallup, Washington, 25 August, 1937. Coll. D. Johnson on dead willow.

#### Oregon Records:-

Corvallis, Coll. J. C. Bridwell.

Portland, April, 1940. Coll. Joe Schuh from goldenrod galls.

68. Megalothrips spinosus Hood. Figs. 70, 71.

1908, Hood, J. D. Three New North American Pholeothripidae. The Canadian Entomologist 40:(9) 305-309.

Length about 4 mm. Color nearly uniform black except the tarsi

which are dark brown.

Head a little more than twice as long as wide, broadly rounded in front with sides almost parallel. There are three pairs of prominent pointed setae as follows; a pair anterior to posterior ocelli, a shorter pair with their bases just behind the posterior ocelli, and a longer pair of postoculars about equal in length to the anterior pair. Ocelli brownish yellow with anterior ocellus on vertex and posterior ocelli contiguous to inner borders of eyes, their diameters about three times that of the facets. The antennae are entirely dark brown which separates this species from other Oregon species of Megalothrips.

Prothorax three-fifths as long as width of head and about three times as long; surface transversely striate. Pterothorax large, rectangular, two-thirds as long as wide. Wings long, attaining ninth abdominal segment. Anterior femora and tibiae with long setae; tarsi armed with a blunt tooth.

Abdomen equal in width to pterothorax and widest at segment IV from which it tapers evenly to tube. Tube almost equal in length to head; base expanded with parallel sides except tip which is constricted; surface with many small setae.

This species was described from specimens taken at Harrisburg, Pennsylvania, March 10th in burrows of insect larvae in dead willow stem. It is also recorded from Massachusetts, New York, Maryland, Virginia, and Illinois.

Oregon Record:-

U. P. R. R. tracks, Parkrose, 30 January, 1946, Coll. R. L. Post from goldenrod galls of Eurosta soldaginis (Fitch) via Berlese funnel.

69. Megalothrips new species. Figs. 72, 73, 74, 75, 76.

In the course of the writer's studies on Thysanoptera he was unable to determine a large series of Megalothrips collected by Joe Schuh from galleries of Cryptorhynchus lapathi (L.). A few slides were sent to the Bureau of Insect Identification, Washington, D. C., and were identified as a new species. In accordance with their request, a series of 115 specimens was forwarded October, 1945, for description of the species by J. C. Crawford. To date this Megalothrips has not been named.

Out of professional courtesy the writer is merely calling attention to this new species and refraining from a detailed description other than to identify it from other species found in Oregon.

Length about 4.8 mm. (distended 5 mm.). Color dark brown to black; antennae dark brown with segment III yellow with yellowish brown only at apex; IV yellow in basal two-thirds and light brown in apical third; V yellow in basal third. Tarsi yellowish brown. Length of tube 0.6 mm., broadest at base and tapering evenly to tip.

This is the largest species of thrips found in Oregon to date.

Oregon Records:-

Portland, 4, 5, 6, and 8 July, 1940. Coll. Joe Schuh from galleries of mottled willow borer, Cryptorhynchus lapathi (L.) in willow. Also from Cryptorhynchus rearing cages.

#### XXXIII. Genus OEDALEOTHRIPS Hood

1916, Hood, J. D. Oedaleothrips hookeri, A New Genus and Species of Thysanoptera. Bull. Brooklyn Soc. 11:(3) 64-65.

Genotype O. hookeri Hood

The swollen head, reduced thorax and enlarged abdomen give the insect an ant-like appearance.

Head about 1.5 times longer than wide, broadly rounded in front, broadest behind eyes, greatly narrowed at base; postocular setae short, sublateral equal in length to a forwardly directed pair near base of antennae. Eyes small, flattened, protruding, produced posteriorly on ventral side, widely separated. Mouth cone short, broadly rounded. Antenna 8-segmented, moderately stout, widely separated at base; segments IV - VI produced ventrally at apex, III longest, with two short sense cones at apex; VIII narrowed at base.

Prothorax unusually small, with normal but very small setae; pterothorax greatly reduced. Legs moderately stout, fore femora thickened more than the others, fore tarsus armed with a stout tooth. Wings wanting.

Abdomen broad and heavy; tube about half as long as head, narrowed distally.

Male similar to female but with head broadest at eyes and with cheeks almost straight, reduced gradually posteriorly.

The members of this genus look very much like ants and some of them occur in frequent association with the species of ants to which they bear a close resemblance. The demarcation between thorax and abdomen so accentuated in the ants is secured in the species of Oedaleo-thrips by the disposition of white marks in such a way as to reduce still further the apparent width of the pterothorax, and to make the abdomen appear pedicellate.

70. Oedaleothrips jacksoni Hood. Fig. 78.

1925, Hood, J. D. Six Thysanoptera from the Western United States.

Entomological News 36: 137-138.

Length 2.5 mm. General color black; posterior third of pterothorax and all of segment I of abdomen nearly white; segment V of abdomen with a pair of white patches at the posterior angles.

Head about 1.5 times as long as wide; elevated and swollen behind eyes; narrowed posteriorly to a neck-like base which is two-thirds the greatest width of head. Ocelli lacking. Segments I - III of antennae yellow, the first two being pale brown at base; remaining segments black.

Thorax with pterothorax greatly reduced, about as long as broad and narrower than head. Legs long and slender; blackish brown with middle and hind tibiae and their tarsi darker. Hind femora and tibiae arcuate. Fore tarsus with a very stout triangular tooth.

Abdomen broad and heavy, abruptly broadened from the narrow base; more than twice as wide as the pterothorax. Tube black, about 0.4 the length of head and more than twice as wide at base than at apex; sides straight, setae nearly colorless and pointed.

This species was described from one female taken at Mill Gulch, Colorado, 30 May, 1919. Coll. L. O. Jackson from a limb of mountain mahogany, Cercocarpus parvifolius.

Oregon Record:-

There are two damaged specimens in the Moulton collection from Forest Grove, winter of 1928. Coll. S. E. Keen from dry grass.

XXXIV. Genus BOLOTHRIPS Priesner

1926, Priesner, H. Treubia 8: Supplement, p. 90.

Genotype Phloeothrips bicolor Heeger

Head somewhat longer than wide, slightly produced in front of eyes, narrowed from eyes to base; postoculars placed directly against posterior margins of eyes, genal setae minute. Eyes somewhat protruding, flattened at the sides, produced posteriorly on ventral side. Mouth cone short, rounded; labrum angular. Antenna 8-segmented, moderately slender, segment III clavate, with two small sense cones; VIII narrowed at base.

Prothorax two-thirds as long as head, with median dorsal thickening, with normal, relatively small setae. Fore legs slightly enlarged in the female, greatly so in the male, fore tarsus unarmed in female, with a strong tooth in the male. Wings present or wanting, when present, with parallel sides and fore pair with double fringe hairs.

Abdomen stout; tube only moderately long; ninth segment distinctly extended over tube.

