

AN ABSTRACT OF THE THESIS OF

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(Name) (Degree)

in ENTOMOLOGY presented on April 20, 1970
(Major) (Date)

Title: A REVIEW OF THE FAMILY EVIPHIDIDAE

(ACARINA: MESOSTIGMATA)

Abstract approved: Redacted for Privacy

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A complete taxonomic review of the Family Eviphididae was made for the first time. The family was found to contain forty-nine species and five genera. The genera included were: Eviphis Berlese, Scarabaspis Womersley, Alliphis Halbert, Pelethiphis Berlese, and Thinoseius Halbert.

The new species described were: Eviphis oregonensis from Deschutes County, Oregon; Eviphis pugiosetosis from Central Africa; Alliphis reticulosternis from Mindanao Island, Philippines; Alliphis intermedius from Central Africa; Alliphis krantzi from Dutch East Africa and Tanganyika; Alliphis punctisternis from Central Africa; Alliphis crassicheles from Madagascar; Alliphis ritchei from Oregon and Arizona, U. S. A.; Alliphis mellotti from Central Africa; Alliphis obesus from Kapanga, Congo; Pelethiphis lobosternis from Central Africa; and Pelethiphis garretis from Central Africa.

The following genera were reduced to synonyms as indicated:

Copriphis Berlese 1910 and Evimirus Karg 1963 for Eviphis Berlese 1903, and Crassicheles Karg 1963 for Alliphis Halbert 1923.

The genus Iphidosoma Berlese 1892 was removed from the Eviphididae and transferred to the Family Rhodacaridae.

The following species synonyms were noted: Alliphis alpinus Schweizer 1961 is Alliphis halleri Berlese 1892, and Alliphis halberti Ryke and Meyer 1957 is Alliphis evansi Ryke and Meyer 1957.

The following species were shifted to other genera as indicated: Alliphis gurei Costa 1963 to Pelethiphis, and Pelethiphis equestris Berlese 1911 to Alliphis.

Several species were removed from the family. These were: Eviphis concentricus Oudemans 1905, Alliphis oviforme Schweizer 1949, Alliphis bristowi Finnegan 1933, and Pelethiphis fragilis Vitzthum 1926. Their correct taxonomic position could not be determined.

Most of the mites seen in this study were taken from scarabaeid beetles from the Central African Museum in Tervuren, Belgium. Additional material was obtained from private collections in the United States and Europe.

The relationships between the genera and a possible phylogeny of the family were discussed.

A Review of the Family Eviphididae
(Acarina: Mesostigmata)

by

Rodger Russell Shoemake

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

June 1970

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Redacted for Privacy

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Date thesis is presented April 20, 1970

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ACKNOWLEDGEMENTS

I am deeply indebted to my major professor, Dr. G. W. Krantz, Professor of Entomology, Oregon State University, for his advice and support, and to my wife, Sandra, whose acceptance of difficulties and unfailing helpfulness were of major importance in carrying out this study.

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A REVIEW OF THE FAMILY EVIPHIDIDAE
(ACARINA: MESOSTIGMATA)

INTRODUCTION

Since its conception by Berlese in 1913, the family Eviphididae has undergone a continuous process of change with many new species and several new genera being described. Despite the activities of such workers as Berlese, Oudemans, Lombardini, and Vitzthum, no comprehensive diagnosis of the family or of the genera contained within exists at this time. In recent years Ryke and Meyer (1957), Evans (1957a and b, 1963), Karg (1963, 1965), and Shoemaker and Krantz (1966) have contributed to a general knowledge of the family. Their efforts have, however, been hampered by the lack of material available to them. Until now there have been no significant studies in which the higher categories are defined or in which keys are given to delimit the species.

My interest in this group of mites was first aroused in 1963 while I was engaged in the identification of a large collection of Acari taken from Central African Scarabaeidae. The great abundance of eviphidid material coupled with the lack of keys and adequate descriptions, made it obvious that a complete revisionary study was necessary in order to place the family Eviphididae on a more stable and workable basis. The purpose of this study was to construct a solid framework for the family Eviphididae and its genera, and to stimulate interest in

the group, particularly in the Western Hemisphere.

The majority of the species included in this study have distributions primarily centered in Africa and Europe. These areas currently represent the regions from which the major collections of eviphidids have been made. Consequently, cited distributions probably are incomplete. Subsequent collections involving samples from presently included areas and new areas probably will show that many species are widely distributed.

HISTORICAL REVIEW

The first eviphidid to be reported in the literature was Iphis ostrinus Koch, 1835, which was designated as the type species for the genus Iphis Koch 1835. During the period 1835-1842, Koch described several species in the genus Iphis, but in 1842 he discovered that the name Iphis was preoccupied (Iphis Leach: Crustacea), and renamed the genus Eumaeus. In his renaming and redescription, he omitted Iphis ostrinus from his generic scheme. G. Canestrini (1847 and 1885) and Berlese (1882, 1882-1892) apparently were unaware of the change in status of Iphis and described many species which they placed in this genus. Berlese (1882-1892) recognized the heterogenous nature of Koch's Iphis and removed many species from it, placing them in the genus Laelaps. Those species remaining in Iphis represented what are now three of the five genera contained within the family Eviphididae. Berlese (1903a) discovered Koch's 1842 paper in which Koch renamed Iphis, and noted his omission of I. ostrinus from the new genus Eumaeus. In a critical comparison of the six species Koch had placed in Eumaeus with I. ostrinus, Berlese discovered that I. ostrinus was unique and he erected the genus Eviphis, with I. ostrinus as the type species. The remaining species of Iphis were subsequently divided into the genera Eviphis and Copriphis, the latter genus erected by Berlese in 1910 with Iphis pterophilus as the type

species. During the period 1910-1914, Berlese described many species in the genus Copriphis which later were placed in Eviphis or Pelethiphis. The genus Pelethiphis was originally proposed as a subgenus of Copriphis by Berlese in 1911. No detailed diagnosis was given for any of these genera. Berlese had, up to this time, considered the genera referred to above to be in the family Laelapidae. In his last comprehensive classification of the Mesostigmata, Berlese (1913b), while retaining his original familial concepts, attempted a tribal classification of the Laelapidae. He proposed four tribes, Laelapini, Iphiopsini, Eviphidini, and Phytoseiini, with the Eviphidini containing the genera Eviphis and Copriphis.

The most significant contributions to the knowledge of the Eviphididae during the 30 years following Berlese's classification are incorporated in the system presented by Vitzthum (1940-1943). He recognized a single family, Laelapidae, with 13 subfamilies. The Dermanyssidae sensu Berlese was divided into two subfamilies, Dermanyssinae Berlese and Liponyssinae Ewing, and the Laelapidae sensu Berlese into six subfamilies, Laelapinae, Hypoaspidinae Vitzthum, Hyletastinae Vitzthum and Raillietinae Vitzthum. The remaining subfamilies were Entonyssinae Ewing, Rhinonyssinae Trouessart, Halarchninae Oudemans, Haemogamasinae Oudemans, and Podocininae Berlese. Vitzthum's subfamilial diagnoses were brief and generalized, but his classification provided an excellent

summary of the existing knowledge of the groups.

Baker and Wharton (1952) adopted a more liberal classification than that of Vitzthum by raising most of Vitzthum's subfamilies to family status, and by retaining in the family Laelapidae only the subfamilies Laelapinae, Hypoaspidinae, and Hyletastinae (=Eviphidini). Turk (1953) followed the Baker and Wharton classification. Until the time of Baker and Wharton's publication, the Eviphidinae had not yet been fully described and was known merely as a group of laelapid mites having in common a lanciform projection of the anterior margin of the epistome. Evans (1957a) considered the species and genera to be sufficiently distinct to warrant the raising of the Eviphidinae to familial status. He also moved the subfamily Thinoseiinae (containing the monotypic genus Thinoseius Halbert 1920) from the Laelapidae to the Eviphididae. Keys to the subfamilies and genera in the British fauna were given. Evans included in his subfamily Eviphidinae the genera Eviphis Berlese 1903, Alliphis Halbert, 1923, and Melittiphis Berlese 1918.

Ryke and Meyer 1957 reviewed the Eviphidinae associated with South African Scarabaeidae and gave keys to the genera and species included in the fauna. Included were representatives of the genera Eviphis, Alliphis, Pelethiphis, and Scarabaspis.

Recently, Karg (1963, 1965) made some radical changes in the classification of certain gamasine groups. He reviewed the genera of

the family Eviphididae (Karg, 1963) and described Evimirus and Crassicheles as new genera. He did not at this time include Thinoseius in the family. Using morphological criteria introduced by Hirschmann (1957, 1959) in his "Gangsystematik" studies, Karg erected the superfamily Eviphidoidea in which he included the families Eviphididae and Macrochelidae (Karg 1965). Considering the limited number of species with which he was working and the number of distinctive characters possessed by only one or the other of the two families mentioned above, it is felt that Karg may have acted precipitously. In this paper, he included the genera Thinoseius Halbert 1920, Eviphis Berlese 1903, Evimirus Karg 1963, Scarabaspis Womersley 1956, Alliphis Halbert 1923, Pelethiphis Berlese 1911, Crassicheles Karg 1963 and Iphidosoma Berlese 1892 in the family Eviphididae. It is paradoxical that such a liberal classification should be the result of taxonomic procedures which would normally produce a conservative classification. This has happened because of the exaggerated importance given to a few characters.

This study represents the first attempt at a classification of the Eviphididae in which all of the genera and all of the known species are considered.

MATERIALS AND METHODS

Collecting

Mites of the family Eviphididae are found in a variety of habitats, almost all being rather temporary in nature. They may be collected using a Tullgren funnel from rotten wood, spoiled vegetables, dung, and various other types of dead and decaying organic material. One of the best sources for eviphid material, and the one employed most in this study, is coprophilous beetles of the family Scarabaeidae, on which eviphidids are phoretic. Museum collections proved to be most fruitful.

Most eviphidids are relatively large and may be easily handled by using the moist tip of a small camel hair brush or a microneedle. They may be stored for an indefinite period of time, either cleared or uncleared, in 70% ethanol.

Preparing for Study

Clearing of the internal tissues so that the chitinized structures were more easily observable was accomplished by heating the mites in lactophenol in a 40°C oven for approximately 48 hours or by heating them in Nesbitts clearing fluid on a 90°C hot plate for approximately ten minutes. Each method had its advantages and disadvantages and

the technique used in a particular case was determined by the condition of the mites to be cleared.

The lacto-phenol method was used to clear the mites that had been dried because it softened the cuticle without destroying it and at the same time cleared the internal tissues. This method, however, is slow and requires that the mites be carefully washed in distilled water before they can be mounted. Failure to wash the specimens properly results in the formation of crystals in the prepared slide, rendering them almost useless for detailed study.

The technique for clearing with Nesbitt's fluid was used on fresh and undried material. This method is much faster than that employing lactophenol, and requires no washing step before mounting. It is, however, a much stronger clearing agent and must be used carefully. Mites that have been dried tend to disintegrate in Nesbitt's fluid.

The mites were in all cases mounted in Hoyer's modification of Berlese's mounting medium and placed in a 40°C oven for 24 hours. Some of the larger species were dissected by separating the dorsal shield from the venter and then mounting them side by side. Hoyer's mounting medium was chosen because of its excellent optical properties and the ease by which specimens may be remounted. The heating causes the specimens to expand and clear slightly with an absolute minimum of distortion. The coverslips were then ringed with

two coats of Zut slide ringing compound to prevent deterioration of the mounting medium.

Equipment

Dissections and mounting was done with the assistance of an AO Spencer dissecting microscope illuminated by two AO Cyclospot illuminators. The prepared material was studied using an AO Spencer phase-contrast compound microscope having a maximum magnification of 970 diameters. Most observations were made at 220X and 430X.

Measurements

All measurements were made with a scale micrometer placed within a 10X ocular and were made under the highest magnification possible. Estimations were made to the nearest tenth of a scale unit. The scale units were calibrated using a 2 mm stage micrometer.

There are two major sources of error in the measurements made. In addition to errors due to estimation, the distortion of the body due to mounting is significant.

Descriptions

In order to conserve space and prevent repetition, the familial and generic descriptions are made as detailed as possible and the specific descriptions merely give unique characters and variations

from the general scheme. Illustrations were made to scale and usually only those characters of taxonomic importance were drawn. The descriptions of the dorsal shield chaetotaxy follows the system outlined by Evans (1957a). The leg chaetotaxy is presented in the form of a formula for each leg segment. This technique was devised by Evans (1963) and is based on the premise that each leg segment is considered to have four setae-bearing surfaces. The data is expressed in the following form:

$$\text{antero-laterals} - \frac{\text{dorsals}}{\text{ventrals}} - \text{postero-laterals}$$

Types

Unless otherwise indicated the type specimens for the new species described were distributed as follows: Holotypes in the Musée del Afrique Centrale, Tervuren, Belgium; paratypes in the U. S. National Museum, Washington, D. C. and the Department of Entomology, Oregon State University, Corvallis, Oregon.

FAMILY EVIPHIDIDAE BERLESE

Eviphidini Berlese, 1913, *Acarotheca Italica*. (not seen)

Hyletastinae Vitzthum, 1941, *Acarina in Bronn's Klassen und Ordnungen des Thierreiches*, 5(4)5: Baker and Wharton, 1953, *An Introduction to Acarology* p. 93.

Eviphididae, Evans, 1957, *J. Linn. Soc. Lond.* 43:229; Ryke and Meyer, 1957, *Ann. Mag. nat. Hist.* 12(10)593; Karg, 1963, *Zool. Anz.* 168:269; Karg, 1965, *Mitt. Zool. Mus. Berlin* 41(2):262.

Diagnosis

Mites in the family Eviphididae have a single dorsal shield, a two-tined palpal claw (apotele) and a distinct epistome bearing one (Eviphidinae) or five (Thinoseiinae) long processes. The male has distinct and separate sternitigenital and anal shields, and a relatively short spermatophore transfer organ on the movable cheliceral digit. The leg chaetotaxy is unique in that there is only a single anterolateral seta on the genu and femur of leg I. All of the species in this family occur naturally in decaying organic material of various types or in phoretic associations with dung beetles in the family Scarabaeidae or beach amphipods in the family Talitridae (Gammaridea).

General External Morphology

Female

Gnathosoma

Chelicerae. The chelicerae of the Eviphididae are strong, three-segmented, and of the chelate-dentate type (Figure 1, 2, 3). The cheliceral shaft in the genera Alliphis, Pelethiphis, Scarabaspis, and Thinoseius, is of approximately equal diameter throughout its length, and the ratio of the length of the chela to the second segment is in the range of 1:2.5 to 1:3.5. The cheliceral shaft in the genus Eviphis tapers gradually from base to chela with the ratio of the length of the chela to the second segment being in the range of 1:4.5 to 1:5. The fixed digit is provided with a variable number of teeth, while the movable digit is usually bidentate in Alliphis, Pelethiphis, Scarabaspis and Thinoseius and usually tridentate in Eviphis. The male movable digit carries on its external face a spatulate spermatophore transfer organ (Figure 3). The arthrodial membrane at the base of the movable digit usually is produced into a fringe of setiform processes. There is in male and nymphal eviphidids a tendency toward shortening of the second cheliceral segment, giving it the appearance of being much more stout than the female chelicera.

Epistome. The epistome of the Eviphididae is a distinct

structure forming the "roof" of the gnathosoma and overlying the chelicerae. Its structure is one of the most characteristic features of the family in that it bears an elongate, lanceolate, median process that may (Alliphis, Scarabaspis, some Eviphis) (Figure 10) or may not (Pelethiphis and some Eviphis) (Figures 9, 12) be flanked by distinct "shoulders." The median process is quite flexible and is generally covered by minute setules. The epistome of the Thinoseiinae represents a highly specialized form usually consisting of five elongate processes (Figure 11). It is easy to see how this type of epistome could have evolved from the Alliphis type by an elongation of the "shoulder" processes and a shortening of the median process.

Basis capitulum and hypostome (Figure 4). The basis capitulum represents the enlarged coxae of the pedipalps which are separated medio-ventrally by a narrow groove, the deutosternum. A longitudinal series of antrorse deutosternal denticles occurs in the groove. There are seven rows in the series, five bearing denticles. The number of teeth per tooth-bearing row are as follows:

	<u>Denticles per row</u>
<u>Eviphis</u>	4-8
<u>Alliphis</u>	2-14
<u>Scarabaspis</u>	6-14
<u>Pelethiphis</u>	12-26
<u>Thinoseius</u>	4-6

The basis capitulum bears ventrally a single pair of capitular setae.

The hypostome bears three pairs of ventral setae and an antero-lateral pair of large horn-like structures (probably representing hypertrophied setae) called corniculi. The eviphidid corniculi usually are short and thorn-like. In some cases, however, they approach the long lance-like form of the hypoaspidine Laelapidae.

Labrum. The labrum is an elongate, rather inflexible structure forming a typical tentorial apparatus between the chelicerae and the epipharynx¹ (Figure 92). It varies in structure from a simple pyramidal structure in Eviphis and some Pelethipis to an elongate serrate or two or three-pronged structure in the other genera.

Palpi. The pedipalps (Figures 5, 6, 7, 8) have five movable segments (trochanter, femur, genu, tibia, and tarsus). The tarsus bears on its inner basal angle a two-tined palpal claw, or apotele. The pedipalpal chaetotaxy is well-defined with a segmental formula for the deutonymph and adult of the Eviphidinae of (2-5-6-14-15). The relatively large number of setae on the tibia and tarsus makes the homologizing of these setae between various groups extremely difficult.

¹ Evans and Till (1965) refer to the elongation of the dorsal portion of the pharynx as the labrum. However, according to Bordeau (1956) and Hughes (1959), this structure is the epipharynx, and the labrum is located dorsal to it. Apparently the species described by Evans and Till did not have a distinct labrum.

However, I feel that we may safely assume that the blunt, sickle-shaped setae found on the outer distal angle of the palp tarsus of Eviphis, Scarabaspis (Figure 5), and of some Alliphis (Figure 7), are homologous structures and are of some taxonomic importance. There are two of these setae on the palp tarsus of Eviphis and Scarabaspis but only one on the species in the Alliphis *halleri* group. The remaining setae of the palps are generally smooth and acuminate, but some of the anterolateral setae of the femur and genu may be spine-like or chisel-shaped.

Idiosoma

Dorsum. The dorsal idiosoma bears a single shield which may or may not cover the entire dorsum. It is usually narrowed anteriorly and is often fused in the humeral region with the peritremal shield. The dorsal shield ornamentation usually is a net-like pattern, but it is rarely strongly developed and may be altogether absent.

The dorsum of the idiosoma has a well-defined chaetotaxy which shows relatively little variation throughout the family. The basic setal pattern is shown in Figure 67. The dorsum of the adult bears 30 pairs of acuminate setae; 12-30 pairs are situated on the dorsal shield. These setae are usually smooth, but may be pectinate as they are in Pelethiphis pectinatus Ryke. The relative length of the dorsal setae is of taxonomic importance. The vertical setae (D1) often differ

in form from the other setae in the region of the vertex.

An interesting and unique situation exists in the Thinoseiinae where there is distinct sexual dimorphism in the dorsal chaetotaxy. The dorsal shield of the female is reduced and bears 12-17 pairs of short setae (Figure 14), whereas the dorsal shield of the male is entire and bears 30 pairs of setae, some of which are twice as long as the female dorsal setae.