71. Bolothrips lativerticis new species. Figs. 77, 79, 80, 81.

(latus-broad, vertex-forehead)

Holotype female: Total length 2.8 mm. Color blackish brown, nearly black including legs, with abdominal segments one to five somewhat lighter; antennal segments I, II and V - VIII blackish brown, III yellow in basal half, IV and V yellow in basal fifth; wings lightly washed with brown. All setae clear. (Larvae with forehead, antennae and legs dark brown, otherwise the entire head and body with deep red pigmentations.)

Head length 0.323 mm., width 0.315 mm.; prothorax, median length of pronotum 0.22 mm., width including coxae 0.455 mm.; tube length 0.22 mm. width at base 0.095 mm., at tip 0.044 mm. Antennal segments length (width): II, 76 (43); III, 76 (46); IV, 86 (50); V, 80 (40); VI, 76 (40); VII - VIII, 100 microns; length of setae: postoculars, 73; on anterior margin of pronotum, present but length undetermined on anterior angles 40; inner on posterior angles 86, outer 76; median on ninth abdominal segment 166, on posterior angles 216; terminal setae 200 microns.

Head approximately as long as greatest width behind eyes; forehead flattened in front between widely separated basal antennal segments, this measurement 60 microns, cheeks swollen behind eyes and then evenly narrowed to base; eyes relatively small, slightly flattened on outer margin, broadly angular on inner margin, produced only a little on ventral surface; mouth cone broad but narrowed before the end where it extends to posterior margin of prosternum; antennae 1.8 times longer than head, segments III to V broadly club-shaped, VII and VIII united as a unit, segment III with three stout, blunt sense cones, one on inner and two on outer apical margin; segment IV with four, two on inner and two on outer margin; postocular setae well developed, with blunt tips and placed well back from eyes, rather close to side margins of head.

Prothorax transverse, weakly emarginate in front, all normal setae developed, with blunt tips; pterothorax only slightly wider than prothorax, abdomen normal, terga without sigmoid setae; tube .7 as long as head, 2.3 times longer than width at base; terminal setae

approximately as long as tube. Legs reasonably slender, fore femora not greatly enlarged, fore tarsus with a strong, nearly straight and moderately sharp tooth; wings of even width, fore pair with 8 - 13 double fringes.

Type material:- Type female, 3 eggs, and 21 larvae taken at Herman Creek, near Cascade Locks, Oregon, 31 January, 1946. Collected by the writer from hollow terminal twigs of elderberry, Sambucus racemosa. Type in author's collection.

Paratype female and 6 larvae taken at Myrtle Creek, near Ophir, Curry County, Oregon, 1 March, 1946. Collected by R. L. Post from hollow terminal twigs of elderberry, Sambucus. Deposited in Moulton collection.

One paratype female, 42 larvae, and 10 prepupae collected at Corvallis, 23 March, 1946. Collected by Leah J. and R. L. Post from stems and twigs of elderberry, Sambucus, via Berlese funnel. In Oregon State College collection.

This species is distinct from other known species in the relatively short head, this being about as long as wide and more especially by the greater width between the basal segments of antennae.

## VI. DEFINITION OF TERMS

Comb: the tergite of the eighth abdominal segment having serrations along the posterior margin which are produced to hair-like points, forming the comb peculiar to this segment. The presence or absence of this character, although satisfactory for specific distinction, is not used in the keys as it is extremely difficult for the student to distinguish it as it requires careful light adjustment.

Anterior longitudinal vein or fore vein: the vein posterior to the ambient vein or "ring vein". Both terms are used interchangeably by Thysanopterists.

Double fringe hairs: a series of hairs that arise from the extreme posterior border of the fore wings. The bases of these hairs are distal of the bases of the regular fringe. Authorities on Thysanoptera often refer to these hairs as "dfh". The numbers of dfh are of importance in determining species of Tubulifera.

Gonapophyses: appendages pertaining to the genitalia.

Posterior longitudinal vein or hind vein: the vein posterior to the anterior longitudinal vein. Both terms are in common usage by Thysanopterists.

Pterothorax: the wing bearing segments in Thysanoptera.

Stylus: a terminal bristle or hair-like projection on the antennal segment.

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Plate 1.

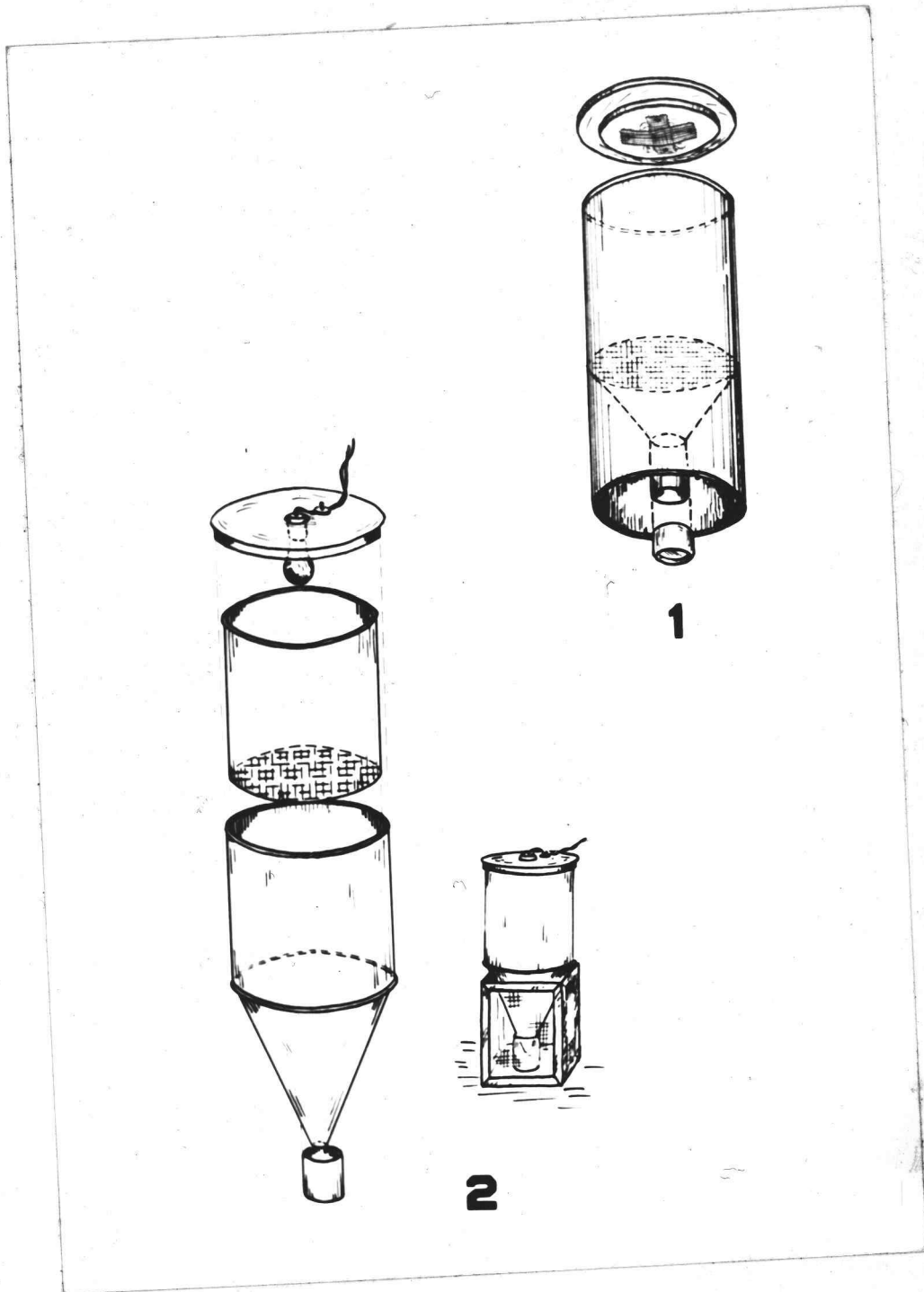
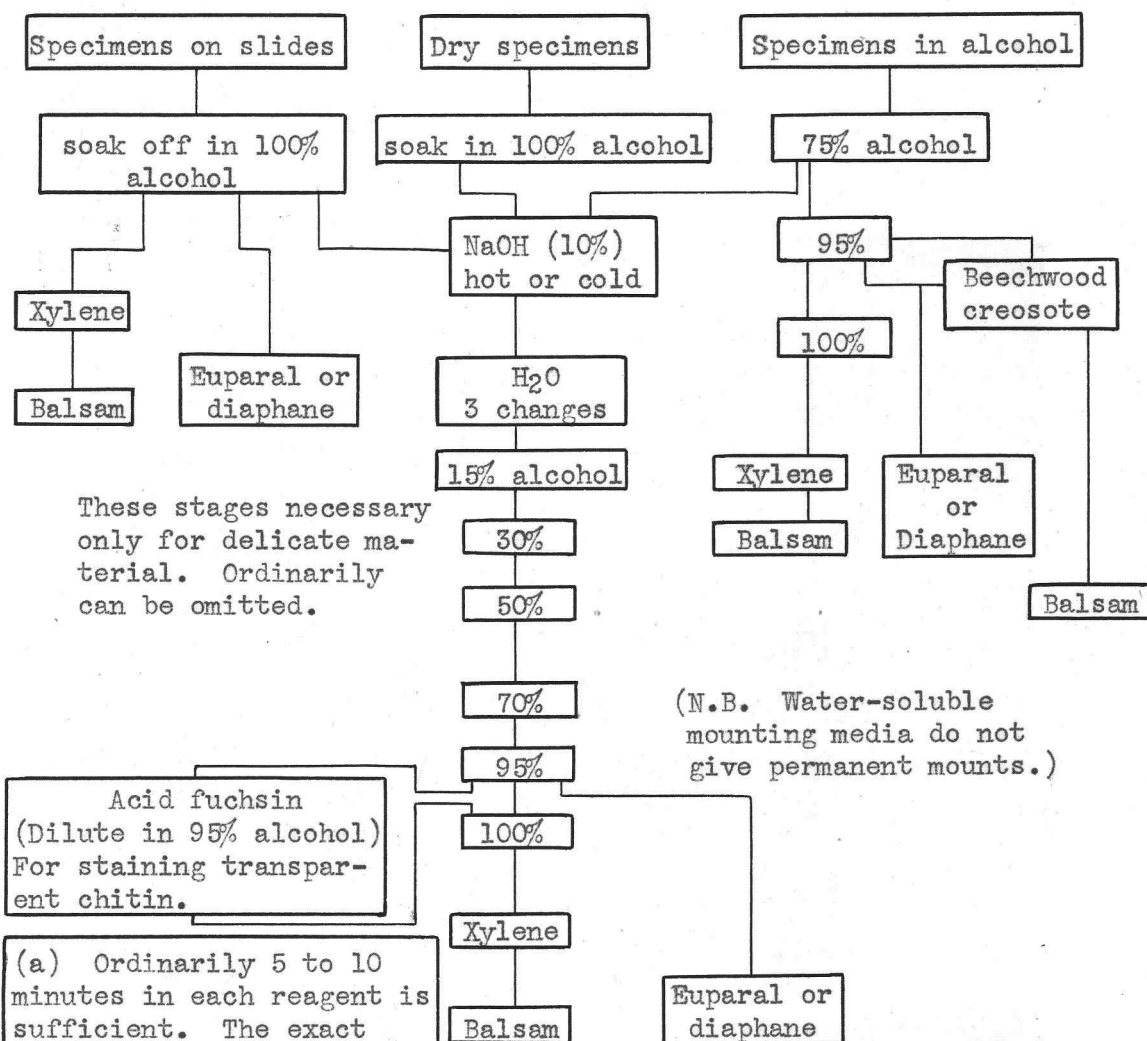


Figure 3.

COURSE OF SPECIMENS THROUGH REAGENTS  
IN MAKING MICROSCOPICAL WHOLE MOUNTS



(a) Ordinarily 5 to 10 minutes in each reagent is sufficient. The exact time must be determined by each worker as the result of his own experience.

(b) NaOH is used to remove all tissue.

(c) Remember that the evaporation of xylene or other solvent will reduce the volume of the balsam, euparal, or diaphane as much as 30-50%, and that an equivalent excess of the mountant must be placed upon the slide, or added later, if the specimen is not to be crushed.

(d) Beechwood creosote leaves the specimens soft and pliable and final adjustments of appendages can be made prior to putting on the cover slip.

Plate III.