Venter. The tritosternum (furca of Van der Hammen, 1964) lies between coxae I on the venter of the idiosoma and is present as a well-developed biramous structure. It consists of a pair of lightly pilose laciniae and a trapezoidal base which may or may not be longer than wide. In some species of Pelethiphis and Eviphis the base is not a distinct structure. The function of the tritosternum is not known.

Five distinct shields are located on the ventral idiosoma; the sternal, the genital, the anal, and a pair of peritremals. The sternal shield in the Eviphidinae is a well-developed structure bearing three pairs of setae and two pairs of lyriform pores, whereas in the Thinoseiinae the sternal shield is greatly reduced and bears 0-1 pair of setae and 0-1 pairs of pores. In all cases the three pairs of setae and two pairs of pores are present in the sternal area. The sternal shield, where present, is generally unornamented; however, ornamentation is of taxonomic value when present. The endopodal plates between coxae I and II and between coxae II and III are commonly fused

to the sternal shield.

The metasternal region between coxae III and IV bears a single pair of setae and pores which may or may not be situated on small metasternal plates.

The female genital orifice (with its apodemes) appears as a transverse slit at the level of the fourth coxae. Associated with this orifice, and extending posterior to it, is a characteristic genital shield and its associated pair of genital setae. Anteriorly the shield has a hyaline flap of varying degrees of development. The genital shield is usually parallel-sided and rounded posteriorly, but in some species of Eviphis and Pelethiphis the shield is more or less flask-shaped. Certain of the less heavily sclerotized species have the epigynial setae located just off the shield. There is generally no ornamentation on the genital shield.

All the eviphidid species have an anal shield bearing three setae and a cribrum. The shield is typically sub-triangular or pear-shaped and only rarely has a weak reticulated pattern on its surface.

The stigmata and peritremes have associated with them a distinct peritremal shield. Anteriorly it is usually fused with the dorsal shield; posteriorly it is free and extends past the stigma. In the genus Eviphis, the posterior extension of the peritremal shields extend past coxae IV. The shields of the other four genera may extend to the posterior edges of coxae IV but never past it. The peritremal shields

normally have a pattern of longitudinal striations.

The unsclerotized portion of the ventral opisthosoma is weakly striated and bears 6-22 pairs of simple acuminate setae and a pair of small weakly sclerotized metapodal platelets just posterior to coxae IV.

The ventral idiosomal setae generally are smooth and acuminate but, in the genus Eviphis, some of these setae are variously modified into spines or spurs.

Legs. The legs of the Eviphididae are seven-segmented, the terminal segment being represented by the ambulacrum. The leg setae are normally smooth and acuminate, but the setae of the coxae of certain species of Eviphis and Scarabaspis are modified into spines, spurs, or small oval protuberances. Leg II of the female is commonly heavier than the other legs with some of the setae being variously modified. The segmental chaetotaxy, particularly that of the first pair of legs, is characteristic for the Eviphididae. The formulae representing the chaetotaxy of the segments are as follows:

Eviphidinae

Leg	Coxa	Troch.	Femur	Genu	Tibia	Tarsus
I	2	6	2-5/4-2	1-3/2, 2/1-2	1-3/2, 2/1-2	-
II	2	5	2-5/3-1	2-3/1, 2/1-2	2-2/1, 2/1-2	18
III	2	5	6	1-2/1, 2/1-1	1-1/1, 2/1-1	18
IV	1	5	6	1-2/1, 2/0-1	1-1/1, 2/1-1	18

Thinoseiinae

Leg	Coxa	Troch.	Femur	Genu	Tibia	Tarsus
I	2	5	2-5/2-2	1-3/2, 2/1-2	1-3/2, 2/1-2	-
II	2	5	2-5/2-1	1-3/1, 2/1-2	1-2/1, 2/1-2	18
III	2	5	7	1-2/1, 2/0-1	1-1/1, 2/1-1	18
IV	1	5	6	1-2/1, 2/0-1	1-1/1, 2/1-1	18

The presence of a single antero-lateral seta on the genu and tibia of leg I is a character found only in the Eviphididae and thus is a useful "key character" for the separation of eviphidids from closely related families (eg. Laelapidae).

Male

The male eviphidid is generally smaller than the female and has the appearance of being more heavily sclerotized. The dorsal shield chaetotaxy and ornamentation of male Eviphidinae are identical with that of the female; the sexual dimorphism in the Thinoseiinae has already been described.

The ventral idiosoma of the male eviphidid has four major shields; the sternitigenital, the anal, and two peritremals (Figure 29). The sternitigenital shield bears 4-5 pairs of setae, 3 pairs of pores, and an anteromedian genital opening. It extends posteriorly to the middle of coxae IV. The ventral setae are similar to those in the female. The anal shield is essentially like that of the female, except in some species (eg. Thinoseius brevisternalis) it may be considerably wider.

The possession of distinct sternitigenital and anal shields in the male is a character useful in separating the family Eviphididae from other closely related families. The peritremal shields are generally 1.5 to 2 times wider than those of the female, but their lengths are equivalent. The morphology of the gnathosoma is essentially like that of the female except for the chelicerae which are generally more stout and have a short spatulate spermatophore transfer organ on the median internal aspect of the digitus mobilis.

Deutonymph

The dorsal shield of the deutonymph is entire and the chaetotaxy and ornamentation is essentially the same as that for the female. The tritosternum is well-developed. A sternal shield resembling that of the male with four or five pairs of setae and three pairs of pores is found on the venter of the deutonymph (Figure 30). The anal shield is similar to that of the adults. The peritremal shields are greatly reduced or absent, the peritremes themselves being much like those of the adults, though occasionally being slightly shorter. The gnathosome, tritosternum, and legs are similar to those of the adults. In some species the deutonymphal chelicerae are considerably more stout or "plump" than those of the adult, a fact that has led Karg (1963) to erect a genus (eg. Crassicheles) based on this character.

The deutonymphs and adults of most of the eviphidid species are

known as a result of their being found on coprophilous scarabaeids. The protonymphs and larvae are not found in this association, but apparently are present only in the habitat of the beetle rather than on the beetle itself. The only species in which these stages are known are those described by Karg (1965). The following descriptions therefore are derived from Karg's (1965) descriptions of the protonymphs of Alliphis sculus Oudms. Evimirus uropodinus (Berl.), Eviphis ostrinus (Koch), and Alliphis sculpturatus Karg and the larva of A. sculpturatus. Unfortunately, he described only the dorsal surfaces of these species.

Protonymph

The dorsal shield is divided into an anterior podosomal and a posterior opisthosomal portion, both of which may or may not be strongly ornamented. The podosomal portion has from 11 to 13 pairs of finely pectinate or minute smooth setae, and the opisthosomal portion has 11 pairs of similar setae.

Larva

The larva of Alliphis sculpturatus has only a very weakly developed dorsal podosomal shield bearing 9 pairs of setae. The unarmed opisthosomal portion of the dorsum also has 9 pairs of setae. No further information is available.

Biology

Our knowledge of the biology of eviphidids is sketchy, the only information available for most species being the collection data. The similarities, however, between these data seem sufficient enough to warrant several observations regarding their biology.

Eviphidids are found in a variety of different habitats, almost all of which are rather temporary in nature. They have been collected from forest floor litter, rotten wood, spoiled vegetables, dung, and various other types of dead and decaying organic material. All organisms inhabiting these energy rich but temporary habitats are confronted with the problem of distribution when the particular habitat in which they occur is no longer suitable for habitation. Most of these organisms can fly or are able to actively move from habitat to habitat. In small delicate organisms such as the mites, pseudoscorpions, and many nematodes, dispersal is accomplished by the possession of behavioral patterns that enable these animals to attach themselves to other more motile organisms frequenting the same habitat. In this way they are transported to new habitats by the movement of their host. This commensalistic relationship is termed "phoresy."

Phoretic behavior is widespread in the Eviphididae and in fact appears to be the generalized condition. All species except the highly specialized Eviphis uropodinus and Eviphis convergens have been taken in association with arthropods. Beetles in the family

Scarabaeidae are the most widely used hosts, but a few species use Diptera (Alliphis halleri) or beach amphipods (Thinoseiinae).

There are essentially three types of phoretic behavior in the acarina based on the life stages actually associated with the host. The first type is one in which males, females, and deutonymphs exhibit phoretic tendencies. In the second type, only females are phoretic. Upon entering the new habitat, this unfertilized female produces eggs that hatch into males which in turn mate with her. Subsequent eggs hatch into females. This type of life history was observed by Filipponi (1955) in his work on Macrocheles glaber. The third type of phoresy is that in which the deutonymph, which may be highly specialized morphologically (e. g. hypopi of the acarids), is the only life stage involved. This latter type is common among the acarids and the parasitids. The Eviphididae exhibit the first and second types with the first appearing to be the most prevalent.

The phenomenon of phoresy is very poorly known, especially its etiological and ecological aspects. It offers some exciting areas for future research.

The life history of only one eviphidid is known and that is for Thinoseius fucicola (Remmert 1956), a highly specialized form not morphologically typical of the other eviphidids. The life stages, however, probably are the same for all of them: egg, larva, protonymph, deutonymph, and adult. Many of the females studied were bearing eggs

and none were found with larvae indicating that they probably are oviparous. Nothing is known about the larvae and protonymphs since they have never been found on another organism. Presumably they are found in the habitat of the host. This is the case in Thinoseius fucicola and Thinoseius brevisternalis which are found in decaying seaweed upon which their host (beach amphipods) feeds.

Familial Relationships

The family Eviphididae is a typical member of the laelapoid group of families (eg. Laelapidae, Haemogamasidae, Dermanyssidae) by virtue of its single dorsal shield, two tined palpal claws (apotele), its well developed female genital shield, and the location of the male genital pore in the anterior margin of the sternitigenital shield. Table 1 shows a comparison of some of the more significant characteristics of these four families. The greatest degree of similarity appears to be between the families Eviphididae and Laelapidae, and more specifically, Eviphididae and the subfamily Hypoaspidae of the Laelapidae. Table 2 shows a further comparison of the Eviphididae and the Laelapidae and the Hypoaspidae in which the similarities between the two groups are even more evident and seem to indicate a very close relationship.

Table 1. Comparison of Some of the More Significant Characters of the Laelapoid Families

Haemogamasidae	Dermanyssidae	Laelapidae		Eviphididae
		Laelaptinae	Hypoaspidae	
Extremely pilose, many excess setae on all plates	Relatively few setae arranged in regular patterns	Relatively few setae arranged in regular patterns	Same	Same
Chelicerae may or may not be dentate, most are not	All edentate	All dentate except <u>Tur</u>	All dentate	All dentate
Male chelicerae with fixed digit	Male chelicerae with fixed digit	Male chelicerae lacking fixed digit	Male chelicerae with fixed digit	Male chelicerae with fixed digit
Pilus dentilis sometimes present	Usually absent	Present	Present	Usually present
Epistome tongue-like, serrate, with a definite shape	Epistome short with a few projections and a definite shape	Epistome an amorphous fleshy mass	Epistome with a definite shape	Epistome distinct with a long lanceolate medium process
Ten or more rows of deutosternal teeth	Ten or more rows of deutosternal teeth	Seven or fewer rows of deutosternal teeth	Seven or fewer	Five rows of deutosternal teeth
Most with many teeth per row	With 1-3 teeth per row	One tooth per row	Many teeth per row	With 3 - many teeth per row
Peritremalia not extending around coxa IV-Metapodal plate distinct	Peritremalia incorporating metapodal plate and extending around coxa IV	Peritremalia not extending around coxa IV-Metapodal distinct	Same	Same
Distinct structures that vary specifically in form	No definite corniculi	Corniculi horn-like, short and broad	Corniculi long and blade-like	Corniculi usually short and broad, some forms long and blade-like
Epigynial shield drop shaped	Epigynial shield not drop shaped, may be almost pointed	Epigynial shield rounded posteriorly or drop shaped	Epigynial shield drop-shaped	Epigynial shield parallel sided, usually but in some is drop-shaped
Parasitic on Vertebrates	Parasitic on Vertebrates	Most parasitic on Vertebrates	Free-living or in association with Arthropoda	Most species associated with Coleoptera, <u>Thinoseius</u> with beach hoppers

Table 2. Relationships with Closely Related Groups

Laelapidae		
Laelapinae	Hypoaspidinae	Eviphididae
Sternal shield wider than long	Sternal shield longer than wide	Sternal shield generally wider than long
1-3 deutosternal teeth per row	Many deutosternal teeth per row	Variable
Pilus dentilus usually expanded	Pilus dentilus setae	Pilus dentilus setae or absent
Corniculi short and thorn like or indistinct	Corniculi usually long and lanceolate	Corniculi distinct and vary from lanceolate to thorn-like
Epistome an amorphous structure	Epistome distinct, but variable in shape	Epistome distinct with one or five elongate processes
Anal shield of male fused with ventral	Anal shield of male generally fused with ventral shield, but in some insect associates the ventral region is unsclerotized	Anal shield of male always distinct
Fixed digit of male chelicera reduced	Fixed digit of male chelicera normal	Normal

Key to the Genera of the Family Eviphididae

1. Mites showing a distinct sexual dimorphism in the chaetotaxy of the dorsal shield; genital shield without setae; sternal shield reduced or absent, never more than one pair of setae on shield; epistome produced into approximately five strong processes Thinoseinae Thinoseius
 Free living or phoretic mites on insects; without sexual dimorphism in dorsal shield chaetotaxy; genital shield usually with a pair of setae on its lateral margins; sternal shield well-developed and bearing three pairs of setae; epistome with a single elongate median process Eviphidinae... 2
2. Palp tarsus with a pair of closely placed rod-like setae (Figure 5); some of ventral setae may be modified into spurs, spines, or small oval protuberances 3
 Palp tarsus may have one rod-shaped seta but never two placed closely together; all ventral idiosomal setae simple and acuminate. 4
3. Peritremal plate extending caudad past coxa IV; labrum a simple triangular structure. Eviphis
 Peritremal plate not extending past coxa IV; labrum

an elongate three-pronged structure; both setae of coxa I

and posterior seta of coxa II modified into small oval

protuberances Scarabaspis

4. Palp tarsus with a single sickle-shaped, rod-like seta

(Figure 7); all of dorsal setae usually short and sub-

equal; vertical setae as long or longer than remaining

dorsal setae; epistome usually with distinct

"shoulders" Alliphis

Palp tarsus without sickle shaped, rod-like seta;

some of dorsal setae (usually in Mg or L series)

many times longer than minute medial setae (D

and M series); verticals several times shorter

than these setae. Epistome usually without

shoulders Pelethiphis

Synopsis of Genera Formerly Assigned to the Family Eviphididae

Genus Copriphis Berlese 1910

The genus Copriphis was never described in detail, but it is obvious from the species Berlese included in it that his concept of Copriphis was similar to the current concept of the subfamily Eviphidinae. Most of the species included in Copriphis have subsequently been removed and placed in the genera Eviphis and

Pelethiphis. The type species for the genus Copriphis pterophilus, is a typical member of the genus Eviphis Berlese 1903. Consequently, Copriphis is a junior synonym of Eviphis.

Genus Evimirus Karg 1963

Karg (1963) erected the genus Evimirus to accommodate the species Eviphis uropodinus Berlese, 1903, basing his diagnosis on the possession of a three-tined apotele and the peculiar arrangement of the ventral plates. After examining a series of E. uropodinus including two specimens identified by Karg, I was unable to find one with a three-tined apotele. Further, the unusual shape and position of the ventral plates in E. uropodinus represents an extreme condition which grades directly into the typical Eviphis type. It is for these reasons that I consider Evimirus Karg, 1963, to be a synonym of Eviphis Berlese, 1903.

Genus Crassicheles Karg 1963

Karg (1963) defined the genus Crassicheles as follows: "Gabel am Palptarsus 2 zinkig, sonst Palptarsus ohne spezielle Haarbildungen, Cheliceren sehr gedrungen und plump, Dorsalschild lateral mit auffälligen seitenparallelen Strukturlinien, Vertikalhaareil lang, Peritremata neben Coxae III mit gewelltem Innenrand, Hypostom mit 6 bezahnten und 2 unbezahnten proximalen Querleisten." Both of the

species Karg included in Crassicheles are known only from the deutonymphal stage.

Karg apparently did not have available to him a very long series of species to study. All of his differential characters are well within the range of variation of species in the genus Alliphis. The form of the epistome in Crassicheles concentricus (Oudemans 1904) is not typical of the Eviphididae although it does bear a superficial resemblance to the epistome of species in the Thinoseiinae. The epistome of C. holsaticus (Willmann 1937) is of a type found in the more primitive members of Alliphis and Pelethiphis and is quite common throughout the species of Mesostigmata associated with insects.

In light of these factors I draw the following conclusions: (1) The genus Crassicheles is not a valid genus in the family Eviphididae. (2) The species included in this genus possibly are not eviphidids at all. A decision on this point must await the availability of adult specimens for study.

Genus Iphidosoma Berlese 1892

The genus Iphidosoma Berlese, 1892, is another example of a genus based on deutonymphal stages. As in the case of Crassicheles it is difficult to draw definite conclusions regarding the true affinities of these species without the availability of adult material.

The character used to delimit this genus is the possession of a

hyaline flap on the fixed digit of the chelicerae. While this character is significant, I do not feel the relationship between Alliphis and this group of mites is correctly indicated by the erection of a new genus, especially since all indications are that this is a heterogenous grouping. The species in Iphidosoma which appear to be eviphidids are separable from Alliphis by the cheliceral character alone.

Iphidosoma fimetarium (Muller, 1859), the type species for the genus, has a three tined palpal claw. This character in combination with the dorsal shield chaetotaxy seems to indicate its inclusion in the family Rhodacaridae. The same seems to be the case for I. ovatum Berlese, 1892 and I. multiclavatum Willmann, 1953. I. bennwili Schweizer, 1961 and I. pratensis Karg, 1965 could very well be eviphidids; however, their dorsal shield chaetotaxies and, in the case of I. pratensis, the form of the female ventral shields seem to indicate their inclusion in the Ascidae. Since the leg chaetotaxy, the epistome, and the labrum were not described for these two species the final solution to this problem must await a critical study of the type specimens.

On the basis of the information available to me at this time, I am inclined to draw the following conclusions regarding the genus Iphidosoma: (1) The genus Iphidosoma sensu Berlese, 1892, and Schweizer, 1961, does not belong in the family Eviphididae and probably should be placed in the Rhodacaridae. (2) Iphidosoma bennwili

Schweizer, 1961, and I. pratensis Karg, 1965, are probably eviphidids in the genus Alliphis, but a final decision on this matter must await a study of the type material.

SUBFAMILY THINOSEIINAE EVANS

Thinoseiinae Evans 1954. Ann. Mag. nat. Hist. 12:615.

The subfamily Thinoseiinae contains only the genus Thinoseius Halbert, 1920. The diagnosis, therefore, is the same as that for the genus and need not be repeated here.