## Plate IV.

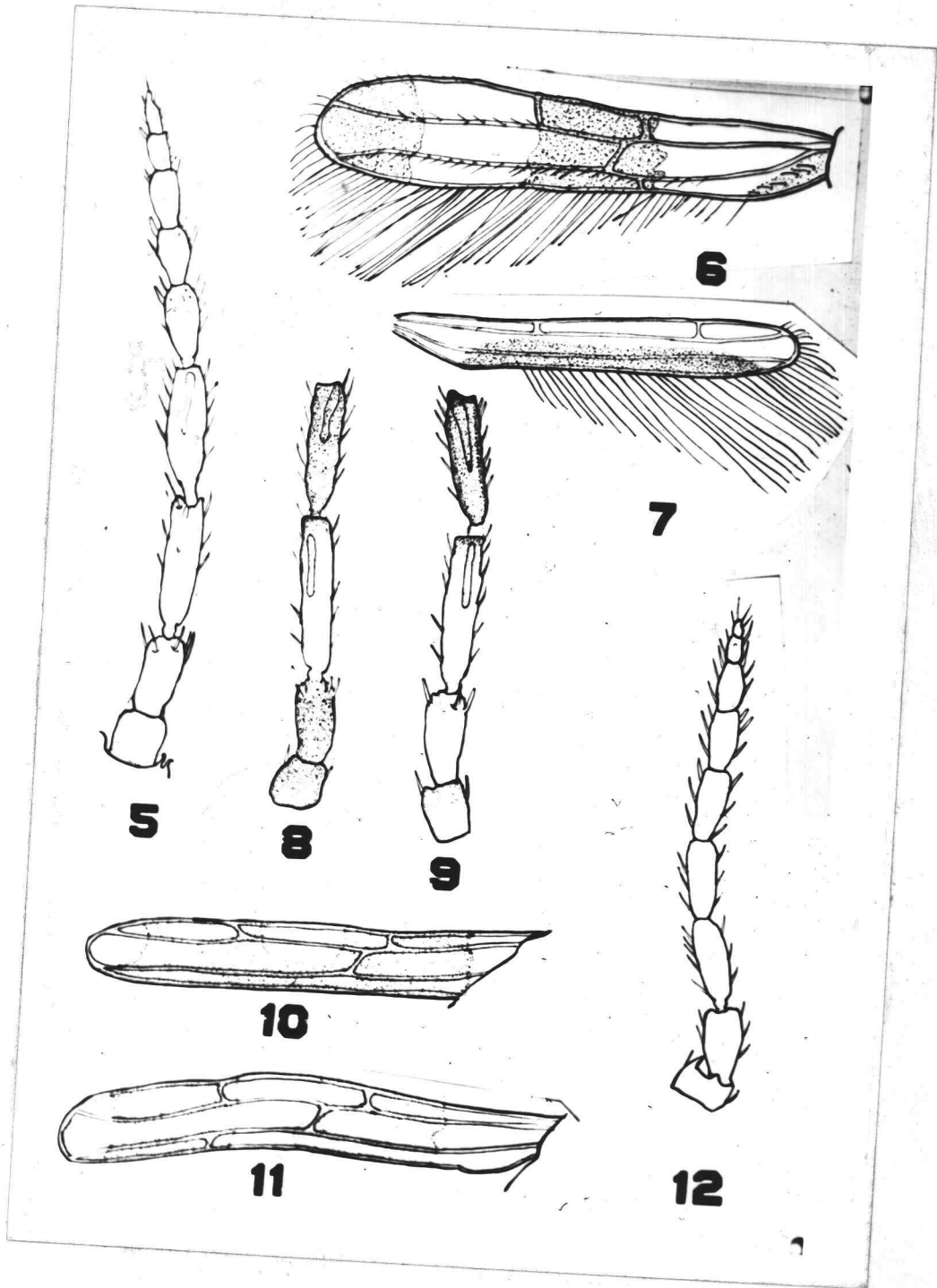
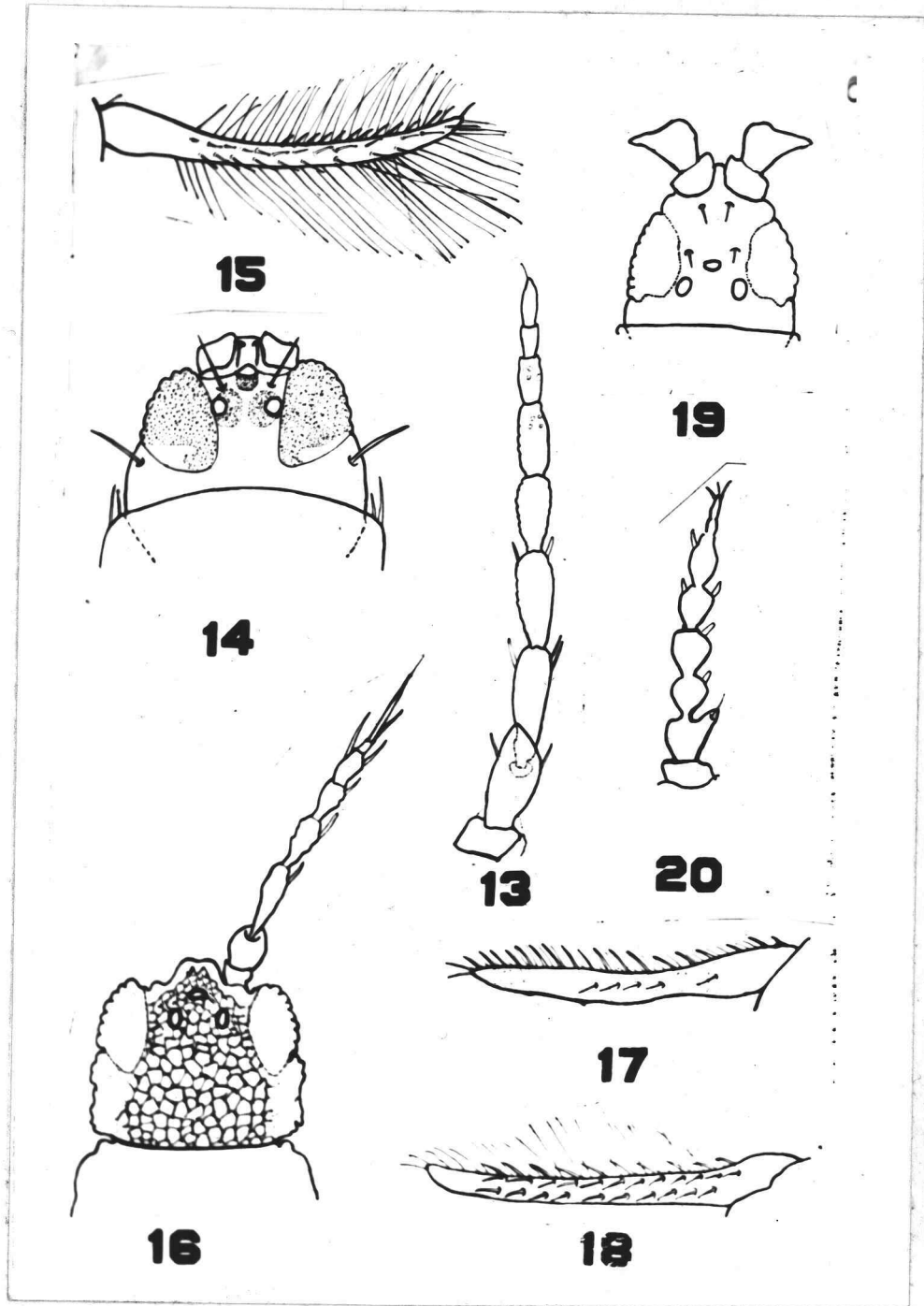
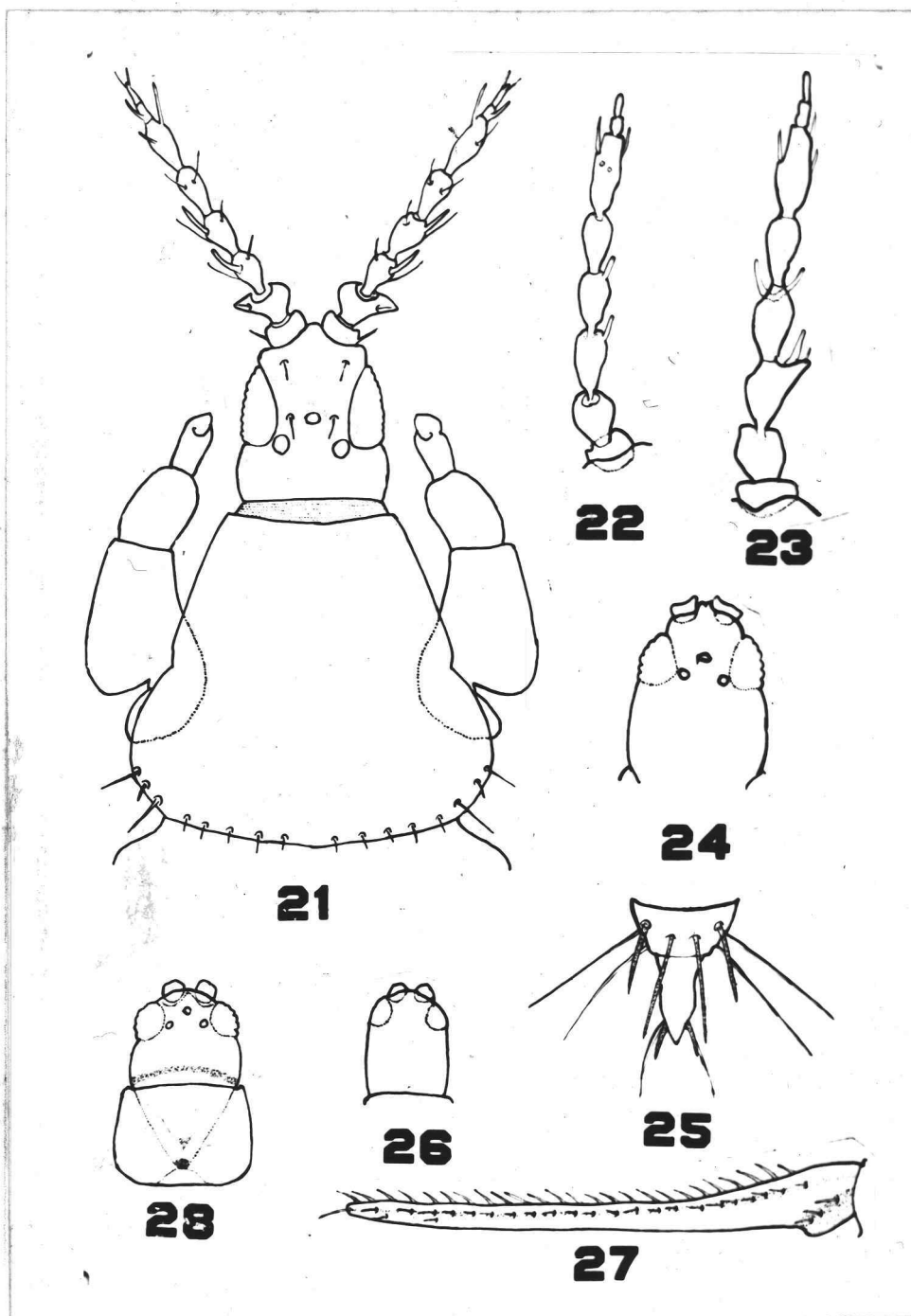