Genus Thinoseius Halbert

Thinoseius Halbert, 1920, Proc. Roy. Irish Acad., 35 B (7):126,

Type Thinoseius berlesei Halbert, 1920 (= Lasioseius fucicola Halbert, 1920); Vitzthum, 1941, Bronn's Klassen und Ord. des Tierreiches, 764; Evans, 1954, Ann. Mag. Nat. Hist., 12:615; Evans, 1957, Jour. Linn. Soc. Zoology, 63:229; Evans, 1963, Ann. Mag. nat. Hist., 13:395.

Gammaridacarus Canaris, 1963, Jour. Parasit., 48 (3):467.

The genus Thinoseius was erected by Halbert (1920) for a female mite, Thinoseius berlesei Halbert, 1920 collected under decaying seaweed. The presence of sexual dimorphism in the dorsal shield and dorsal chaetotaxy resulted in the initial description of the male and female as different species in different genera. Evans and Browning (1953) recognized the error and described the dimorphism.

Evans (1954) revised the genus Thinoseius and erected the

subfamily Thinoiseinae to contain it within the broadest interpretation of the family Laelapidae. He later (1957a) recognized its affinities with the family Eviphididae Berlese and moved it to that family as a separate subfamily.

The work that has been done by Evans on this genus has been excellent and is up to date. The following diagnosis and keys differ little from those given by him.

Diagnosis

The most outstanding features of this genus are the sexual dimorphism in the dorsal shield sclerotization and chaetotaxy, and the relative absence of sclerotization in the sternal region of the female. These characters are unique in the family Eviphididae.

General Description

Female

There is a single dorsal shield in both sexes; however the female shield is weakly sclerotized and does not cover the entire dorsum. The surface of the shield bears a weak reticulated pattern. The dorsal idiosoma (Figure 14) bears thirty pairs of short setae; 14-17 pairs are located on the shield and 13-16 on the striated cuticle surrounding the shield. The tritosternum has a rectangular base and

two relatively short, pilose laciniae. The sternal shield (Figure 13) may be absent, with all of the sternal setae and pores located on the soft integument of the sternal region or it may consist of an irregular bar of sclerotization bearing the first pairs of sternal setae and pores. In all cases the endopodal plates are present. The metasternal setae and pores are located on the soft cuticle of the metasternal region. The genital shield is parallel sided, rounded or sub-truncate posteriorly, and is without ornamentation. The genital setae are located off the shield. The anal shield varies interspecifically in shape from nearly round to distinctly pear-shaped and bears three setae and a cribrum. The peritremal shields are rather weakly developed, but they may extend caudad as far as the posterior margin of coxae IV. The peritremes extend to the middle of coxae I except for T. spinosus where they extend only slightly past the anterior margin of coxae II. The interscutal portion of the ventral opisthosoma bears four to seven pairs of simple setae. The epistome has five elongate processes which may (T. brevisternalis) or may not (T. acuminatus) be fimbriate distally. The chelicerae are similar to those in the genus Alliphis. The palp trochanter, femur, and genu bear two, five and five setae each respectively. This palpal chaetotaxy is unique within the family Eviphididae.

Male

The male dorsal shield is entire, well sclerotized, and bears thirty pairs of setae; some (T. brevisternalis) or all (T. acuminatus) of these setae are many times longer than the comparable setae on the female dorsum. The sternal region of the male bears a well-developed sternitigenital shield which bears four pairs of simple setae and three pairs of pores. The male and shield is generally larger and more heavily sclerotized than that of the female and may be of an entirely different shape (T. brevisternalis). The peritremal shields are greatly reduced and in some cases may be absent. The chelicerae are identical with those of the female except that they bear a stout hook-like spermatophore transfer organ on the movable digit. The remaining external characteristics are as in the female.

Key to the Species of the Genus Thinoseius HalbertFemales

1. Dorsal setae short, broad in the basal half and acuminate
in the distal half. Thinoseius acuminatus Evans
- Dorsal setae otherwise 2
2. Sternal setae I situated on a sclerotized shield which is
fused with the endopodals in the region of coxae II
(Figure 13). Thinoseius brevisternalis (Canaris)

- Sternal setae I situated on unsclerotized integument 3
3. Peritreme extending past coxa I. . Thinoseius fucicola (Halbert)
 Peritreme extending to the anterior margin of coxa II
 (Figure 16) Thinoseius spinosus (Willmann)

Males

1. Dorsal setae slender, smooth 2
 A number of dorsal setae stout and spine-like or
 pencillate 3
2. Setae $J_2 - J_4$ subequal in length; peritreme extending
 to about the middle of coxa I. British Isles
 Thinoseius acuminatus Evans
 Setae J_2 more than twice the length of setae J_4 and
 J_3 ; peritreme extending to the anterior margin of
 coxa II. Germany, Iceland and the British Isles
 Thinoseius spinosus (Willmann)
3. Eight pairs of dorsal setae stout, pencillate; anal
 shield pyriform, longer than broad. British Isles
 and Germany Thinoseius fucicola (Halbert)
 Fourteen pairs of dorsal setae stout spine-like; anal
 shield considerable broader than long. North
 America Thinoseius brevisternalis (Canaris)

Description of the Species Included in the Genus ThinoseiusThinoseius acuminatus Evans

Thinoseius acuminatus Evans, 1963, Ann. Mag. nat. Hist. 13(4):553-556.

Female. The idiosoma is weakly sclerotized with the dorsal shield incompletely covering the dorsum. The dorsal surface has 30 pairs of characteristically shaped setae; 14 are located on the shield. The tritosternal base is about as long as it is wide. The sternal region is weakly sclerotized; the endopodals are well-sclerotized and those in the region of coxae II are connected by an irregular sclerotized bar bearing the first pair of sternal setae and pores. The epigynial shield is narrow and parallel sided; the epigynial setae are located off the shield. The anal shield is subcircular in shape and bears the usual three setae and a cribrum. The ventral interscutal cuticle bears seven pairs of setae; four pairs of these setae are of the same type as those on the dorsum, three pairs are simple. The peritremal shields are pointed posteriorly and produced to the posterior margin of coxa IV. The peritremes extend anteriorly to the middle of coxae I. The tectum is produced into five slender processes. The deutosternal ridges bear numerous minute denticles.

Male. The length of the idiosoma is 390 μ and the width is 250 μ .

The dorsal shield is entire and bears 30 pairs of relatively long simple setae. The sternito-genital shield is reticulated and bears four pairs of simple setae and three pairs of pores. The anal shield is suboval in shape and bears the usual three setae and a cribrum. The remaining ventral features are as in the female.

Habitat and Locality. Collected from tidal debris at Sea Houses, Northumberland by J. T. Salmon (Evans, 1962).

Type. Holotype female, allotype male, five paratype females and two paratype males deposited in the British Museum (Nat. Hist.) London.

Thinoseius brevisternalis (Canaris)

Gammaridacarus brevisternalis Canaris, 1962, Jour. Parasit. 48(2): 467-469.

Thinoseius brevisternalis, Evans, 1962, Ann. Mag. nat. Hist. 13(5): 395-399.

This species was described in detail by Canaris (1962) and by Evans (1962b) and so the following is a brief summary presented for diagnostic purposes.

Female. (Figures 13, 12) The dorsal shield is approximately 580 μ long and 330 μ wide; it incompletely covers the dorsum of the idiosoma and bears 17 pairs of setae. The cuticle surrounding the

shield is coarsely striated and shows varying degrees of sclerotization. The verticals lie off the dorsal shield. The sternal region is weakly sclerotized with the first pair of sternal setae lying on an irregular shield which is fused laterally with the endopodals of legs II. Sternal setae II and III and the metasternal setae are located on unsclerotized cuticle. The epigynial setae are located off the shield. The anal shield is pear-shaped, as wide as it is long, and bears the usual three setae and a cribrum. The ventral interscutal cuticle bears six pairs of simple setae. The peritremal shield is narrow and pointed posteriorly; the peritreme extends beyond coxa I. The tectum is produced into five strong, distally-divided processes. The deutosternal ridges have 3-6 denticles per row.

Male. The length of the idiosoma is approximately 590 μ and the width is about 350 μ . The dorsal shield is entire and bears 30 pairs of setae. Thirteen pairs of these setae are stout and spine-like; the verticals are very short and spine-like. The sternitigenital shield is reticulated and bears four pairs of setae and three pairs of pores. The shield is fused with the endopodals up to the level of the middle of coxae III. The anal shield is considerably wider than long and bears the usual three setae and a cribrum. The remaining ventral features are similar to those in the female.

Habitat and Locality. Thinoseius brevisternalis has been collected from Orchestoidea californiana at Westport, Washington; North

Cove, Washington; Oceanlake, Oregon; Newport, Oregon; Charleston, Oregon; Sidney Is., British Columbia; and San Quintin, Mexico. It has also been taken from Orchestoidea pugettensis and O. traskiana from Cadboro Bay, Victoria; from O. benedicti from Dillon Beach, California; and from O. columbiana from Petticoat Beach, California (Evans, 1963).

Type. Holotype female and allotype male deposited in the U. S. National Museum. Paratypes deposited in the British Museum (Nat. Hist.) and Oregon State University.

Thinoseius fucicola Halbert

Lasioseius fucicola Halbert, 1920, Proc. Roy. Irish Acad. 35b(7):125.

Thinoseius berlesei Halbert, 1920, Proc. Roy. Irish Acad. 35b(7):127.

Lasioseius fucicola, Evans and Browning, 1953, Bull. Nat. Hist.

Mus. London Zool. 15:414.

Thinoseius fucicola, Evans, 1954, Ann. Mag. Nat. Hist. 12:616.

The following descriptions are short and intended for diagnostic purposes; for a more extensive description of the morphology of T. fucicola one should consult the original description (Halbert, 1920), Evans and Browning (1953) and Evans (1954).

Female. The length of the idiosoma is 670-845 μ ; the width is 500-590 μ . The dorsal surface of the idiosoma bears 30 pairs of setae of varying lengths; 12 are located on the dorsal shield. The weakly

sclerotized dorsal shield is ornamented and has an irregular margin. The verticals are slightly more spinose than the other dorsal setae. The tritosternum has a distinct base which is approximately as long as it is wide. The sternal region is unsclerotized; however, the three pairs of sternal and one pair of metasternal setae are present. Small endopodal plates are present between coxae I and II, coxae II and III, and coxae III and IV. The epigynial shield is sub-rectangular and truncate posteriorly; the epigynial setae are located off the shield. Four post-epigynial platelets are conspicuous. The anal shield is pear-shaped and with the usual three setae and a cribrum. The ventral interscutal membrane is provided with seven pairs of short simple setae. The peritremal shield is pointed posteriorly and is not connected with the dorsal shield anteriorly. The peritreme extends beyond the level of coxa I. Tectum with five process most of which are forked distally. Deutosternal rows with numerous minute denticles.

Male. The length of the idiosoma is 700-768 μ and the width is 480-537 μ . The dorsal shield is ornamented, covers the entire dorsum, and bears 30 pairs of setae. Eight pairs of the dorsal setae in the marginal series are long, stout, and setose distally. The vertical setae are relatively long and blunt. The remaining setae are short and simple. The sternitigenital shield is well-developed and bears four pairs of setae and three pairs of pores. The remaining ventral characteristics are essentially the same as in the female.

Habitat and Locality. T. fucicola has been collected along the shoreline and under decaying sea-weeds from various locations in the British Isles and continental Europe.

Type. The location of the types of T. fucicola is unknown.

Thinoseius spinosus (Willmann)

Lasioseius spinosus Willmann, 1939, Abh. Nat. Ver. Bremen,
31:572-549.

Lasioseius spinatus Sellnick, 1940, Goteborgs Vetensk. Samh. Handl.
5(6B):102.

Lasioseius uncinatus Sellnick, 1940, Goteborgs Vetensk. Samh. Handl.
5(6B):103.

Thinoseius spinosus, Evans, 1954, Ann. Mag. Nat. Hist 12:619.

Thinoseius spinosus has been described in detail by Willmann (1939) and Sellnick (1940). It is considered necessary only to present a brief summary for diagnostic purposes.

Female. The length of the idiosoma is 594-850 μ , and the width is 363-585 μ . The dorsal shield is reduced and bears 14 of the total 30 pairs of dorsal setae. The sternal region is unsclerotized but bears the three pairs of sternal and one pair of metasternal setae. The endopodal plates are present between coxae I-II, II-III, and III-IV. The epigynial and anal shields are basically similar to those in T.

fucicola. The peritremal shield is irregular posteriorly and is not fused to the dorsal shield anteriorly. The peritreme extends only a short distance beyond the anterior margin of coxa II. The gnathosomal features are described in detail by Willmann (1939).

Male. The length of the idiosoma is 506-600 μ , the width is 308-390 μ . The dorsal shield is entire and bears 30 pairs of simple setae. Some of the setae in the marginal and lateral series are longer and stouter than the remaining dorsal setae. The difference in the form of the dorsal setae between sexes in T. spinosus is not as closely marked as in T. fucicola. The sterniti-genital region is described in detail by Willmann (1939). The remaining ventral characteristics are as in the female.

Habitat and Locality. Thinoseius fucicola has been recorded from seaweeds along the N. German coast and from Iceland. This species also has been found by the author in the wood chips and dung layer beneath chicken roosts at the Oregon State University Poultry houses. This collection record represents the first time that any species in this genus has not been found in beach litter or associated with coastal amphipods.

Type. The location of the types of T. spinosus is unknown.

SUBFAMILY EVIPHIDINAE BERLESE, 1913

The subfamily Eviphidinae contains the genera Eviphis Berlese 1903, Scarabaspis Womerley 1956, Alliphis Halbert 1923, and Pelethiphis Berlese 1911. It may be distinguished from the subfamily Thinoeseinae by the possession of an epistome with a single, long, median process and the absence of sexual dimorphism in the dorsal shield chaetotaxy.

Genus Eviphis Berlese

Iphis Koch, 1835, Deutsch. Crust. 2:6 (preoccupied)

Eviphis Berlese, 1903, Redia 1:242, Type: Iphis ostrinus Koch 1835;

Ryke and Meyer, 1957, Ann. Mag. Nat. Hist. 12(10):593.

Uroiphis Berlese, 1903, Redia 1:245 (synonym).

Copriphis Berlese, 1910, Redia 6:261 (synonym).

Iphidoides Oudemans, 1904, Entom. Ber. 1:140 (synonym).

Eviphis (Oloiphis) Berlese, 1917, Redia 12:30.

Evimirus Karg, 1963, Zool. Anz. 170:270 (New Synonym).

A considerable amount of confusion has existed concerning the identity of the type species of the genus Eviphis. Evans (1957a), Radford (1950), and Karg (1963) list Eumaeus pyrobolus (Koch, 1839) as the type while Ryke and Meyer (1957) state that the type species is Iphis ostrinus (Koch, 1835). It is apparent that a detailed account of

the history of these two species is necessary in order to clear up this problem.

Koch originally described the genus Iphis in 1835 with Iphis ostrinus as the type. Iphis pyrobolus was described by Koch in 1839. The generic name Iphis was later recognized by Koch (1842) to be invalid (preoccupied) and he erected the genus Eumaeus to accommodate the species formerly included in it. He did not, however, include Iphis ostrinus in this new genus, but instead he designated Iphis pyrobolus as the type species. Iphis ostrinus was placed in the oribatid genus Notaspis. Berlese (1913b) indicated that the species which Koch shifted to Notaspis was not Iphis ostrinus but was some species other than the one originally described. Therefore he concluded the real Iphis ostrinus (sensu Koch 1835) was still the type of the now invalid genus Iphis. He proposed the name Eviphis to replace Iphis and indicated that Iphis ostrinus Koch, 1835 was still typical of the genus. His designation of the type was somewhat indirect, but his intent was clear. He indicated that Iphis ostrinus (sensu Koch 1835) was distinct from the species included in Eumaeus (which was also an invalid name) and proposed the name Eviphis for "this group." Unfortunately he neglected to say "which group." In his description of Eviphis uropodinus, however, he compared E. uropodinus with Eviphis ostrinus, thus indicating that he was referring to the Iphis form.

It is obvious that Eviphis ostrinus does not belong in the Oribatei nor to the genus Notaspis, but is more closely related to the group of mites originally placed in the genus Iphis by Koch. Therefore, Berlese's (1913b) contention that the species which Koch moved to Notaspis was not Iphis ostrinus in the original sense, appears valid. Iphis pyrobolus is known only from the original description and its true generic affinities are not known.

Diagnosis

Mites in the genus Eviphis are the largest and most striking of the eviphidids. They are characterized by the possession of a pair of blunt sickle-shaped setae on the outer distal angle of the palpal tarsus and the extension of the peritremal shields to a point posterior to coxae IV. The chelicerae are unlike those in the other genera in that they are slender and taper gradually from base to chelae (Figure 1) whereas those of Alliphis, Pelethiphis, Scarabaspis, and Thinoseius are stout and cylindrical (Figure 2). The labrum is a small pyramidal structure or is not visible at all. The setae on the coxae and/or the ventral shields are commonly modified into spurs or spines. The dorsal setae vary in length interspecifically but are always smooth and acuminate; in some species (eg. E. cultratellus) the postero-marginal setae of the dorsal shield are flattened.

General Description

Female (Figures 26, 27, 28)

The idiosoma ranges in size from 395 μ to 1080 μ long and 275 μ to 820 μ wide. The dorsal shield is entire and bears 29 or 30 pairs of setae of varying sizes. The surface of the shield is either unornamented or bears a reticulated pattern on its surface. There are two pairs of large lenticular pores in the region between dorsal setae D7 and L8. The tritosternum has a narrow, elongate base and a pair of slender, lightly pilose laciniae. The sternal shield is generally as wide as it is long, is unornamented except for a few light lines running mediad from each of the sternal setae, and bears three pairs of setae. The first pair of sternal setae are always simple, and the distance between their insertions is usually less than half the distance between sternal setae II. The metasternal plates may or may not be fused with the endopodals, however, in both cases the metasternal setae are located on the plate. The genital shield may be parallel sided or drastically expanded, as it is in E. uropodinus. The genital setae are always located on the shield. The anal shield varies in shape from round (E. capensis) to pear-shaped (E. cultratellus) and always bears the three anal setae and a cribrum. Sternal setae II and III, the metasternal setae, the genital setae, and the posterior setae of coxae I-III may be variously modified into spurs

or spines. The distributional pattern and type of modification varies interspecifically. The peritremal shields are usually broad and well-developed; in all cases they extend caudad to a level posterior to coxae IV. The metapodal plates are free in most species but in E. uropodinus, E. convergens, and E. ostrinus they are fused with the posterior tips of the peritremal shields. The peritremes extend cephalad to a level anterior to coxae I. The chelicerae are unlike those of the other genera in the eviphididae in that they taper gradually from base to chelae and that the chelae are much shorter in relation to the length of the cheliceral shaft than in the other genera. The corniculi are very short and thorn-like. The epistome has a long pilose median projection and may or may not have a distinct basal portion. The deutosternal groove contains seven ridges, five of which bear three to eight teeth; the second ridge (first tooth bearing row) is strongly arched and bears three to four large teeth. The labrum is a weakly developed structure that is short and pyramidal or conical in form.

Male (Figure 29)

The dorsum of the male is identical with that of the female. The male has a sternitigenital shield with the genital aperture on its anterior margin and bears five pairs of setae. A small post sternitigenital plate is present. The distribution pattern and type of

modification of the ventral setae usually corresponds with that of the female. The peritremal shields are usually several times broader in the male than the female, but they are of a similar shape. The remaining ventral idiosomal features are as those in the female. The chelicerae are shorter than those of the female and bear a small spermatophore transfer organ on the movable digit.

Deutonymph (Figure 30)

The dorsum of the deutonymph is similar to that of the female. Ventrally the deutonymph has a holosternal shield bearing four or five pairs of setae. The form of the ventral setae commonly varies slightly from that of the adult. The deutonymph of E. cultratellus has a spur-like sternal seta II; this same seta on the adult mite is simple. The holosternal shield may (E. cultratellus) or may not (E. hastatellus) be fused with the endopodals. The deutonymphal peritreme is greatly reduced and in some cases (E. hastatellus) does not extend posterior to coxa IV. The remaining ventral and gnathosomal features are as in the female.

Key to Females of the Genus Eviphis

1. Metapodal plates partially fused with posterior tip of peritremal shields or apparently absent. Found in rotting wood or decomposing forest floor litter. 2

- Metapodal plates not fused with peritremal shield;
 venter with or without some of setae modified into
 spurs or spines. Found in dung or associated with
 dung beetles 4
2. Dorsal shield highly domed and bearing extremely
 minute setae. Metapodal plates imperceptively
 fused with peritremal shields. Genital shield narrow . . . 3
- Dorsal shield not highly domed; dorsal setae on mar-
 gins of shield relatively long and stout. Metapodal
 plates only partially fused with peritremal shields
 or line of fusion is evident; genital shield parallel
 sided (Figure 17) Eviphis ostrinus (Koch)
3. Peritremal shields curve gradually toward the mid-
 line and are separated by the width of the genital
 shield (Figure 18) E. uropodinus Berlese
- Peritremal shields curve radically toward the mid-
 line and nearly touch posterior to the genital shield
 (Figure 20). E. convergens Berlese
4. One or more pairs of ventral or coxal setae modified
 into stout spurs or spines 5
- All of ventral and coxal setae simple 12
5. Setae on metasternal and genital shields simple 6
- Setae on metasternal and genital shields modified 8

6. Posterior seta of coxae II and III simple; Sternal seta III a paddle-like spur (Figure 21). . . . E. oregonensis n. sp.
 Posterior seta of coxae II and III modified into a spur or spine 7
7. Sternal seta III and posterior seta of coxae II and III modified into paddle-like spurs (Figure 22)
 E. hastatellus (Berlese)
 Sternal seta III and posterior seta of coxae II and III modified into acuminate spines (Figure 25)
 E. transvaalensis Ryke and Meyer
8. Dorsal setae Mg 4 - Mg 10 longer than the distance between their insertions; tips of setae sharply pointed 9
 Dorsal setae Mg 4 - Mg 10 shorter than the distance between their insertions; tips of setae flattened (Figure 27). E. cultratellus (Berlese)
9. Sternal seta II modified into a stout dagger-shaped spur (Figure 31). E. pugiosetosis n. sp.
 Sternal seta II simple 10
10. Posterior seta of coxa I modified into a stout spur. Distance between insertions of sternal setae I less than half the distance between sternal setae II 11
 Posterior seta of coxa I simple. Distance between

- insertions of sternal setae I subequal to the distance between sternal setae II (Figure 34). E. falcinellus (Canestrini)
11. Dorsal setae in marginal series whip-like; vertical setae (D_1) much shorter than L_1 (Figure 37)
 E. mullani Oudemans
- Dorsal setae in marginal series stout; vertical setae (D_1) subequal to L_1 (Figure 38)
 E. meyeræ Shoemaker and Krantz
12. Idiosoma with an elongate pear-shape; its greatest width being at the level of coxa IV (Figure 44)
 E. longus Vitzthum
- Idiosoma oval to egg-shaped; its greatest width being at the level of coxa II 13
13. Sternal shield as long as it is wide; epistome with a distinct base but without distinct angular shoulders. Anal shield nearly round; metasternal plates free (Figure 47) E. stephaninianus (Berlese)
- Sternal shield wider than long; epistome with distinct angular shoulders. Anal shield pear-shaped; metasternal plates partially fused with endopodals. E. capensis¹ Ryke and Meyer

²E. paolianus Berlese, 1921, and E. paolianus abyssinica Lombardini, 1941, would also key out at this point. It is not possible to differentiate between these species due to the lack of specimens for study and of adequate descriptions.

Descriptions of the Species Included in the Genus Eviphis

Eviphis ostrinus (Koch)

Iphis ostrinus Koch, 1835, Deutschlands Crustaceen Myriapoden und Arachniden, Regensburg 2:6; Berlese, 1882, Bull. Ent. Ital. 14:346; Canestrini, 1885, Prospetto dell' acarofauna italiana. Padova. p. 99.

Gamasus rotundus Kramer, 1876, Arch. Naturg. Berlin. 1(1):99.

Laelaps ostrinus, Canestrini, G and R, 1882, Atti Soc. Veneto-Trent, Sc. Nat. Padova 8(1):75.

Laelaps (Iphis) ostrinus, Berlese, 1892, Acari, Myriapoda et Scorpiones hucusque in Italia reperta, Pt. LXVI(4):38.

Eviphis ostrinus, Berlese, 1903, Redia 1:242; Tragardh, 1938, Ent. Tidskr. Stockholm 59(3-4):123; Tragardh, 1943, Ent. Tidskr. Stockholm 64(1-2):91; Bregetova, 1956, The Gamasid Mites, Moscow. p. 73; Willmann, 1956 Cesk. Parasit. 3:225.

Eviphis ostrinus is intermediate in morphology between the group represented by E. uropodinus Berlese, 1903 and the one represented by E. cultratellus Berlese, 1910. It can be distinguished from the former by the shape of the sternal and genital shields and from the latter by the partial fusion of the peritremal shields with the metapodal plates.

Female. The length of the idiosoma averages 528μ with a range of 480μ to 550μ ; the width averages 416μ with a range of 360μ to 440μ . The dorsal shield is much like that of E. cultratellus Berlese. The only difference is that the marginal setae of E. ostrinus are all simple while those of E. cultratellus are variously modified. The sternal shield (Figure 17) is wider than long, is unornamented, and bears three pairs of simple setae and two pairs of pores. The metasternal plates are fused with the endopodals and bear the metasternal setae. The epigynial shield is only slightly expanded posterior to coxa IV; the posterior margin of the shield is flanked by four small platelets. The anal shield is large and pear-shaped; the anal opening and the three setae are located in the posterior half of the shield. The peritremal shields are large and well-developed; posterior to coxa IV they curve medially and are partially fused with the metapodal plates. The interscutal area of the ventral opisthosoma bears nine pairs of simple setae. The epistome (Figure 19) is thick, lanceolate, and covered with long, fine setules; no distinct basal portion is present. Seta al of the palp trochanter is modified.

Type. The location of the type of Iphis ostrinus is unknown.

Habitat. E. ostrinus occurs in various kinds of leaf litter, rotting wood, and top soil. It is a common species in Europe and has been collected on the east coast of the U. S. A. It has never been found in association with beetles as have most of the other species

in this genus.

Eviphis uropodinus Berlese

Eviphis uropodinus Berlese, 1903, Redia 1:243.

Evimirus uropodinus, Karg, 1963, Zool. Anz. 170(7/8):270-272.

This species is closely related to Eviphis convergens Berlese, 1913 and Eviphis ostrinus (Koch), 1839. It may be distinguished from both by the shape and size of the peritremal shields and the genital shield. The highly domed dorsum and the extreme development of the ventral shields make this mite look similar to mites in the family Uropodidae.

Female. The length of the idiosoma is approximately 395 μ ; the width is approximately 275 μ . The dorsal shield is very highly domed, is entire, and bears 29 pairs of minute setae; there is no ornamentation on the surface of the shield. The ventral surface of E. uropodinus is quite characteristic (Figure 18); the coxae are close together leaving only a narrow sternal area. The sternal shield is compressed laterally and has a series of arches in the surface of the anterior half of the shield; the normal three pairs of setae and two pairs of pores are present. A pair of well-developed pre-sternal plates are present. The metasternal plates are large and well-developed, but not fused with the endopodals. The genital shield is

greatly expanded in its posterior half. It is truncate posteriorly and bears the usual three setae and a cribrum. The peritremal shields are large and well-developed; they are imperceptively fused with the metapodal plates. The interscutal area of the ventral opisthosoma bears nine pairs of rather stout, simple setae. The epistome is a simple lanciform type without shoulders but with relatively long, fine hairs on the distal half. The specimens I examined, three of which were sent me by Karg, differ from the descriptions presented by Karg (1963) in the following respects: the apotele is two tined (Karg described it as being three-tined); there is a small seta near the base of the apotele and it is possible that he mistook it for the third tine. There are the usual seven deutosternal ridges (Karg indicates only five) three of which bear 4-8 minute denticles.

Habitat and Locality. Eviphis uropodinus has been collected from hothouse compost (Karg, 1965) in Germany, from Spirobolus culture media at the University of Kansas, and from rotting wood in Italy (Berlese, 1903a). It has never been found associated with insects.

Type. The holotype is presumably in the Berlese collection, Stazione di Entomologia Agraria, Florence, Italy.

Eviphis convergens Berlese

Eviphis convergens Berlese, 1913, Redia 9:84.

E. convergens is closely related to Eviphis uropodinus Berlese, 1903, but may be distinguished from that species by the form of the peritremal and genital shields. Eviphis convergens is known only from the original description and specimens were not available for study, therefore the following diagnosis is taken from the original description.

Female. The length of the idiosoma is 390μ and the width is 280μ . The dorsal shield was not described. The genital shield is not as broad posteriorly as that of E. uropodinus, and the strongly developed peritremal shields converge on each other until they are separated by only a narrow strip of cuticle (Figure 20).

Habitat and Locality. This species is known only from Samarang, Java; the habitat was not given (Berlese, 1913).

Type. Presumably the type for E. convergens is in the Berlese collection housed at the Stazione di Entomologia Agraria, Florence, Italy.

Eviphis oregonensis New Species

This species is most closely related to Eviphis hastatellus (Berlese) 1910 but may be distinguished from that species by the possession of simple posterior setae on coxae II and III. These setae on E. hastatellus are modified into flat, paddle-like spurs.

Female. The length of the idiosoma averages 515μ with a range

of 490 μ to 545 μ ; the width averages 360 μ with a range of 349 μ to 392 μ . The idiosoma is oval in shape and is a characteristic rusty red color. The dorsal shield is entire, unornamented, and bears thirty pairs of acuminate setae. The length and placement of the dorsal setae is as for E. hastatellus (Figure 24). The sternal shield is wider than long, unornamented, and bears the usual three pairs of setae and two pairs of pores (Figure 21). Sternal setae I and II are simple but setae III are flat and paddle-like; all remaining ventral setae are simple. The metasternal plates with setae and pores are fused with endopodals III-IV. The genital shield is nearly parallel sided, rounded posteriorly, and bears the single pair of genital setae on its posterolateral margins. The anal shield is pear-shaped, unornamented, and bears the usual three setae and a cribrum. The peritremal shields and metapodal plates are distinct and of a shape typical for the genus. The ventral interscutal membrane bears ten pairs of simple setae. The epistome is identical with that of E. hastatellus. The labrum is longer than normal in the genus but is still a simple pyramidal structure. The remaining gnathosomal features are typical for the genus.

Habitat and Distribution. Eviphis oregonensis was taken from the hind coxal cavities of Trox atrox Lec. (Coleoptera:Trogidae) collected in Deschutes Co., Oregon, U.S.A. in April, 1964, by Dr. C.W. Baker. This is the only known collection of this species.

Types. The holotype is deposited in the United States National Museum, Washington, D.C. Paratypes are placed in the Oregon State Acarology Collection, Corvallis, Oregon; the British Museum in London, and in the collection of the author.

Eviphis hastatellus (Berlese)

Copriphis hastatellus Berlese, 1910, Redia 6:262.

Eviphis rufus Oudemans, 1914, Ent. Ber. (Nederland) 4:68.

Eviphis exemplaris Vitzthum, 1925, Suppl. Ent. Berlin, 11:31.

Eviphis hastatellus, Ryke and Meyer, 1957, Ann. Mag. Nat. Hist.

12(10):599; Shoemake and Krantz, 1966, Inst. Parcs Nat.

Congo - Mission H. De Saeger, 49(1):5.

Eviphis hastatellus appears to be most closely related to E. cultratellus (Berlese) and E. transvaalensis Ryke and Meyer. It differs from the former by the possession of simple rather than spur-like setae on the metasternal and genital shields and from the latter by the possession of paddle-like rather than spine-like setae at sternal III and the posterior seta on coxae II and III.

Female. The length of the idiosoma averages 515μ with a range of 480μ to 540μ ; the width averages 359μ with a range of 330μ to 380μ . The dorsal shield (Figure 24) is entire and bears thirty pairs of setae; the marginal setae (except Mgl) are stout and lanceolate while the rest are simple and vary in length from small to minute. The surface of the dorsal shield may be unornamented or bear a faint reticulated pattern. Sternal seta III and the posterior seta of coxae II and III are paddle-like; the remaining ventral setae while varying somewhat in thickness are all simple (Figure 22). Sternal shield about as long or

slightly longer than wide; bearing three pairs of setae and two pairs of pores; and is unornamented except for three pairs of rather indistinct lateral lines. Metasternal plates partially fused with endopodals and may or may not be fused with the ventro-lateral corners of the sternal shield. The genital shield is narrow, parallel sided, and bears the genital setae on its lateral margins. The anal shield is pear-shaped, unornamented, and bears the three pairs of setae in its posterior half. The peritremal plate is relatively narrow, but its form is typical for the genus. The metapodal plates are free. The ventral interscutal cuticle bears ten pairs of rather stout setae. The epistome (Figure 23) consists of a long lanceolate median process and a proximal portion denticulated on the lateral edges. The palp genu and femur are each provided with a chisel-shaped seta.

Male. Ryke and Meyer (1957) described what they considered to be the male of E. hastatellus; it differed sharply from the female in the form of the ventral setae. After studying a long series of E. hastatellus including males, females, and deutonymphs, I am brought to the conclusion that the specimen described as the male of E. hastatellus is in fact the male of the closely related species E. transvaalensis. The following description is, therefore, the first for the male of E. hastatellus.

The length of the idiosoma averages 421μ with a range of 380μ to 490μ ; the width averages 282μ with a range of 240μ to 340μ . The dorsal

shield and chaetotaxy are as in the female. The shape of the sternitigenital shield is typical for the genus. Sterniti-genital seta III is paddle-like as are the posterior setae of coxae II and III; the remaining ventral setae are simple. A small rounded plate is present just posterior to the sternitigenital shield. The peritremal shields are similar in form to those of the female but are much more broad. The spermatophore transfer organ is short, narrow and pointed. The remaining ventral and gnathosomal features are as in the female.

Deutonymph. The deutonymphs of E. hastatells that I have examined do not agree with the descriptions presented by Ryke and Meyer (1957). It appears that here also they described the deutonymph of the closely related species E. transvaalensis.

The length of the idiosoma is approximately 420 μ long; the width averages 277 μ with a range of 270 μ to 290 μ . All of the shields are much less heavily sclerotized than those of the adults. The dorsal shield and chaetotaxy are as in the adults. The holosternal shield is weakly sclerotized and bears four pairs of setae and three pairs of pores; seta III of the holosternal shield and the posterior seta of coxae II and III are paddle-shaped. No post holosternal plate is present. The peritremal shields are narrow and very poorly developed; they are interrupted at the level of coxa IV with only a small plate representing the posterior tip of the shield remaining just posterior to coxa IV. The remaining ventral and gnathosomal characters are as in the female.

Habitat and Distribution. Eviphis hastatellus has been found in association with the following Central African beetles: Onitis adelphus, Onitis alexis, Onitis chironitis collarti, Onitis mniszechianus, Onitis pyramus, Onitis sulcipennis, Onitis vanderkelleni, Onitis viridulus, Heliocopris andersoni, Heliocopris anguliceps, Heliocopris colossus, Heliocopris felchei, Heliocopris haroldi, Heliocopris hamadryas, Diastellopalpus johnstoni. It has also been found associated with Copris isidis, Egypt, Heliocopris tyrannus, Siam, Heliocopris jafetus, South Africa, and Heliocopris gigas, South Africa.

Type. The type for Eviphis hastatellus is presumably in the Berlese collection, Stazione di Entomologia Agraria, Florence, Italy.

Eviphis transvaalensis Ryke and Meyer

Eviphis hastatellus transvaalensis Ryke and Meyer, 1957, Ann. Mag. Nat. Hist., 12(10):602.

Eviphis transvaalensis, Shoemaker and Krantz, 1966, Inst. Parcs Nat. Congo - Mission H. De Saeger 49(1):5.

This species agrees in almost all respects with Eviphis hastatellus (Berlese); the only difference is the presence of acuminate spine-like setae instead of the characteristic paddle-shaped setae in the sternal III position and on coxae II and III (Figure 25). The same holds true for the male and deutonymphal stages which were, as

previously mentioned, originally described by Ryke and Meyer (1957) as life stages of E. hastatellus.

Habitat and Distribution. Eviphis transvaalensis was found in association with Heliocopris hamadryas from Transvaal, with Onitis sp. from Potchefstroom, and with Heliocopris gigas from Potchefstroom (Ryke and Meyer, 1957).

Eviphis transvaalensis has been found in association with the following Central African beetles: Heliocopris antenor, Heliocopris felchei, Heliocopris samson, Heliocopris yapetus, Onitis uncinatoides. It has also been found associated with Heliocopris gigas and Heliocopris hamadryas in South Africa.

Type. The type female is deposited in the British Museum (Nat. Hist.), London, England.

Eviphis cultratellus (Berlese)

Copriphis cultratellus Berlese, 1910, Redia 6:261.

Eviphis cultratellus, Ryke and Meyer, 1957, Ann. Mag. Nat. Hist.

12(10):596; Shoemaker and Krantz, 1966, Inst. Parcs Nat.

Congo - Mission H. De Saeger, 49(10):5.

Female. The length of the idiosoma averages 813μ with a range of 720μ to 910μ ; the width averages 635μ with a range of 560μ to 700μ . The dorsal shield (Figure 27) is entire, unornamented, and bears 29 pairs of setae. Ten pairs of setae in the Mg series are stout,

lanceolate and several times longer than the remaining setae. The verticals are short and spine-like; seta Mg10 is apically flattened and rounded. The tritosternum consists of a distinct base that is narrow and long and a pair of lightly pilose laciniae. The sternal shield (Figure 26) is wider than long and bears three pairs of setae and two pairs of pores. Sternal setae III are flattened and spur-like; the other two pairs are simple. The metasternal setae as well as the genital and posterior setae of coxae II and III are spur-like but are not as long as sternals III. The metasternal plates are large, triangular and bear the metasternal setae and pores. The genital shield is bell-shaped, rounded posteriorly, unornamented, and bears the modified genital setae on the postero-lateral margin. The anal shield is large, pear-shaped, and bears the usual three setae and a cribrum. The post and seta is longer and more stout than the adanals. The peritremal shields are broad, produced posteriorly to a point beyond coxa IV, and fused anteriorly with the dorsal shield at the level of coxa I. A triangular shaped metapodal plate is present in the area posterior to coxa IV. The ventral interscutal cuticle bears ten pairs of setae. The epistome has a thick, pilose median process and narrow but distinct shoulders that slant gradually posteriorly (Figure 28). Palp femur and genu with seta al chisel-shaped.