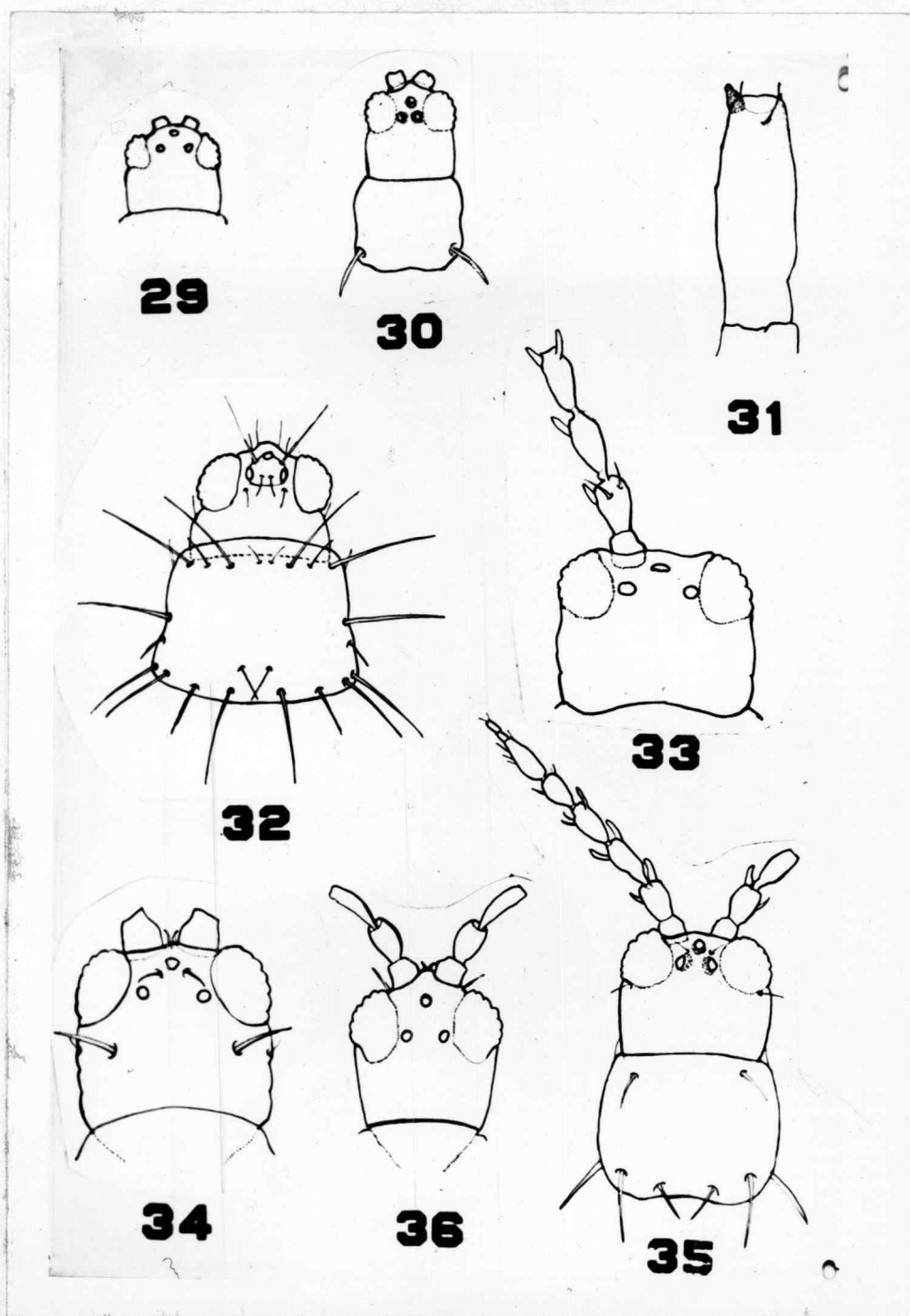
Plate V.