Male. The length of the male idiosoma averages 743 μ with a range of 650 μ to 800 μ ; the width averages 577 with a range of 480 μ to

610 μ . The dorsal shield is essentially the same as in the female. The shape of the sternitigenital shield is typical for the genus and bears five pairs of setae and three pairs of pores; sternitigenital seta III, IV, and V as well as the posterior seta of coxae II and III are stout and spur-like (Figure 29). A triangular-shaped plate is present just posterior to the sternitigenital shield. The peritremal shield is much broader than that of the female but is similarly shaped. The spermatophore transfer organ is small, flattened and pointed. The remaining ventral and gnathosomal features are as in the female.

Deutonymph. The length of the idiosoma averages 588 μ with a range of 520 μ to 680 μ ; the width averages 456 μ with a range of 400 μ to 550 μ . The dorsal shield and chaetotactic pattern are as in the adults. The venter of the deutonymph (Figure 30) differs from that of the male in that sternal seta II is also spur-like; the peritremal shield is very narrow; and no post holosternal plate is present. The remaining ventral and gnathosomal features are as in the female.

Habitat and Distribution. Eviphis cultratellus (Berlese) is a common species found in association with a variety of beetle species. Berlese (1910) reported it from "beetles" from Java and Egypt; Ryke and Meyer (1957) found it on Onitis sphinx and Onitis sp. from South Africa; and Shoemaker and Krantz (1966) reported it from miscellaneous insects from the Belgian Congo.

Eviphis cultratellus has also been taken from the following

beetle hosts collected in the Congo and preserved in the Musée Afrique Centrale, Tervuren, Belgium: Onitis adelphus, Onitis artuosus, Onitis mniszechianus, Onitis monstrosus, Onitis planatus, Onitis pyramus, Onitis reichei, Onitis robustus, Onitis sphinx, Onitis suberenatus, Onitis vanderkelleni, Onitis viridulus, Catharsinus stuhlmani, Chironitis arrowi, Copris elphenor, Copris interioris, Diastellopalpus johstoni, Heliocopris andersoni, Heliocopris colossus, Heliocopris haroldi, Heliocopris sp.

Type. The type for E. cultratellus is presumably in the Berlese collection, Stazione di Entomologia Agraria, Florence, Italy.

Eviphis pugiosetosis New Species

This species is probably most closely related to Eviphis cultratellus (Berlese) 1910 and Eviphis mullani Oudemans 1910 but may be distinguished from both species on the basis of the form of the ventral setae and the length of the setae on the margins of the dorsal shield.

Female. The length of the idiosoma averages 902 μ with a range of 870 μ to 930 μ ; the width averages 666 μ with a range of 632 μ to 711 μ . The dorsal shield (Figure 32) is entire, has a faint reticulated pattern on its surface, and bears 30 pairs of setae. Setae Mg2-10 and L₁-L₄ are long and stout as opposed to the longer whip-like setae in the Mg series of E. mullani and the shorter setae of E. cultratellus; the

verticals are relatively long and stout; the remaining dorsal setae are minute. The sternal shield (Figure 31) is broader than long, is unornamented, and bears the usual three pairs of setae and two pairs of pores. Sternal setae II and III, the metasternal setae, the genital setae, and the posterior seta of coxae II and III are stout and dagger-shaped. The metasternal plates bearing the one pair of metasternal setae are fused with the endopodals between coxae III and IV. The genital shield is expanded slightly posterior to coxae IV and bears the genital setae on its postero-lateral angle. The anal shield is pear-shaped and bears the usual three setae and a cribrum. The post anal seta is twice as long as the adanal pair. The peritremal shields are typical for the genus and are widely separated from the metapodals. The ventral interscutal membrane bears nine pairs of simple setae. The tectum (Figure 33) is thick and has a distinct basal part which bears strong setules along its lateral margins. It is very much reminiscent of the tectum of E. mullani.

Habitat and Distribution. Eviphis pugiosetosis has been found on Onitis mnizechianus from the following locations in Central Africa: Kabwe Konouo, Mukana, Kafui Ruanda, Lusinga and Kapelwa. It has also been taken from Onitis uncinatoides from Lusinga.

Eviphis falcinellus (Canestrini) New Combination

Laelaps falcinellus G. and R. Canestrini, 1882, Atti. R. Inst. Veneto.

Sc., Lett. ed Arti 5(8):923.

Iphis falcinellus, Canestrini, 1885, Atti. R. Inst. Veneto. Sc., Lett. ed Arti. Pt. 7:93.

Iphis drepanogaster, Berlese, 1882-1892, Acari, Mgr. Scorp. hucusque Italia reperta. p. 44.

This species is closely related to Eviphis mullani but may be distinguished from that species by its smaller size and the placement of the sternal setae. E. falcinellus is known only from the original description, however, Berlese (1882-1892) described and illustrated E. falcinellus as Iphis drepanogaster; and the following discussion is taken from his description.

Female. The length of the idiosoma is approximately 800 μ . The dorsal shield is entire and has a row of long whip-like setae around the margin. The venter (Figure 34) is much like that of E. mullani; the posterior setae of coxae II and III, the genital setae and the metasternal setae, and sternal setae III are all broad and falciform. The remaining ventral setae are simple. The distance between the insertions of sternal setae I is subequal to the distance between sternal setae II.

Habitat and Distribution. Unknown.

Type. Unknown.

Eviphis mullani Oudemans

Laelaps mullani Oudemans, 1910, Ent. Ber. 3(54):83; Oudemans, 1910, Ent. Ber. 3(56):104.

Eviphis mullani, Oudemans, 1915, Ent. Ber. 4(83):183; Oudemans, 1915, Archiv. für Naturgesch. Berlin 1(1):137.

Copriphs (Copriphs) mullani, Vitzthum, 1926, Treubia 8:79.

Vitzthum, 1931, Mem. Mus. Roy. Hist. Nat Belgique 3(5):27.

This species is closely related to Eviphis cultratellus Berlese 1910 but can be distinguished from that species by its greater size and by the possession of long whip-like setae on the margins of the dorsal shield.

Female. The length of the idiosoma averages 1073 μ with a range of 1065 μ to 1080 μ ; the width averaged 810 μ with a range of 800 μ to 820 μ . The dorsal shield (Figure 37) is entire, has a joint reticulate pattern, and bears 29 pairs of setae. Dorsal setae L_1 , L_2 , and Mg_3 , Mg_{11} are long and whip-like; the verticals and seta Mg_2 are about half as long as L_1 ; the remaining dorsal setae are minute. Sternal setae 3, the metasternal setae, the genital setae, and the posterior setae of coxae II and III are broad, stout and falciform; the posterior seta of coxa I is stout and spine-like; the remaining ventral setae are simple. The sternal shield (Figure 35) is about as wide as it is long, is concave posteriorly, is unornamented, and bears the

normal three pairs of setae and two pairs of pores. Metasternal plates large and fused with the endopodals. Genital shield large and bell-shaped; genital setae located on postero-lateral margins of the shield. The anal shield is large and pear-shaped; the normal three seta and a cribrum are present. The peritremal shields are narrow and relatively weakly sclerotized but are otherwise typical of the genus. The interscutal area of the ventral opisthosoma bears nine pairs of simple setae. The tectum (Figure 36) is large, thick, and has strongly serrated lateral margins in the proximal half. The labrum is a simple pyramidal-shaped structure.

The male is described and illustrated in great detail by Oudemans (1915). The deutonymph described by Oudemans (1915) as E. mullani is in reality the nymph of E. cultratellus Berlese 1910 (Ryke and Meyer, 1957).

Habitat and Distribution. Eviphis mullani has been found in association with Heliocopris bucephalus from Khetwady (Bombay) India (Oudemans, 1915), with Helicopris sp. from Jabalpur, India, and with Synaspis tridens from Szechuen, China.

Type. The type of this species is presumably located in the Rijksmuseum van Natuurlijke Historie, Leiden.

Eviphis meyerae Shoemaker and Krantz

Eviphis meyerae Shoemaker and Krantz, 1966, Inst. Parcs Nat.

Congo-Mission H. De Saeger 49(1):4.

This species is closely related to Eviphis cultratellus (Berlese) and Eviphis mullani (Oudemans). It may be distinguished from them by the character and disposition of the dorsal setae, the form of the tectum, and the width of the peritrematal shield.

Female. The length of the idiosoma averages 1058μ with a range of 1030μ to 1080μ ; the width at the level of coxae IV averages 898μ , with a range of 880μ to 920μ . The dorsal shield (Figure 38) is entire and bears 29 pairs of simple setae; setae D_1 and D_2 are many times longer than setae D_3 to D_8 ; the setae on the margins of the shield are long and stout, longer posteriorly. The surface of the shield has a faint reticulated pattern (Figure 39). Sternal shield (Figure 43) wider than long, unornamented, and with three pairs of setae and two pairs of pores; sternal setae III as long as I and II but stout and lanciform. The posterior setae of coxa I, the metasternal setae and the genital setae are similarly shaped but not as long as sternals III. The posterior setae of coxae II and III are short and spur-like; the remaining ventral setae are relatively long and simple. The metasternal plates are fused with the endopodals but not with the sternal shield. The genital shield is large, bell-shaped, and without ornamentation; the genital setae are placed on the posterolateral margin of the shield. The anal shield is large and pyriform; the anal opening and anal setae are in the posterior half of the shield. The

adanal setae are less than half the length of the post anal seta. The peritremal shields are very narrow but generally have the characteristic Eviphis shape. The ventral interscutal cuticle bears nine pairs of simple setae. The epistome is unipartite (Figure 40), thick, and finely pilose. The labrum (Figure 42) is represented by a short pyramidal process. The tooth bearing deutosternal ridges have three to many denticles per ridge.

Habitat and Distribution. Eviphis meyeræ has been found on "a coprophagous beetle" collected in the Garamba National Park, Congo (Shoemaker and Krantz, 1966).

Type. The holotype female is deposited in the collection of the Institut des Parcs Nationaux, Brussels, Belgium. Paratypes are placed in the following institutions: U. S. National Museum, Washington, D. C.; British Museum (Nat. Hist.), London, England; Oregon State University, Corvallis, Oregon, U.S.A.; Potchefstroom University, Potchefstroom, South Africa; Zoological Institute of the Academy of Sciences, Leningrad, U. S. S. R.

Eviphis longus Vitzthum

Eviphis longus Vitzthum, 1926, Treubia 8:85.

This species is known only from the original description of the deutonymphal stage (Vitzthum, 1926). In that description, Vitzthum

indicated that the shape of the idiosoma of Eviphis longus was similar to that of Copriphis elongatus, Berlese 1911. He did not, however, indicate the ways in which they differ. Since specimens of either species are not available for study, an evaluation of their relationships cannot be made at this time.

Deutonymph. The length of the idiosoma is 416 μ to 452 μ ; the width at the level of coxa IV is 238 μ to 257 μ . This elongate pear-shape is unique among the species of Eviphis. The dorsal shield is entire, has a joint reticulate pattern on its surface, and bears 28 pairs of simple setae. The tritosternum has a short base and a pair of short lightly-pilose laciniae. The holosternal shield (Figure 44) is long and narrow, is not fused laterally with the endopodals, and bears five pairs of simple setae. The anal shield is nearly round and bears the usual three setae. The peritremal shields are very narrow and extend anteriorly to the level of coxae II. The interscutal portion of the ventral opisthosoma bears nine pairs of simple setae. The epistome, according to Vitzthum's illustrations, has a distinct base with fringed shoulders and a long lightly-pilose median process.

Habitat and Distribution. Eviphis longus was collected from Heliocopris sp. from Java (Vitzthum, 1926).

Type. The location of the type of this species is unknown.

Eviphis stefaninianus (Berlese)

Copriphis stefaninianus Berlese, 1921, Redia 14:172.

Eviphis stefaninianus, Shoemaker and Krantz, 1966, Inst. Nat.

Congo - Mission H. De Saeger 49(1):6.

This species is very similar to Eviphis hastatellus (Berlese) and to Eviphis transvaalensis Ryke and Meyer. It may be distinguished from these species in that all of the ventral setae are simple and sub-equal in length.

Female. The length of the idiosoma averages 435μ with a range of 430μ to 440μ ; the width averages 300μ with a range of 290μ to 310μ . The dorsal shield (Figure 45) is entire and bears 30 pairs of simple setae; the marginal and lateral setae are slightly longer than the median and dorsal setae; the verticals are relatively long and stout. The sternal, genital, and anal shields (Figure 47) are identical in shape and ornamentation with those of E. hastatellus. The metasternal shields, unlike those of E. hastatellus and E. transvaalensis are not fused with the endopodals. The ventral setae are all simple and sub-equal in length. The peritremal shields are similar to those of E. hastatellus. The epistome is elongated (Figure 46) with a slender, finely pilose distal portion and a broad basal portion fringed on the lateral edges only. The tooth-bearing deutosternal ridges (Figure 50) have six - eight denticles per ridge.

Habitat and Distribution. Eviphis stefaninianus has been found in association with the following Central African beetles: Heliocopris faunus, Heliocopris antenor, Gymnopleurus virens, Onitis mniszechianus, Festurus paganus. It has also been found on Heliocopris hamadryan from Egypt and Nepal, and Enoplatrupes sharpi from Siam.

Type. The type specimen for E. stefaninianus is in the Berlese collection, Stazione di Entomologia Agraria, Florence, Italy.

Eviphis capensis Ryke and Meyer

Eviphis capensis Ryke and Meyer, 1957, Ann. Mag. Nat. Hist. 12(10): 594.

This species is known only from the original description based on a single female. The following diagnosis is taken from that original description. Ryke and Meyer (1957) indicated that E. capensis is closely related to E. paolianus Berl. 1921 and E. paolianus abyssinica Lombardini 1941. These species were inadequately described, consequently I am unable to make a decision as to the validity and relationships of these species at this time.

Female. The length of the idiosoma is 550 μ and the width is 396 μ . The dorsal shield is entire and bears 29 pairs of setae; 19 pairs are lanceolate and the others are small and simple. The sternal shield is wider than long, is unornamented except for a few weak lines

in the region of the sternal setae, and bears the normal three pairs of setae and two pairs of pores. All of the ventral setae are simple. The metasternal plates are not fused with the endopodals and bear the metasternal setae and pores. The genital shield is expanded slightly posteriorly, is unornamented, and bears the genital setae on small postero-lateral protuberances. The anal shield is large, almost round, and is provided with the usual three setae. The peritremal shields are typical for the genus. The interscutal area of the ventral opisthosoma bears nine pairs of setae. The epistome is thick, denticulate, and provided with a distinct base with angular shoulders.

Habitat and Distribution. This species was found in association with Scarabaeus bonellii McL. from Capetown, South Africa (Ryke and Meyer, 1957).

Type. The holotype female of E. capensis is deposited in the British Museum (Nat. Hist.), London, England.

Species Formerly Included in the Genus Eviphis

concentricus

Iphidoides concentricus Oudemans, 1904, Ent. Ber. 1:140.

Eviphis concentricus, Oudemans, 1905, Ent. Ber. 2(1):1; Oudemans, 1915 Archiv. Natg. 81A(H1):149.

This species was found in the deutonymphal stage on a "dipteran"

from France. The descriptions and illustrations given by Oudemans (1904, 1915) indicate that this is definitely not an eviphidid. Its true familial affinities are unclear. The location of the type is not known; however, it is most probably in the Oudemans' collection at the Rijksmuseum van Natuurlijke Historie, Leiden.

gibbus

Eviphis gibbus Berlese, 1903, Redia 1(2):246.

This species is the type for the genus Iphidozercon Berlese, 1903 (Laelapidae).

holsaticus

Eviphis holsaticus Willmann, 1937, Schr. d. Naturw. Vereins f.

Schleswig-Holstein 22(1947):181.

This species is not in the genus Eviphis, but is in Alliphis. It is known only from the deutonymphal stage which closely resembles the deutonymphs of Alliphis halleri. The two are possibly conspecific, but I hesitate to synonymize them until I have seen the female of E. holsaticus. The location of the type is unknown.

siculus

Eviphis siculus Oudemans, 1905, Ent. Ber 2(25):7; Oudemans, 1915,

Archiv. Natg. 81A(H1):150.

This species is a typical member of the genus Alliphis and was moved there by Ryke and Meyer (1957).

Species Incertae sedis

Eviphis magnificus Berlese, 1916, Redia 12:30.

According to Berlese's description, this species has very large and well-developed ectopodal and peritrematal shields; the peritrematal shields extend almost to the anal shield. This description resembles that for Eviphis convergens, Berlese 1913. No illustrations were given, therefore it is impossible to distinguish E. magnificus from E. convergens or even evaluate its placement in Eviphis with the information available. The type is in the collection of the Stazione di Entomologia Agraria, Florence, Italy, but was not available for study.

Eviphis minimus Berlese, 1921, Redia 14:173.

The original description of this species is very general and without illustrations. On the basis of this description it is impossible to make a decision on the validity and relationships of E. minimus. The type is in the collection of the Stazione di Entomologia Agraria, Florence, Italy, but was not available for study.

Eviphis paolianus (Berlese) 1921, Redia 14:171.

Ryke and Meyer (1957) indicated that Eviphis paolianus was related to Eviphis capensis Ryke and Meyer, 1957, but did not say how it could be distinguished from E. capensis. The original description is very general and without illustrations making it impossible to give a diagnosis for E. paolianus with the information available. The type is in the collection of the Stazione di Entomologica Agraria, Florence, Italy, but was not available for study.

Eviphis tubicolous Berlese, 1903, Redia 1:243.

Ryke and Meyer (1957) indicated that this species was related to Eviphis falcinellus, cultratellus, and hastatellus and was probably most closely related to E. cultratellus. The original description is on the deutonymphal stage and is not adequate to properly distinguish E. tubicolous. It was collected from the nest of Termitis tubicolae from South Africa. The type is in the collection of the Stazione di Entomologica Agraria, Florence, Italy.

Genus Scarabaspis Womersley

Scarabaspis Womersley, 1956, J. Linn. Soc. Lond., Zool., 42:590,

Type Scarabaspis aspera Womersley, 1956 (= Iphidozercon orientalis Berlese, 1920); Evans, 1957, Ann. Mag. Nat. Hist. 12(10):490-416.

Womersley (1956) proposed the genus Scarabaspis with the species Scarabaspis aspera Womersley, 1956 as the type. He placed it in the family Laelapidae (subfamily Hypoaspidae) because of the shape of the genital shield and the possession of a two-tined apotele. Evans (1957b) subsequently showed that Scarabaspis aspera Womersley is a synonym of Berlese's (1920) Iphidozercon orientalis, and thus the latter became the type species of the genus. In the same paper, Evans transferred the genus Scarabaspis from the family Laelapidae to the family Eviphididae.

Diagnosis

The species in the genus Scarabaspis may be distinguished from those of all other genera in the family Eviphididae in that the coxal setae of legs I and the posterior coxal setae of legs II are modified into sclerotized oval protuberances or "asperites." The following combination of characters is also characteristic of the genus:

1. The dorsal shield is entire and bears 30 pairs of short simple setae.
2. The vertical setae are short and spine-like.
3. The palptarsus has a pair of characteristic rod-like setae on its outer distal angle.
4. The labrum is distinct and tri-partite.