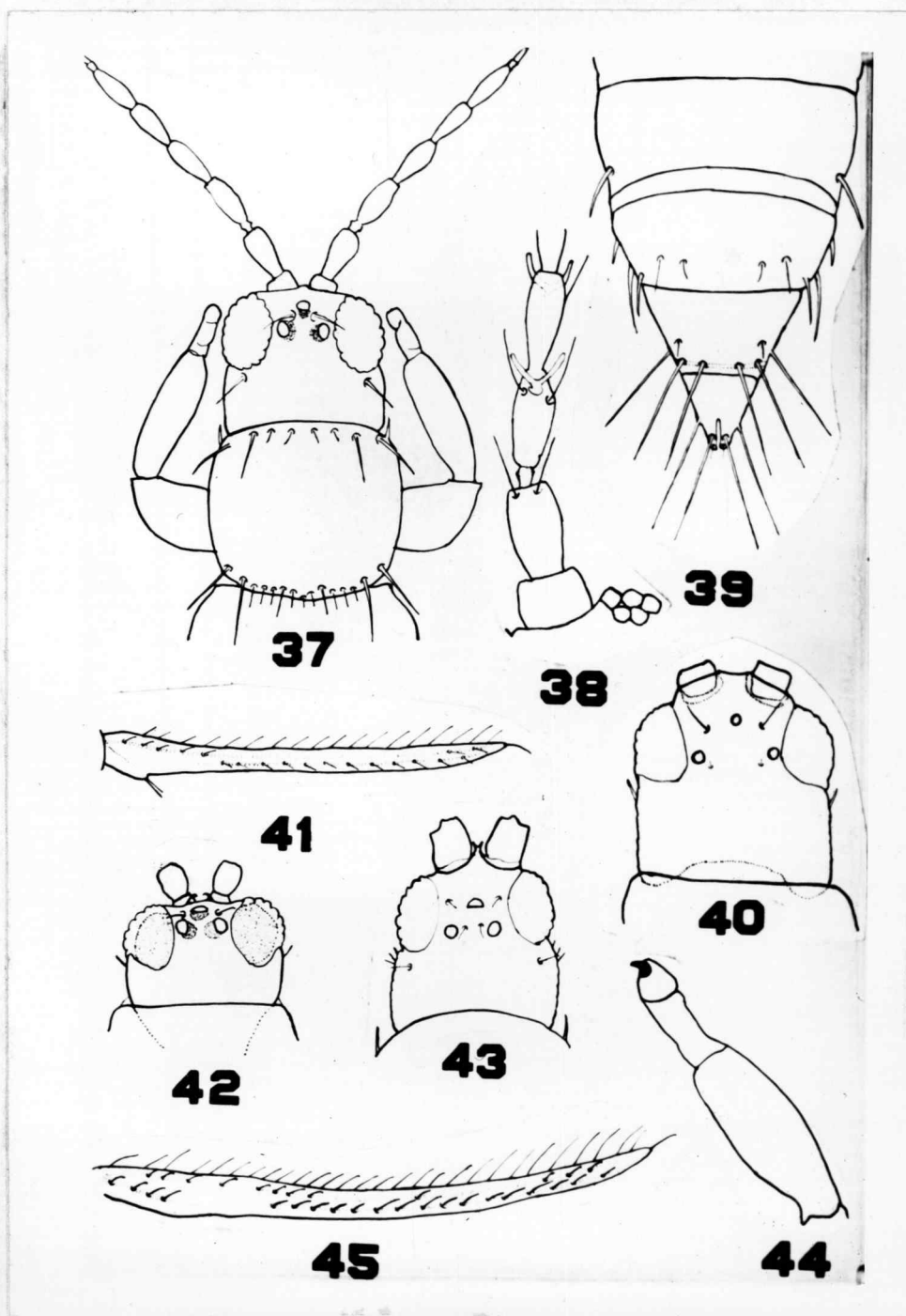
## Plate VI.



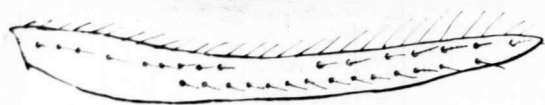
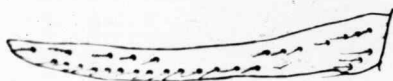
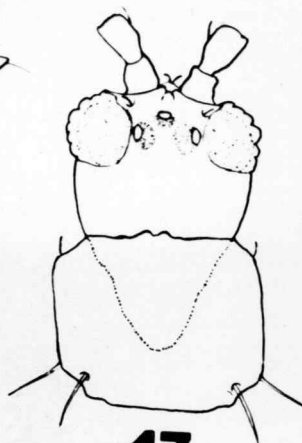
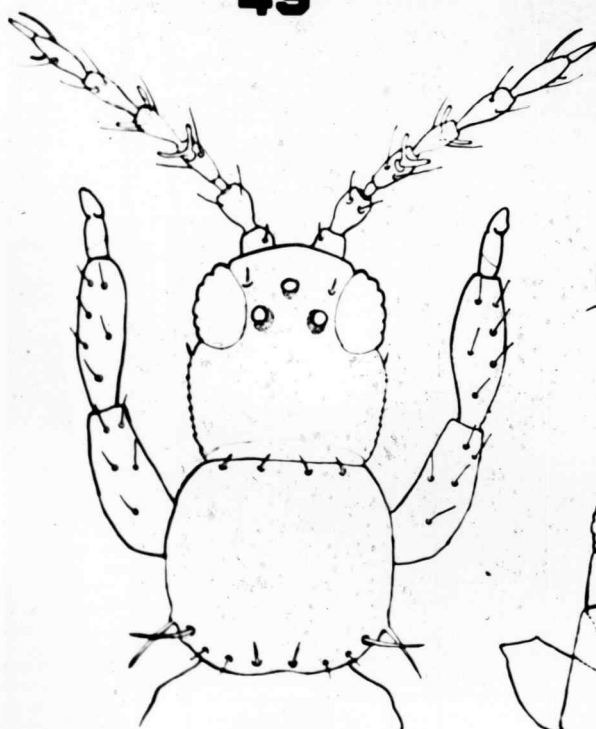
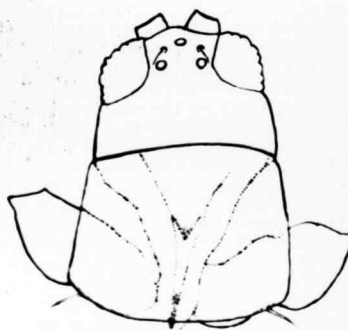
## Plate VII.