The remaining features generally agree with those of mites in the

Alliphis halleri group of species.Key to Species of the Genus Scarabaspis

1. Seta Mg4 of dorsal shield simple and similar in size
and shape to other setae in the Mg series 2
Seta Mg4 of dorsal shield short and spine-like,
remaining setae in Mg series simple 3
2. Dorsal shield ornamented with lines forming two
inverted V-shaped figures; greater part of shield
covered with punctures which are connected by
lines to form a polygonal network
. Scarabaspis orientalis (Berlese)
Dorsal shield without conspicuous inverted V-shaped
figures but dorsum is densely punctured and
reticulated Scarabaspis africanus Ryke and Meyer
3. Large species greater than 575 μ in length; anal
shield truncate anteriorly and more than 1.5 times
as broad as long Scarabaspis inexpectatus (Ouds.)
Small species about 450 μ in length; anal shield
only slightly broader than long 4
4. Sternal shield broader than long; genital shield
reticulated; anterior margin of anal shield irregular
and nearly truncate. Scarabaspis punctatus Evans

Sternal shield longer or as long as it is broad;
 genital shield without ornamentation; anterior
 margin of anal shield smooth and convex (Figure 127)

. Scarabaspis rykei Shoemake and Krantz

Descriptions of the Species Included in the Genus Scarabaspis

Scarabaspis inexpectatus (Oudemans)

Emeus inexpectatus Oudemans, 1903, Ent. Berl. 13:91; Oudemans,
 1905, Abh. Nat. Ver. Bremen 18:89.

Iphidozercon inexpectatus, Berlese, 1921, Redia 14:170.

Copriphis variola Schweizer, 1949, Res. Rech. Scient. Parc. Nat.
 Suisse N. F. 2:77.

Scarabaspis inexpectatus, Evans, 1957, Ann. Mag. Nat. Hist. 12(10);
 411.

Female. The length of the idiosoma is about 575 μ ; the width
 about 350 μ . The dorsal shield is entire, has a strongly developed
 vertex, and is ornamented with inverted V-shaped figures. It bears
 30 pairs of short, smooth setae; the verticals and Mgr's are spine-
 like; the remaining 28 pairs are simple. The tritosternum has a
 short, broad base with a pair of lightly pilose laciniae. The sternal
 shield is broader than long, is unornamented, and bears three pairs
 of simple setae and two pairs of pores. The genital shield is small

with concave sides and is rounded posteriorly; the genital setae are located off the shield. The anal shield is truncated anteriorly and is more than 1.5 times as wide as it is long. It bears the usual three setae and a broad cribrum. The peritremal shields are broad, rounded posteriorly, and fused with the dorsal shield at the level of coxa II. The peritremes extend to a level above the gnathosoma. The ventral interscutal cuticle bears nine pairs of simple setae. The width of the epistomal base is less than half the length of median process. The epistomal shoulders are produced into truncate fringed processes. The labrum is tripartite; the tooth bearing deutosternal rows bear 4-10 minute denticles per row.

Male. The length of the idiosoma is approximately 500 μ and the width 280 μ . The ornamentation and chaetotaxy of the dorsal shield is essentially the same as in the female. The sterniti-genital shield is truncate posteriorly and bears five pairs of simple setae and three pairs of pores. The anal shield is similar in general outline to that of the female but not as broad in relation to its length. The short spermatophoral process is spatulate distally. The remaining ventral and gnathosomal features are essentially the same as in the female.

Deutonymph. The length of the idiosoma is approximately 470 μ , and the width about 280 μ . The dorsal shield is basically the same as for the adults. The major differences between the deutonymph and the adult female is in the absence of a well-developed peritremal shield

and the presence of an entire holosternal shield occupying the greater part of the intercoxal region.

Habitat and Distribution. Scarabaspis inexpectatus has been collected in the following places: "Insel Borkum" by Oudemans (1903); cowdung at 1800 m. in the Swiss Alps by Schweizer (1949); and on Geotrupes stercorarius at St. Agnes, Isles of Scilly by Hyatt (1959).

Type. The deposition site of the types is unknown, however they are probably in the Oudemans collection in the Rijksmuseum van Natuurlijke Historie, Leiden.

Scarabaspis orientalis (Berlese)

Iphidozercon orientalis Berlese, 1920, Redia 14:169.

Scarabaspis aspera Womersley, 1956, Jour. Linn. Soc. Lond. Zool. 42:590.

Scarabaspis orientalis, Evans, 1957. Ann. Mag. Nat. Hist. 12(10): 410.

Specimens of this species were not available for study.

Descriptions are based on those of Evans (1957b) and Womersley (1956).

Female. The length of the idiosoma is approximately 450 μ and the width 275 μ . The dorsal shield is entire, is ornamented with two inverted V-shaped figures, and bears the normal 30 pairs of setae. The verticals are spine-like, but all the remaining dorsal setae are

simple. The sternal shield is longer or as long as it is wide, is unornamented, and bears the usual three pairs of setae and two pairs of pores. The genital shield is sub-rectangular, unornamented, and the genital setae are located off the shield. The anal shield is sub-triangular and bears the usual three setae and a cribrum. The peritremal shields are broad and extend only slightly posterior to the stigmata. The ventral interscutal cuticle bears nine pairs of simple setae. The epistome is of the normal form found in the genus. The structure figured by Womersley as the tectum is the tripartite labrum found in all species of Scarabaspis.

Male. The length of the idiosoma is approximately 390 μ and the width about 285 μ . The dorsal shield ornamentation and chaetotaxy is the same as in the female. The sternitigenital shield extends to just past the midline of coxa IV and bears four pairs of simple setae and three pairs of pores. The remaining ventral and gnathosomal features are as in the female.

Habitat and Distribution. Scarabaspis orientalis has been reported from "a small scarab on low growing flowers, near Dorrigo, New South Wales" by Womersley (1956).

Type. Holotype female and allotype male are presumably deposited in the Womersley collection at the South Australian Museum.

Scarabaspis rykei Shoemake and Krantz

Scarabaspis rykei Shoemake and Krantz, 1966, Inst. Parcs Nat.

Congo, Mission H. De Saeger 49(1):7.

Female. The length of the idiosoma averages 451μ with a range of $440-460\mu$; width averages 275μ with a range of $250-290\mu$. The dorsal shield (Figure 125) is strongly reticulated and bears thirty pairs of short setae. The verticals and Mg. 4's are spine-like while the remaining 28 pairs are simple. The sternal shield (Figure 127) is as long or longer than wide, and is produced between coxae I-II and II-III. It is unornamented and bears three pairs of simple setae and three pairs of pores (the metasternal pores are located on the edge of the shield). The metasternal setae are located on the soft cuticle just posterior to the shield. The genital shield is narrow, unornamented, and rounded posteriorly; the genital setae are located off the shield. The peritremal shields are broad, rounded posteriorly and fused with the dorsal shield at the level of coxa II. The anal shield is convex anteriorly, slightly wider than long, and bears three small simple setae; the cribrum is short and half as wide as the anal shield. The ventral interscutal membrane bears nine pairs of simple setae. The epistome (Figure 126) has distinct shoulders produced into truncate fringed processes; the median process is more than twice as long as the width of the base.

Male. The length of the idiosoma averages 372μ with a range of $340-390\mu$; the width averages 218μ with a range of $200-230\mu$. The chaetotaxy and ornamentation of the dorsal shield is essentially the same as in the female. The sterniti-genital shield extends posteriorly to the middle of coxae IV, and bears five pairs of simple setae and three pairs of pores. That portion of the shield between coxae IV has a faint reticulated pattern. The spermatophore transfer organ is short and slender. The remaining ventral and gnathosomal features are as in the female.

Habitat and Distribution. Scarabaspis rykei has been collected from various insects and decaying vegetation from the Parc National De La Garamba, Congo (Shoemaker and Krantz, 1966); and from Onitis chironitus anamalous, Onitis podicuus, Onitis pyramus, Onitis reichei, Onitis vanderkelleni, and Sisyphus quadricollis from Central Africa (new records).

Type. The holotype female and allotype male are deposited in the United States National Museum, Washington, D. C.

Scarabaspis africanus Ryke and Meyer

Scarabaspis africanus Ryke and Meyer, 1957, Ann. Mag. Nat. Hist. 12(10):616.

Female. The length of the idiosoma is approximately 400μ and the width about 220μ . The dorsal shield has a strongly developed

vertex and a distinctive ornamentation of dense punctures and reticulations. It bears thirty pairs of short setae; the verticals are spine-like while the others (including Mg. 4) are simple. The sternal shield is wider than long, is unornamented except for many minute punctures, and bears three pairs of simple setae and two pairs of pores. The genital shield is parallel sided, is rounded posteriorly, and has a joint reticulated pattern on its surface; the genital setae are located off the shield. The anal shield is wider than long and is punctured and reticulated. It bears three simple setae and a cribrum that is half as wide as the anal shield. The peritremal shields are narrow, rounded posteriorly and fused with the dorsal shield at the level of coxa II. The peritremes extend to a level above the gnathosoma. The ventral interscutal cuticle bears ten pairs of simple setae. The epistomal base is truncate anteriorly with a few fringe-like processes on each shoulder; the median process is about twice as long as the width of the base. The labrum is tripartite; the tooth bearing deutosternal ridges have 8-10 denticles per row.

Male. The length of the idiosoma is 330 μ , the width is 172 μ . The dorsal shield ornamentation and chaetotaxy is essentially the same as in the female. Sterniti-genital shield unornamented except for minute punctures and bearing five pairs of pores. The anal shield is similar in shape to that of the female but is without the reticulated pattern. The spermatophore transfer organ is short and spatulate.

The remaining ventral and gnathosomal features are essentially the same as in the female.

Habitat and Distribution. Scarabaspis africanus has been reported from Pachylomora femoratus from S. Rhodesia by Ryke and Meyer (1957); from Pachylomora sp. from Potchefstroom, South Africa by Ryke and Meyer (1957); and from Copris carmelita from Bambesa, Central Africa (new record).

Type. The holotype female has been deposited in the British Museum (Nat. Hist.).

Scarabaspis punctatus Evans

Scarabaspis punctatus Evans, 1957, Ann. Mag. Nat. Hist. 12(10):413.

Specimens of this species were not available for study. The following description is taken from Evans' original description.

Female. The length of the idiosoma is 407μ and the width is 220μ . The dorsal shield is entire and is densely punctured and reticulated. It bears 30 pairs of short setae; the verticals and Mg 4's are spine-like while the others are simple. The sternal shield is broader than long and is covered with minute punctures; the normal three pairs of simple setae and two pairs of pores are present on the shield. The genital shield is parallel sided, rounded posteriorly, and has a reticulated pattern on its surface. The genital setae are

located off the shield. The anal shield is truncated anteriorly, subtriangular in shape, and has a reticulated pattern on its surface. It bears the normal three setae and a cribrum. The peritremal shields are broad, rounded posteriorly, and fused anteriorly with the dorsal shield at the level of coxa II. The peritremes extend to a point above the gnathosoma. The epistome is essentially the same as that of S. inexpectatus (Oudms.).

Male. The length of the idiosoma is 335 μ and the width is 198 μ . The dorsal shield ornamentation and chaetotaxy is the same as in the female. The sternitigenital shield extends to the middle of coxa IV and bears five pairs of simple setae and two pairs of pores. Its surface is covered with minute punctures. The anal shield has a slightly convex anterior margin and is slightly broader than long. The spermatophore transfer organ is short and spatulate in its distal half. The remaining ventral and gnathosomal features are as in the female.

Habitat and Distribution. Scarabaspis punctatus has been collected from heaped cattle dung, moist and beginning to decompose, at Phewa Tal, Pokhara (2,500 ft.), Nepal by K. H. Hyatt.

Type. The holotype female and allotype male are deposited in the British Museum (Nat. Hist.), London.

Genus Alliphis Halbert

Alliphis Halbert, 1923, J. Linn. Soc. Zool. 35:369, Type Copriphis halleri (G and R. Canestrini, 1881, by original designation; Ryke and Meyer, 1957, Ann. Mag. Nat. Hist. 12(10):595-618; Evans, 1957, J. Linn. Soc. Zool. 63:229; Karg, 1963, Zool. Anz. 170(7/8):272-279; Karg, 1965, Mitt. Zool. Mus. Berlin 41(2):262-263.

Crassicheles Karg, 1963, Zool. Anz. 170(7/8):276, Type Eviphis concentricus Oudemans, 1904, by original designation; Karg, 1965, Mitt. Zool. Mus. Berlin 41(2):262-263. New synonymy.

The genus Alliphis was erected by Halbert in 1923 to accommodate Copriphis halleri (G and R. Canestrini, 1881). No generic diagnosis was given at that time. No attempt was made to adequately define the genus until Ryke and Meyer (1957) reviewed the Eviphidinae associated with South African beetles. Their diagnosis of Alliphis was as follows: "Vertical setae short and spine-like; all setae on dorsum relatively short; metasternal setae on free metasternal plates; anterior pair of sternal pores arranged as longitudinal slits on the medial side of sternal setae I." They also indicated that the genera Alliphis and Pelethiphis were so closely related that at times it was extremely difficult to separate them. Willmann (1956) separated Alliphis from Pelethiphis by the length of the dorsal marginal setae--"Alliphis

wurde zunächst als Untergattung von Untergattung von Copriphis (= Pelethiphis) aufgestellt für die eigentlichen Copriphis - Arten (= Pelethiphis) besonders am Seitenrande sehr lange Haare aufweisen." Costa (1963) restricts the name Pelethiphis to "the less sclerotized forms occurring beneath the elytra of their hosts." On this basis he described a species, Alliphis gurei, which is a typical member of the Pelethiphis. Karg (1963) indicated that the diagnosis for Alliphis given by Ryke and Meyer (1957) was inadequate. He did nothing, however, to remedy the situation but rather added to the confusion by erecting the genus Crassicheles based on what I consider to be typical Alliphis deutonymphs.

The following diagnosis is based on all of the known species of the genus Alliphis.

Diagnosis

All of the dorsal setae are short, simple, and subequal; the vertical setae are spine-like or lanceolate and are usually as long or longer than the remaining dorsal setae. The tectum (Figure 10) usually has a long lightly pilose median process and a distinct base with lateral shoulders. The tooth bearing rows of the deutosternal series have fewer than 15 teeth per row. A sickle-shaped, rod-like seta is generally present on the outer distal angle of the palp-tarsus (Figure 7). The tritosternal base is short and trapezoidal; its length

is sub-equal to its width. The peritremes extend cephalad to a point anterior to the middle of coxa I and usually to a point above the gnathosoma.

The genus Alliphis is easily distinguished from Eviphis and Scarabaspis by the absence of the paired sickle-shaped setae on the the palp-tarsus and by the possession of only simple setae on the ventral idiosoma. Its separation from Pelethiphis is more difficult, but it may be made on the basis of the above combination of characters. The best "spot characters" for distinguishing the species of Alliphis from Pelethiphis are in the lengths of the dorsal setae and in the form of the tectum.

General Description

The genus Alliphis appears to be comprised of two rather indistinct morphological groupings of species. One is represented by A. halleri and the other by A. obesus n. sp. The A. halleri group usually has spine-like vertical setae, a tectum with sharp angular shoulders, the peritremes extending to a level above the gnathosoma, and a tripartite labrum. The A. obesus group generally has lanceolate vertical setae, a tectum with slanting or rounded shoulders, a peritreme that does not extend as far as the level of the gnathosoma, and a unipartite labrum. The latter group appears to be most closely related to species in the genus Pelethiphis.

Female. The dorsal shield is entire except in A. obesus and bears 29-30 pairs of short acuminate setae; the vertical setae are spine-like or lanceolate. The surface of the dorsal shield is generally reticulated, but may bear a pattern of V-shaped figures (A. evansi) or lack ornamentation completely. Where long series of specimens of a given species were available for study, some intraspecific variation in the dorsal shield ornamentation was noted. Ventrally the tritosternal base is about as wide as it is long, and the laciniae are long and lightly pilose. The sternal shield generally is as wide or wider than long, and bears three pairs of simple setae and two pairs of lyriform pores. The surface of the sternal shield usually is unornamented, but where ornamentation is present it is useful as a taxonomic feature. The metasternal setae are simple and located on free metasternal platelets. The genital shield is parallel sided, rounded posteriorly and unornamented. The genital setae are simple and may be located on or off the shield. The anal shield is typically pear-shaped, and may or may not be ornamented. It bears three simple setae and a cribrum. The peritremal shield is broad and well-developed, may extend as far as the middle of coxa IV, and may or may not bear ornamentation. The interscutal portion of the ventral opisthosoma bears seven to ten pairs of simple setae. The epistome is a distinct structure with a long lightly pilose median process and a base with lateral shoulders, while the labrum is tripartite or unipartite.

The tooth bearing rows of the deutosternal series have fewer than 15 teeth per row. The palp-tarsus usually has a sickle-shaped, rod-like seta on its outer distal angle (A. halleri group); the al setae of the palp femur and genu usually are chisel-shaped. The corniculi generally are short and thorn-like.

Male. The dorsal shield and chaetotaxy is the same as in the female. The sternite-genital shield has the genital aperture in its anterior margin and bears five pairs of simple setae and three pairs of pores. The peritremal shield is generally broader than that of the female. The male chelicerae each bear, on the outer face of the movable digit, a short spatulate spermatophore transfer organ. The remaining ventral idiosomal and gnathosomal features are as in the female.

Deutonymph. The dorsal shield and chaetotactic pattern is the same as in the adults. The elongate holosternal shield extends to the posterior margin of coxae IV and bears four pairs of simple setae and three pairs of pores. Endopodal plates may be free (A. halleri) or fused with the holosternal shield (A. evansi). The peritremes generally have only traces of a narrow external peritremal shield. Anteriorly the deutonymphal peritreme is generally shorter than that of the adults. The remaining ventral idiosomal and gnathosomal characters are as in the female.

Key to the Species of the Genus Alliphis

1. Peritremes extending to a point above the gnathosoma
(Figure 56); labrum tripartite (Figure 55); tooth bearing
ridges in deutosternal groove usually with ten or more
teeth per row; vertical setae usually spine-like 2

Peritremes extending to the middle of or slightly
beyond coxa I, but not to the gnathosoma (Figure 91);
labrum unipartite (Figure 92); ridges in deutosternal
groove usually with six or less teeth per row; vertical
setae usually lanceolate 8
2. Distal hypostomal seta much thicker and longer than
other hypostomal setae; deutosternal ridges with 3-6
teeth per row (Figure 55) A. reticulosternis n. sp.