## Plate VIII.



## Plate IX.

**46****48****49****47****50****51****52**

## Plate X.

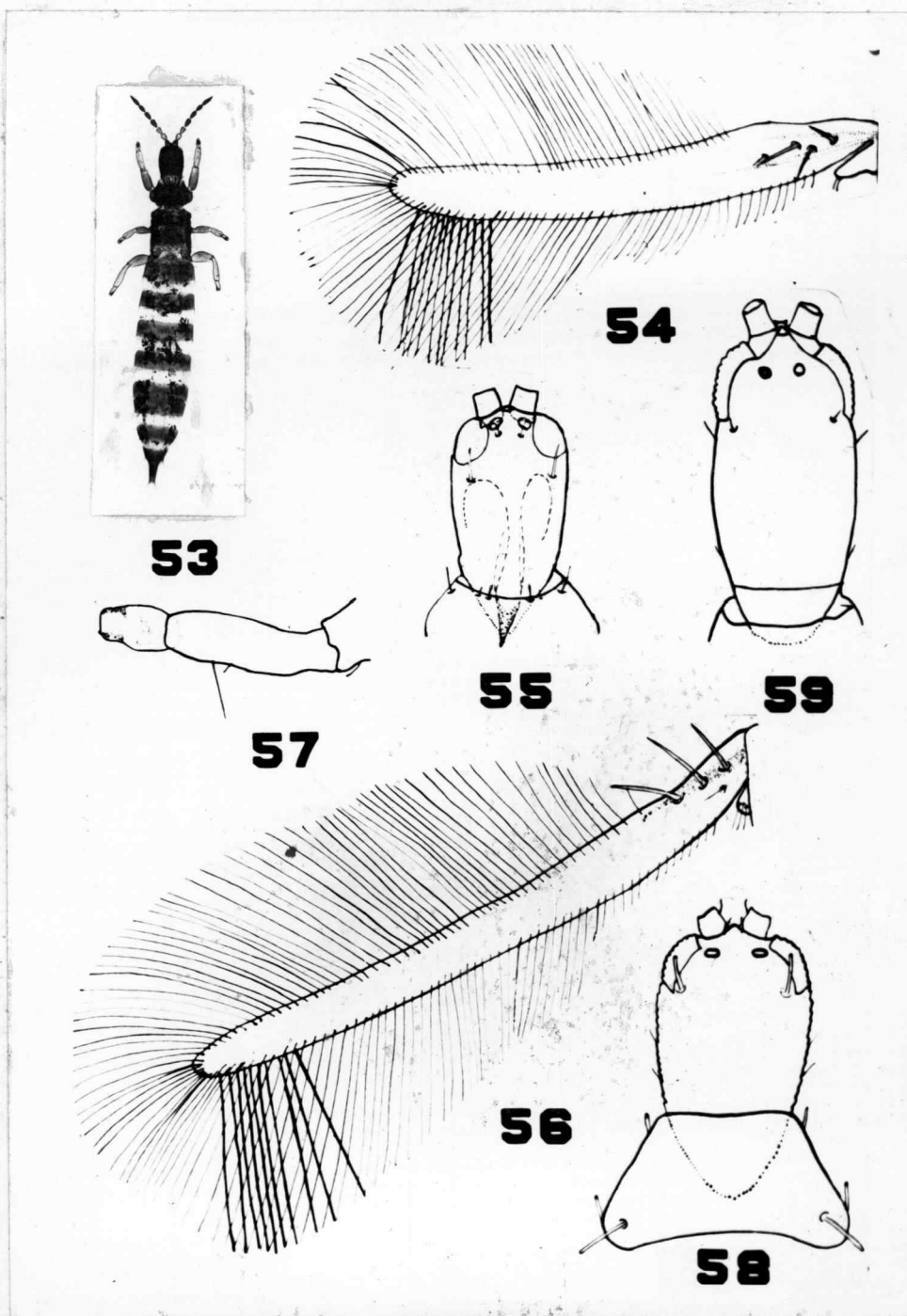
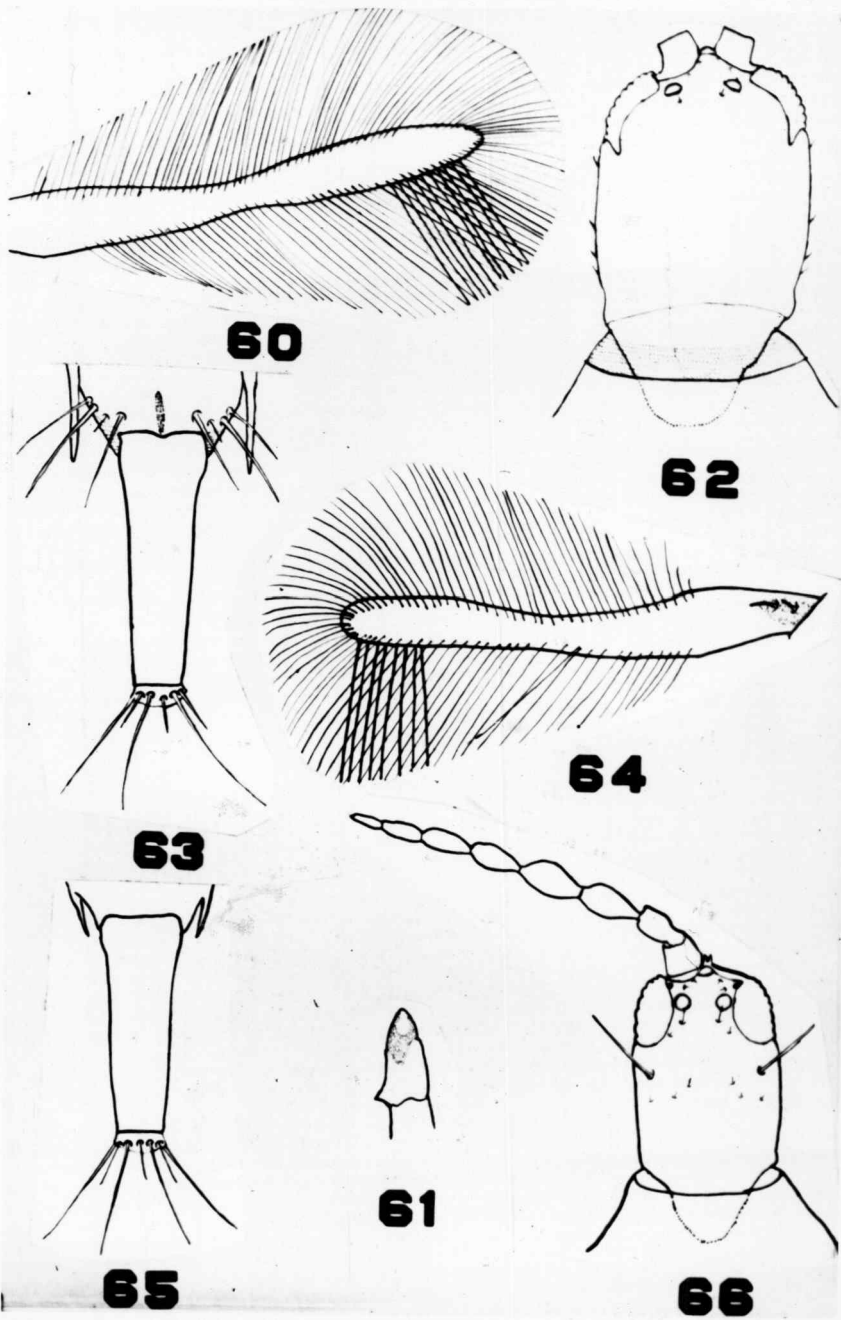
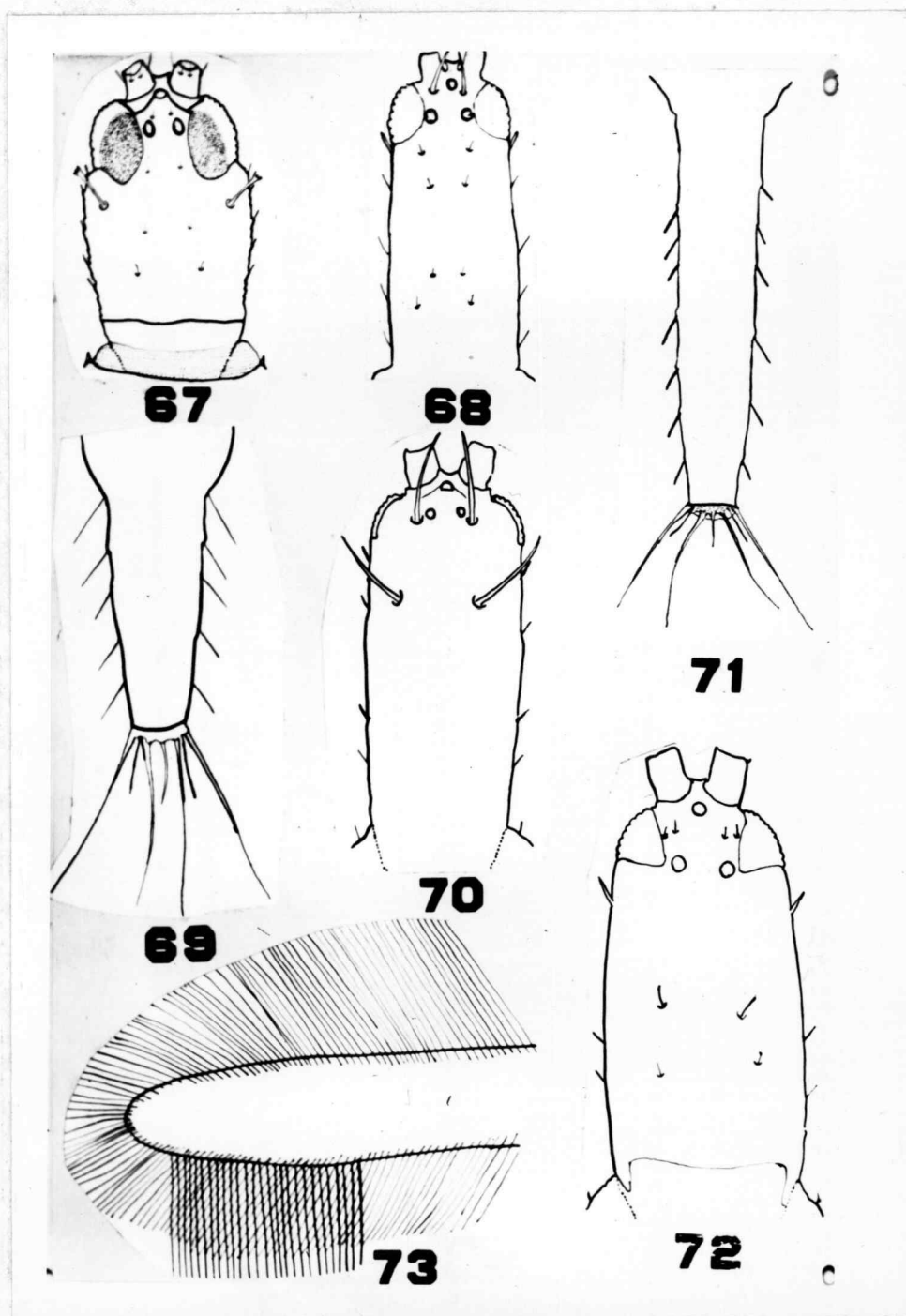