Distal hypostomal seta approximately the same size or
smaller than the proximal median hypostomal seta;
deutosternal ridges with ten or more teeth per row 3
3. Median process of epistome at least twice as long as
the width of the base 4

Median process of epistome less than twice as long as
width of base 6
4. Sternal shield fused laterally with endopodal plates,
about as wide as long 5

- Sternal shield not fused with endopodal plates, longer than wide; dorsal shield heavily sculptured. . . . A. sculpturatus Karg
5. Anterior margin of epistomal base truncate; median process three times as long as the width of the base; vertical setae lanceolate (Figure 57). A. halleri (G & R Canes.)
- Anterior margin of epistomal base with slanting shoulders; median process only slightly more than twice as long as the width of the base; vertical setae setiform (Figure 61) A. siculus (Ouds.)
6. Anal shield wider than long; shoulders of tectal base sharp and angular; median process short and thick (Figure 62) A. chirophorus Willmann
- Anal shield as long as it is wide; shoulders of tectal base slanting posteriorly or rounded 7
7. Posterior margin of peritremal shield pointed and with a pore in its tip; shoulders of tectal base slanting; anal and epigynial shields with a distinct pattern (Figures 63, 64, 65) A. santosdiasi Ryke
- Posterior margin of peritremal shield truncate and without pore; shoulders of tectal base rounded; Anal and epigynial shields without a distinct pattern (Figure 66) A. evansi Ryke and Meyer

8. Peritremes not extending cephalad of coxae II
 A. equestris (Berlese)
 Peritremes extending to or slightly beyond coxae I 9
9. Distal hypostomal seta distinctly longer and stouter
 than proximal medial hypostomal seta 10
 Distal hypostomal seta subequal to or smaller than
 remaining hypostomal setae 12
10. Ventral shields with no or only very indistinct
 ornamentation; epigynial setae located off the shield;
 dorsal seta L8 scimitar-like, many times longer than
 remaining dorsal setae (Figures 69, 71). A. intermedius n. sp.
 Some or all ventral shields with distinct patterns of
 reticulations or punctures; all dorsal setae subequal 11
11. Minute punctures forming a distinctive pattern in the
 posterior half of sternal shield; epigynial shield
 unornamented and expanded posterior to level of
 coxa IV; anal shield heart-shaped (Figure 74). A. krantzi n. sp.
 Large deep punctures scattered over median portion of
 sternal shield; epigynial shield parallel-sided with a
 distinct reticulated pattern; anal shield pear-shaped
 (Figure 76) A. punctisternis n. sp.
12. Peritremes extending just past anterior margin of
 coxa I; peritremes curve dorsally so that the anterior

- portion is visible from above 14
- Peritremes extending to middle of coxa I, but not past;
peritremes not visible from above 13
13. Large, robust species more than 700 microns long;
tooth bearing deutosternal rows with combs of
fine teeth (Figures 21, 92) A. crassicheles n. sp.
- Medium sized species less than 550 microns long;
tooth bearing deutosternal rows with two teeth per
row (Figures 79, 80). A. ritcheri n. sp.
14. Deutosternal ridges with 3-6 teeth per row; epigynial
shield expanded posterior to coxa IV; epigynial setae
located on shield (Figures 82, 84) A. mellotti n. sp.
- Deutosternal ridges with approximately 10 minute teeth
per row; epigynial shield parallel-sided; epigynial setae
located off shield (Figures 86, 90) A. obesus n. sp.

Descriptions of the Species Included in the Genus Alliphis

Alliphis reticulosternis New Species

Female. The length of the idiosoma is 480 μ with a range of 460-500 μ and the width is 286 μ with a range of 270-300 μ . The dorsal shield (Figure 54) is entire, has only a faint net-like pattern on its surface (Figure 52), and bears 30 pairs of smooth simple setae.

The vertical setae are lanceolate and only slightly more stout than the remaining dorsal setae. The posterior half of the shield has three pairs of small circular pores and six pairs of large elliptical pores. The tritosternum consists of a short distinct base and a pair of thin, lightly pilose laciniae. The sternal shield (Figure 51) is as wide as it is long and has a distinct reticulated pattern on its anterior and lateral portions. Sternal setae and pores normal. Metasternal setae on integument; metasternal plates absent. Epigynial shield expanded slightly or parallel sided, without any ornamentation, and with epigynial setae inserted on its lateral margins. Anal shield also with a distinct reticulated pattern on its anterior portion; three pair of anal setae and a cribrum present. Ventral interscutal integument with ten pairs of simple setae. Peritremal shields strong, with an irregular posterior margin, and fuses at the level of coxa II with the dorsal shield. Peritremes curve dorsally at the level of coxa II and are readily visible from above. The epistome is distinctive with the shoulders produced into lobes (Figure 53) and the median process slightly shorter than twice the width of the base. The labrum is tripartite; the deutosternal ridges have four teeth per row. The distal hypostomal seta is much stouter than the proximal setae and is modified as shown in Figure 55.

Male. Length of the idiosoma 397μ with a range of $380-410\mu$ and the width is 253μ with a range of $240-270\mu$. The dorsal shield is

identical with that of the female. The sternitigenital shield bears five pairs of setae and three pairs of pores; the ornamentation is similar to that of the female. The remaining ventral features are as in the female. The spermatophore transfer organ is large and scoop-shaped. Leg II is heavier than the other legs and bears ventrally on its femur a large long spine which appears to articulate with a short tubercle on the genu.

Habitat and Distribution. Males and females were found in association with Catharsius molossas L. collected in 1947 on Mindanao Island, Cotabato Province, Phillipines. Males and females were also found in association with Homalocoprissus tmolus Fisch from Turkestan.

Types. The holotype female will be deposited in the U. S. National Museum, Washington, D. C. Paratypes will be deposited in the following institutions: Oregon State University Acarina Collection, Corvallis, Oregon and the British Museum (Nat. Hist.), London.

Alliphis sculpturatus Karg

Alliphis sculpturatus, Karg, W. 1963. Zool. Anz. 170 (7/8):274;

Karg, W. 1963. Mitt. Zool. Mus. Berlin, 41(2):216, 222.

Specimens of this species were unavailable for study, the following being a summary of Karg's (1963) original description.

Female. The idiosoma is 390-430 μ long and 260 μ wide. The dorsal shield is entire, has a heavily sculptured pattern and bears 30 pairs of simple setae. The vertical setae are very short and thorn-like. Tritosternum with a short distinct base and a pair of short pilose laciniae. The sternal shield is rectangular mainly due to the absence of fusion between the sternal shield and the endopodal plates between coxae II and III and bears three pairs of simple setae and two pairs of pores. Epigynial shield nearly parallel-sided and with simple epigynial setae located on small lateral protuberances. Anal shield pear-shaped, about as long as it is wide, and bears three pairs of setae and broad cribrum. Peritremal shields broad, blunt posteriorly and fused anteriorly with the dorsal shield at the level of coxae II. Peritremes extend anteriorly to a level above the gnathosoma. Ventral interscutal membrane with ten pairs of simple setae. Epistome with base about half as wide as the median process is long. The shoulders of the base are sharp and angular. Deutosternal ridges with 12-14 minute teeth.

Male. Unknown.

Deutonymph. The idiosoma is 325-340 μ long and 200 μ wide. The dorsal shield is like that of the female only the ornamentation is not as distinct and more net-like. The ventral shield is fused with the endopodals and bears 4 pairs of setae and two pairs of pores. The peritremal shields are absent; the peritremes extend slightly past

the middle of coxae I. The remaining features of the venter and of the gnathosoma are as in the female.

Habitat and Distribution. Collected from surface soil in Germany (Karg 1963).

Types. Holotype female in the collection of W. Karg, Biologische Zentralanstalt Berlin, Kleinmachnow, Germany.

Alliphis halleri (G. and R. Canestrini)

Gamasus halleri, Canestrini G. and R. 1881, Atti. Ist. Venet. 5 (7): 1077.

Laelaps halleri, Canestrini, G. and R. 1882. Gamasi Italiani Monographia, Padova. p. 57.

Iphis halleri, Canestrini, G., 1885, Prospetto dell' acarofauna italiana, Padova. p. 158; Berlese, A., 1892, Acari Myriopoda et Scorpiones hucusque in Italia reperta. Padova Pt. LXVII (6):36.

Copriphis (Alliphis) halleri, Halbert, 1923, J. Linn. Soc. Zool. 35 (1923).

Alliphis halleri, Sellnick, 1958, Medd. Vaxtskyddsanst. Stockh. 1171: 24; Griffiths, 1960, Ann. appl. Biol. 48(1):142; Costa, 1963, J. Linn. Soc. (Zool.) 45(303):37; Karg, 1963, Zool. Anz. 170(7/8):272-273.

Alliphis alpinus Schweizer, 1961, Denks. schweiz. naturf. Ges. 84:142.

New Synonymy.

This is the most commonly collected of all the eviphidids and is one of several species that is probably cosmopolitan in distribution. Even though A. halleri is a common species it was not described adequately until recently (Costa 1963). Many of the references to A. halleri appearing in the literature, therefore, may possibly be incorrect.

Female. The idiosoma is 405-435 μ long and 265-295 μ wide. The dorsal shield (Figure 58) is entire, ornamented with a net-like pattern (Figure 59), and bears thirty pairs of short simple setae. The vertical setae are lancet shaped. The tritosternum has a distinct base that is about as long as it is wide. The sternal shield (Figure 56) is unornamented, about as long as it is wide, and bears three pairs of simple setae and two pairs of pres. Epigynial shield expanded slightly posterior to coxa IV and bears a pair of simple setae on its lateral margins. Anal shield pear shaped with three setae and a cribrum. Peritremal shields well developed, extend nearly to the posterior margins of coxae IV, and have an irregular posterior margin; peritreme extends anteriorly to a level above the gnathosoma. Ventral interscutal membrane with ten pairs of simple setae. Epistome (Figure 57) with a distinct base that is less than half as wide as the median process is long. Deutosternal rows with 6-8 minute teeth per row. Labrum tripartite (Figure 60).

Male. The length of the idiosoma is 335-365 μ and its width is 215-245 μ . The dorsal shield and its chaetotaxy is as in the female. The sternitigenital shield is faintly ornamented with a net-like pattern and bears 5 pairs of simple setae and 3 pairs of pores. Its anterior margin is quite indistinct and its posterior margin rounded. The ventral interscutal membrane has 8 pairs of simple setae. The peritremal shields are slightly shorter than the females and are rounded posteriorly; the peritremes do not quite reach the anterior margin of coxae I. The spermatophore transfer organ is short and terminates in a disc-like structure.

Deutonymph. The idiosoma is 335-350 μ long and 215-225 μ wide. The dorsal shield is similar to that of the adults. The sternal shield is unornamented and bears 4 pairs of simple setae. The endopodal shields between coxae II and III and between coxae III and IV are free and distinct. Peritremal shields greatly reduced and not extending posterior to the stigmata. The remaining features of the venter are as those in the adults.

Habitat and Distribution. A. halleri has been collected in a great variety of habitats from all over Europe. Schweizer (1949), Sellnick (1958), and numerous others have reported this species from under moss and stones. Griffiths (1960) reported it from grainstacks in the open field, Davies (1963) reported it from mineral soils, Homann (1934) from sound stocks of bees, Costa (1963) from the

coprophilous scarab Copris hispanus (L.), and Halbert (1923) from decayed potatoes and rotting leaves. In Oregon, U. S. A. I have collected it from the dried dung and fodder mixture on the floor of horse stalls.

Types. The location of the type is not known.

Alliphis sculus (Oudemans)

Eviphis sculus Oudemans, 1905, Ent. Ber. 2(25):7.

Eviphis sculus Oudemans, 1915, Archiv. fur Naturgesch. Berlin 81(1):150.

Pelethiphis sculus Gotz and Hirschmann, 1957, Mikrokosmos 46:115.

Alliphis sculus Ryke and Meyer, 1957, Ann. Mag. Nat. Hist. 12(10): 603; Karg, 1963, Zool. Anz. 170(7/8):273.

According to Karg (1963) this species is common throughout Europe. However, references to it in the literature are scarce.

A. sculus is similar to A. halleri and it is possible that many of the numerous reports in the literature of A. halleri actually refer to A. sculus.

Female. The length of the idiosoma is 480-500 μ and the width is 306 μ . The dorsal shield is entire and has a fish scale-like ornamentation. Thirty pairs of smooth simple setae are inserted on the dorsal shield. The vertical setae differ very little from the

remaining dorsal setae. Tritosternum with a short distinct base and a pair of lightly pilose laciniae. Sternal shield slightly longer than wide, unornamented, and with three pairs of simple setae and two pairs of pores. Epigynial shield expanded slightly posterior to coxa IV, and bears the epigynial setae on its lateral margins. Anal shield pear-shaped with normal three setae and cribrum. Peritremal shields irregularly rounded posteriorly; peritremes extending to a level above the gnathosoma. Ventral interscutal membrand with nine pairs of simple setae. Epistome with gradually sloping shoulders (Figure 61) and a median process that is longer than twice the width of the base. Labrum tripartite; deutosternal ridges with six-eight teeth per row.

Male. Length of the idiosoma 400-425 μ ; width of 220 μ . Dorsal shield chaetotaxy and ornamentation essentially the same as in the female. Sternitigenital shield with five pairs of simple setae and three pairs of pores. Spermatophore transfer organ short and scoop-like. Peritremal shields greatly reduced or absent. Remainder of ventral characters as in the female.

Habitat and Distribution. This species has been collected in association with Scarabaeus semipunctatus L. from Catania, Sicily. Karg, 1963, indicates that it is a common species in Europe associated with various beetles and in decaying organic material.

Type. In the Oudemans collection, Rijksmuseum van

Natuurlijke Historie, Leiden.

Alliphis chirophorus Willmann

Alliphis chirophorus Willmann, C. 1956. Ceskoslov. Parasit. 3:224;

Karg, W. 1963. Zool. Anz. 170(7/8):273.

This species is very much like Alliphis halleri (G. and R. Canestrini, 1881) but may be distinguished from that species by the form of the tectum and of the anal shield. Since no specimens of this species were available for study, the following description was taken from Willmann's (1956) original description.

Female. The length of the idiosoma is 465μ and the width is 300μ . The dorsal shield is entire and has a net-like pattern on its surface. Willmann's illustration of the dorsal shield shows 33 pairs of setae; this is probably not actually the case. Some of the setae which appear to be on the edge of the shield are probably on the lateral integument since he shows three pairs more setae in the marginal series than is normally the case. All dorsal setae with the exception of the spine-like verticals are short and simple. Tri-tosternal base distinct and about as long as it is wide. Sternal shield unornamented, with normal compliment of setae and pores. Epigynial shield parallel sided or very slightly expanded posteriorly and bearing a pair of simple setae on its lateral margins. Peritremal shields

irregular posteriorly and appear to be fused with the dorsal shield at the level of coxa II; peritremes extending to a level just beyond coxae I. The anal shield is subtriangular, wider than long, and has the normal three setae. Ventral interscutal membrane bears seven pairs of setae (this number of setae probably should also be suspect). The epistome (Figure 62) has a distinct base with sharp angular shoulders and a short, thick, pilose median process. The median process is only slightly longer than the width of the base.

Male. The length of the idiosoma is 375μ and the width is 240μ . The dorsal shield was not described. The sternitigenital shield is truncate posteriorly and bears five pairs of setae and three pairs of pores. The anal shield is about as long as it is wide. The remainder of the ventral features are as in the female. The spermatophore transfer organ on the movable digit of the chelicerae is short and spatulate.

Habitat and Distribution. This species has been collected in mold, under animal fodder and in wet moss pads in Czechoslovakia (Willmann, 1956).

Types. The location of the types was not given in the original description; presumably they are in the collection of the author.

Alliphis santosdiasi Ryke

Alliphis santosdiasi Ryke, P. A. J. 1959. Mem. e Est. do Mus.

Zool. da Univ. de Coimbra. 258:13.

This species is closely related to Alliphis evansi Ryke and Meyer 1957 and bears a superficial resemblance to Alliphis halleri (G. and R. Canestrini; 1881). It may, however, be distinguished from these species by the form of the tectum and of the ventral shields.

Female. The length of the idiosoma averages 372μ with a range of 360μ - 380μ ; width of idiosoma at level of coxa III averages 230μ with a range of 220μ - 240μ . Dorsal shield covering entire dorsum, ornamentation a distinct net-like pattern. It has 30 pairs of short, smooth, simple setae; verticals only slightly more spine-like than the remaining dorsal setae. Tritosternum with a distinct base and a pair of relatively short pilose laciniae. Sternal shield unornamented, about as long as it is wide, and with irregular anterior and posterior margins. It bears three pairs of simple setae and two pairs of pores. Epigynial shield (Figure 64) expanded slightly posterior to coxa IV, and has a distinct V shaped pattern on its surface. Epigynial setae simple and located on the lateral edges of the shield. Anal shield subtriangular in shape, with the normal three setae and a cribrum, and with a distinct reticulated pattern on its surface. Peritremal shields pointed posteriorly (Figure 65) and fused anteriorly with the dorsal shield at the level of coxae II; peritremes extending to a level above the gnathsoma. Ventral interscutal membrane bears ten pairs of setae. Epistome with gradually sloping shoulders (Figure 63) and a median process that is shorter than twice the width

of the base. The labrum is tripartite.

Male. Length of idiosoma 330 μ ; width, 195 μ . The dorsal shield and its chaetotaxy is basically the same as that of the female. The sterniti-genital shield bears five pairs of setae, three pairs of pores, and is truncate posteriorly. Peritremal shields and other features of the venter agree with those of the female. The movable digit of the chelicerae is provided with a spermatophore transfer organ.

Immatures. Ryke (1959) indicates the presence of deutonymphs on the host beetle but does not describe nor illustrate them. The larvae and protonymphs are unknown.

Habitat and Locality. Males, females and deutonymphs of Catharsius tricornutus Deg. collected Tinonganine (Maputo), Mozambique.

Habitat and Distribution. Ryke (1959) recorded this species as being found on Catharsius tricornutus from Mozambique. The following are new records for A. santosdiasi: Heliocopris cornieulatus from Congo. Lula, Kapanga; Heliocopris samson from Congo, Lac Albert, Butiaba; Onitis mniszechianus from Mukana, from Ruanda Kafui, from Lusinga, from Kabue Kanono, from Kapelwa, from Kanipadika, and from Katanga; Onitis overlaeti from Bambesa; Onitis podicuus from Congo, Kafur and Congo, Lusinga; Onitis uncinatoides from Congo. Mukana from Kapelua, and from Lusinga; and Onitis uncinatus from

Kuri, Karimiura.

Types. Holotype female deposited in the collection of the "Museu Dr. Alvaro de Castro," Lourenco Marques; the allotypes and paratypes are deposited in the collection of the Institute for Zoological Research of the Patchefstroom University, Patchefstroom, South Africa.

Alliphis evansi Ryke and Meyer

Alliphis evansi Ryke, P. A. J. and M. K. P. Meyer, 1957. Ann.

Mag. Nat. Hist. 12(10):603; Shoemaker, R. R. and G. W. Krantz.

(1966). Inst. Parcs Nat. Congo, Mission H. De Saeger. 49(1):8.

Alliphis halberti Ryke, P. A. J., and M. K. P. Meyer, 1957

(deutonymph of A. evansi) new synonymy.

The morphology of A. evansi has been adequately described and figured by Ryke and Meyer (1957). The following is merely a brief diagnosis presented to indicate some useful characters for separation from other species of the genus.