Plate XI.



## Plate XIII.



## Plate XIII.

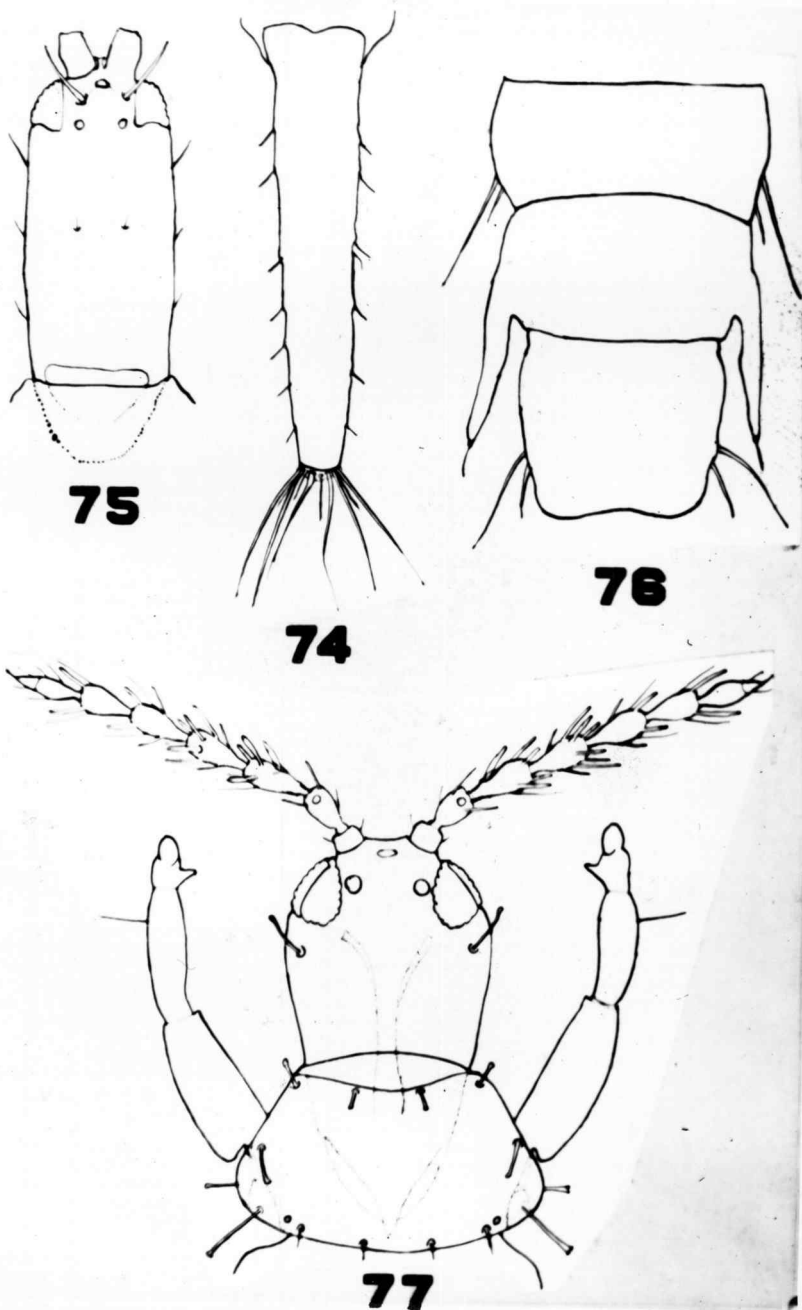


Plate XIV.