Female. The length of the idiosoma averages 453μ with a range of 430μ - 480μ ; width of idiosoma at level of coxa III averages 285μ with a range of 260μ - 310μ . The dorsal shield (Figure 67) covers the entire dorsal idiosoma and bears 30 pairs of short simple setae with the exception of the spine-like vertical setae. The tritosternum

has a distinct base which is approximately as long as it is wide. The sternal shield (Figure 66) is unornamented, approximately as long as it is wide, and bears the usual three pairs of simple setae and two pairs of pores. The epigynial shield is parallel sided and bears one pair of epigynial setae on its lateral margins. The anal shield is subtriangular in shape with the normal three setae and a cribrum. The ventral interscutal membrane is provided with ten pairs of simple setae. The peritremal shield is blunt posteriorly and fused anteriorly with the dorsal shield at the level of coxa II; the peritreme extends to a level above the gnathosoma. The epistome is as in Figure 68; median projection less than twice the width of the base. The labrum is tripartite.

Male. The length of the idiosoma averages 367μ with a range of $320\mu - 380\mu$; width of idiosoma at level of coxa III averages 238μ with a range of $230\mu - 260\mu$. The dorsal shield and its chaetotaxy is essentially same as for the female. The sternitigenital shield has five pairs of simple setae and three pairs of pores; the posterior edge of the shield is more or less truncate. The peritremal shields are slightly broader than those of the female. The remainder of the venter is essentially the same as in the female.

Deutonymph. The length of idiosoma averages 366μ with a range of $340\mu - 380\mu$; the width at the level of coxa III averages 228μ with a range of $200\mu - 250\mu$. The dorsal shield and chaetotaxy is as in

the adults. The sternal shield has four pairs of simple setae and three pairs of pores; the endopodal plates are free giving the posterior half of the sternal shield a narrow pointed shape. The peritremal shields are greatly reduced; not extending posterior to stigmata. The chelicerae are essentially the same as in the female. There is some variation between individuals in the relative lengths of the hypostomal setae. This has led Ryke and Meyer (1957) to describe the deutonymph as a new species of Alliphis. In light of this variation Alliphis halberti Ryke and Meyer, 1957, is considered a synonym of Alliphis evansi Ryke and Meyer, 1957.

Habitat and Distribution. Alliphis evansi has been found in association with the following beetles: Amomala transvaalensis and Onitis sp. from Potchefstroom, South Africa; Onthophagus gazella and Oniticellus sp. from Fochville, South Africa (Ryke and Meyer, 1957). It has also been found in association with the following Central African beetles: Catharsius dux, Catharsius obtusicornis, Diastellapalpus basilobatus, Garreta azureus rubrocupreus, Heliocopris anguliceps, Heliocopris colossus, Heliocopris felchei, Heteronitis castelmani, Onitis adelphus, Onitis alexis, Onitis artusus, Onitis chironitis anamalus, Onitis fabricii, Onitis monstrosus, Onitis robustus, Onitis vanderkellini, Onitis viridulus and Sisyphus quadricollis.

Types. The types of Alliphis evansi are deposited in the

collection of the Dept. of Zoology, Potchefstroom University,
Potchefstroom, South Africa.

Alliphis equestris (Berlese) New Combination

Copriphis (Pelethiphis) equestris Berlese, 1911, Redia 7:186.

Pelethiphis equestris, Hyatt, 1958, Ent. mon. Mag. 95:22.

The dorsal shield and chaetotaxy of this species are typical of the genus Alliphis and the Alliphis obesus group of species. It is on the basis of these characters that I am transferring this species to the genus Alliphis. Alliphis equestris may be distinguished from the other members of the A. obesus group by its extremely short peritreme. Specimens of A. equestris were not available for study so the following is a summary of Hyatt's (1958) description.

Female. The dorsal shield is 371μ - 283μ long by 157μ - 170μ wide and bears 27 pairs of short simple setae; the verticals are subequal to the remaining dorsal setae. A narrow band of unsclerotized cuticle bearing five pairs of simple setae is present around the posterior $2/3$ of the dorsal shield. The surface of the shield bears a joint reticulated pattern. The sternal shield is longer than wide, is unornamented, and bears three pairs of simple setae and two pairs of pores. The metasternal setae are situated on the membrane posterior to the sternal shield. The genital shield is parallel sided,

rounded posteriorly, and has a reticulated pattern on its surface. The genital setae are located off the shield. The anal shield is subtriangular, is lightly reticulated anteriorly, and bears the usual three setae and a cribrum. The peritremes extend only to the posterior region of coxae II, and the peritremal shields are fused with the dorsal shield lateral to coxae II. The interscutal portion of the ventral opisthosoma bears seven pairs (not counting the genital setae) of simple setae. The epistome has a long lightly pilose median process and a base with distinct angular shoulders. The length of the median process is more than twice the width of the base.

Habitat and Distribution. Alliphis equestris (Berlese) has been found beneath the elytra of Geotrupes stercorarius from Moremma, Tuscanny (Berlese, 1911), from East Sheen, Surry (Evans, 1957a), and from Wareham, Dorset (Hyatt, 1958).

Type. The type specimen is in the Berlese collection at the Stazione di Entomologia Agaria, Florence, Italy.

Alliphis intermedius New Species

Female. The length of the idiosoma averages 570μ with a range of 590μ - 600μ ; the width averages 370μ with a range of 360μ - 380μ . The dorsal shield (Figure 71) is entire and bears 30 pairs of simple setae. The most outstanding feature of this species is the modification of dorsal seta L8 into a long scimitar-like structure; the

verticals are lanceolate; the remaining dorsal setae are small and simple. The tritosternum has a distinct base that is as long as it is wide and two short, lightly pilose laciniae. The sternal shield (Figure 69) is as long as it is wide, is unornamented except for slightly more heavily sclerotized lateral margins, and bears the usual three pairs of simple setae and two pairs of pores. The metasternal setae are placed on small platelets. The epigynial shield is more or less parallel-sided, is unornamented, and the epigynial setae are located just off its lateral margins. The anal shield is pear shaped, has a reticulate pattern on the portion anterior to the anal opening, and has the usual three setae and a cribrum. The peritremal shields are well-developed; the posterior margins are pointed and the anterior portions are fused with the dorsal shield at the level of coxa II. The peritremes extend almost to the anterior margin of coxa I. The interscutal membrane of the ventral opisthosoma bears nine pairs of simple setae. The median process of the epistome (Figure 70) is shorter than twice the width of the base. The labrum is unipartite with a short lateral fringe. The deutosternal ridges have 3-4 teeth per row. The distal hypostomal setae (Figure 72) are large thick and longer than the slender proximal medial setae which are in turn longer than the proximal lateral setae.

Male. The length of the idiosoma is 480 μ and the width is 330 μ . The dorsal shield is, except for its size, identical to that of the female.

The sternitigenital shield is unornamented and bears five pairs of setae and three pairs of pores. The remaining ventral features are as in the female. A large blunt spine is present on femur II; smaller spines are present on the genu fibia and tarsus of the same leg.

Femur II has on its ventral face a stout peg-like seta not unlike that on A. punctisternis males. The spermatophore transfer organ is rather scoop shaped and with a pattern of longitudinal striations.

Habitat and Distribution. Alliphis intermedius has been found in association with Catharsius sesastris, Diastellopalpus couradi, and Diastellopalpus infernalis from Central Africa.

Alliphis krantzi New Species

Female. The length of the idiosoma averages 658μ with a range of 620μ to 680μ and the width averages 425μ with a range of 410μ to 440μ . The dorsal shield is entire, unornamented and bears 29 pairs of minute, simple setae, and one pair of lancet-like vertical setae. The tritosternal base is distinct and is as long as it is wide. The sternal shield is wider than long and is ornamented with a peculiar pattern of punctures in its posterior half (Figure 74); three pairs of setae and two pairs of pores are present on the shield. The metasternal setae are situated on small platelets. The epigynial shield is drop-shaped, unornamented, and bears the epigynial setae on its lateral margins. The anal shield is heart shaped, has a reticulated

pattern on its surface, and bears the usual three setae and a cribrum. The peritremal shields are broad and ornamented with a distinct reticulate pattern; the peritremes extend to the anterior margin of coxa I and do not curve dorsally. The epistome (Figure 73) has a large rounded base and a rather short and slender median process. The median process is approximately as long as the width of the base. The labrum is unipartite with slightly serrate lateral margins in its distal half. The deutosternal ridges (Figure 75) have 3-5 teeth per row. The distal hypostomal setae are quite long and stout.

Habitat and Distribution. Females only are found in association with Diastellopalpus monapoides from Dutch East Africa and Tanganyika Territory.

Alliphis punctisternis New Species

Female. The length of the idiosoma averages 517μ with a range of 470μ - 570μ and the width averages 352μ with a range of 290μ - 370μ . There are two distinct size groups in this species; one includes those mites associated with Diastellopalpus couradti, and Diastellopalpus tridens which average about 50μ smaller than those mites associated with Diastellopalpus basilobatus. All other features of the two groups are, however, the same. The dorsal shield is entire, with a weak reticulate pattern, and bears 30 pairs of simple setae; the vertical setae are lanceolate and slightly longer than the

remaining dorsal setae. The tritosternal base is about as long as it is wide. The sternal shield (Figure 76) is slightly wider than long and has a pattern of large punctures down the median part of the shield; three pairs of sternal setae and two pairs of pores are present on the shield. The metasternal setae are situated on small platelets. The epigynial shield is parallel-sided, has a distinct reticulate pattern and bears the epigynial setae on its lateral edges. The anal shield is pear-shaped, has a reticulate pattern, and bears the normal three setae and a cribrum. The peritremal shields are well-developed and extend posteriorly to the level of the middle of coxae IV. The peritremes extend to the anterior margin of coxa I and do not curve dorsally. The interscutal membrane of the ventral opisthosoma bears nine pairs of simple setae. The epistome (Figure 78) has a short slender median process and a broad base with slightly slanting shoulders; the median process is as long as the width of the base. The labrum (Figure 77) is unipartite. The deutosternal ridges have 4-6 teeth per row.

Male. The length of the idiosoma averages 520μ with a range of 460μ - 580μ and the width averages 325μ with a range of 300μ - 350μ . The dorsal shield and its setation is as in the female. The sternitigenital shield bears five pairs of setae and three pores; the anterior-median portion of the shield has the pattern of large punctures seen in the female; the posterior portion of the shield has a reticulate or

striate pattern. The remaining ventral features are as in the female. Leg II is highly modified with heavy spurs on the ventral face of the femur and tarsus; Femur III bears a stout peg-like seta on its ventral face; tarsus IV has an apical spur. The spermatophore transfer organ is a long kite-shaped structure.

Habitat and Distribution. Males and females were found in association with the beetles Diastellopalpus basilobatus, Diastellopalpus couradti, and Diastellopalpus tridens from Central Africa.

Alliphis crassicheles New Species

This species is in the Alliphis obesus group of species, but it differs from most other members of the group in that the tooth bearing deutosternal rows have combs of very fine teeth. In addition, the chelicerae are exceptionally large and stout.

Female. The length of the idiosoma averages 730 μ with a range of 706-754 μ , the width averages 375 μ with a range of 324-400 μ . The greatest width being at the level of coxa II. The dorsal shield is entire and bears 29 pairs of smooth acuminate setae; the setae in the Mg series are about twice as long as the minute setae on the interior of the shield. The vertical setae are long and lanceolate. The dorsal shield is without ornamentation. Ventrally (Figure 91) the tritosternal base is slightly longer than wide; the lacinae are short and lightly pilose. The sternal shield is wider than long and bears the

usual three pairs of simple setae and two pairs of pores. The area of the cuticle between the sternal shield and the tritosternum is more heavily sclerotized than the surrounding cuticle and has a wrinkled appearance. The metasternal plates are small and bear the metasternal setae. The epigynial shield is broad with slightly concave lateral margins and a rounded, convex posterior margin; the epigynial setae are located on the postero-lateral margins of the shield. The anal shield is egg-shaped and bears the usual three setae and a cribrum; the anterior third of the shield is more heavily sclerotized than the remaining two thirds and may bear a series of transverse lines. The ventral interscutal integument has ten pairs of simple setae. The peritremes extend anterad to a level about the middle of coxae I; the peritremal shields are about four times the width of the peritreme. The epistome is short and sub-triangular, similar to that of Pelethiphis vaneedeni (Figure 96). The deutosternal rows (Figure 92) bear combs of minute teeth; the labrum is unipartite with serrate antero-lateral borders.

Habitat and Distribution. A. crassicheles has been found in association with Helutopleurus punctalis and Helictopleurus curuseus from Madagascar.

Alliphis ritcheri New Species

Female. The length of the idiosoma averages 495 μ with a range

of 450μ - 540μ and the width averages 320μ with a range of 280μ - 360μ . This species shows a large degree of size variation between specimens from different host species. Those mites from Canthon simplex average about 80 microns larger than those from Canthon laevis. The mites from C. laevis also tend to be a little less sclerotized than mites from C. simplex. The dorsal shield is entire, is unornamented, and bears thirty pairs of simple setae; the vertical setae are lanceolate. The tritosternal base is as long as it is wide. The sternal shield (Figure 80) is wider than long, is unornamented, and bears the usual three setae and two pairs of pores. The metasternal setae are situated on small platelets. The epigynial shield is expanded slightly posterior to coxa IV and is unornamented; the epigynial setae are located off the shield. The anal shield is subtriangular to almost oval in shape and bears the usual three setae and cribrum. The peritremes extend almost to the anterior margin of coxa I. The interscutal portion of the ventral opisthosoma bears nine pairs of simple setae. The median process of the epistome (Figure 81) is shorter than twice the width of the base; the shoulders are rounded. The labrum is unipartite. The deutosternal ridges (Figure 79) have two teeth per row.

Habitat and Distribution. Females only found in association with Canthon simplex from Jackson Co., Oregon, U. S. A. and Canthon laevis, Cochise Co., Ariz. U. S. A.

Type. The holotype female will be deposited in the U. S. National Museum, Washington, D. C.; paratypes will be placed in the U. S. N. M. and the collection at Oregon State University, Corvallis, Oregon.

Alliphis mellotti New Species

Female. The length of the idiosoma averages 620μ with a range of 600μ - 650μ and the width averages 420μ with a range of 410μ - 430μ . The dorsal shield is entire, has a faint reticulate pattern and bears thirty pairs of simple setae. The vertical setae (Figure 83) are lanceolate and longer than the remaining dorsal setae. The tri-tosternal base is distinct and longer than wide; the laciniae are short and pilose. The sternal shield (Figure 82) is wider than long, unornamented, and bears three pairs of relatively long setae and two pairs of pores. The metasternal setae are subequal in length to the sternals and are placed on small platelets. The epigynial shield is expanded posterior to coxa IV; is unornamented and has the epigynial setae on its lateral margin. The anal shield is pear-shaped and bears the usual three pairs of setae and a cribrum. The interscutal membrane of the ventral opisthosoma bears nine pairs of simple setae. The peritremes extend to a level just past coxa I; the peritremal shields are narrow and are produced only slightly beyond the stigma. The epistome (Figure 85) has a thick, pilose median process and a

distinct base with slightly slanting shoulders. The median process is shorter than twice the width of the base. Labrum (Figure 84) unipartite and with a serrated lateral edges. The deutosternal rows bear three-six teeth per row.

Male. The length of the idiosoma is 580 μ and the width is 320 μ . The dorsal shield is, except for size, identical to that of the female. The sternitigenital shield bears five pairs of simple setae and three pairs of pores. The posterior margin is convex. The peritremal shields are greatly reduced and are present only as a thin line of sclerotization on the outer edge of the posterior half of the peritremes. The remaining features of the ventral idiosoma are as in the female. The femur of leg II bears on its ventral aspect a short stout spine. The spermatophore transfer organs on the only male specimen were broken off and thus unavailable for description.

Habitat and Distribution. Males, females and deutonymphs were taken from the beetles Catharsius eteocles, Catharsius pandion, and Catharsius sesastris from Central Africa.

Alliphis obesus New Species

Female. The length of the idiosoma averages 690 μ with a range of 650 μ - 720 μ ; the width averages 526 μ with a range of 510 μ - 550 μ . The dorsal shield is narrowed posteriorly exposing a narrow strip of unsclerotized integument. The dorsal shield (Figure 89) has 29 pairs

of smooth simple setae; the vertical setae being long and lanceolate. Ornamentation of shield in the form of a joint reticulate pattern. The tritosternal bas is longer than wide; the laciniae are long and lightly pilose. The sternal shield (Figure 86) is wider than long, unornamented, and bears three pairs of smooth falciform setae and two pairs of pores. The first pair of sternal setae are situated on a more heavily sclerotized transverse band along the anterior margin of the shield. The metasternal setae are placed on small irregular metasternal plates. The epigynial shield is broad and rectangular; the epigynial setae are located off the shield. The anal shield is pear-shaped and bears the usual three setae and a cribrum. The ventral interscutal integument has seven pairs of simple setae. The peritremal shields are twice the width of the peritremes and have an irregular posterior margin; the peritremes extend to a level just past coxa I. The median process of the epistome (Figure 88) is shorter than twice the width of the base; the shoulders slant slightly posteriorly. The deutosternal ridges (Figure 90) have approximately ten minute teeth per row; the labrum is unipartite.

Habitat and Distribution. This species has been found in association with Catharsius alpheus, Catharsius eteoeles, and Catharsius melancholius from Kapanga, Congo and Catharsius vitulus from Lac Moero, Congo.

Species Formerly Included in the Genus Alliphisalpinus

Alliphis alpinus Schweizer 1961, Denks. schweiz. naturf. Ges. 84:142.

Schweizer erected this species solely on the basis of a 100 μ difference in the length of his specimen and one of Alliphis halleri described by Berlese (1892). The measurements given by Schweizer for A. alpinus fall within the size range of A. halleri, so that this character is not diagnostic. Consequently A. alpinus must be considered synonymous with A. halleri.

gurei

Alliphis gurei Costa, 1963, J. Linn. Soc. (Zool.)45(303:39.

The dorsal shield and chaetotaxy and the form of the tectum of this species indicates that it is a typical member of the genus

Pelethiphis.halberti

Alliphis halberti Ryke and Meyer, 1957, Ann. Mag. Nat. Hist. 12(10):
605.

This species was based on a deutonymph found on the same beetle with a female of Alliphis evansi. A comparison of known

deutonymphs of A. evansi and A. halberti showed them to be conspecific. For these reasons A. halberti is considered here to be a synonym of A. evansi.

oviforme

Ameroseius oviforme Schweizer, 1949, Res. Rech. scient. Parc.

National Suisse, N. F. 2:44.

Alliphis oviforme, Schweizer, 1961, Denks. schweiz. naturf. Ges.

84:143.

According to Schweizer's figures accompanying the description, this species has a peritremal shield which hooks around coxa IV.

This species probably belongs in the family Ascidae.

Genus Pelethiphis Berlese

Copriphs (Pelethiphis) Berlese, 1911, Redia 7:185, Type:

Copriphs (Pelethiphis) insignis Berlese, 1911.

Pelethiphis, Ryke and Meyer, 1957, Ann. Mag. nat. Hist. 12(10):

606-616; Karg, 1963, Zool. Anz. 170(7/8):278; Karg, 1965,

Mitt. Zool. Mus. Berlin 41(2):263.

The name Pelethiphis was originally proposed as a subgenus of the genus Copriphs (Berlese, 1911). No diagnosis was given at that time and Copriphs (Pelethiphis) insignis, which was designated

as the type species, received only a very short and general description. This has caused considerable confusion concerning the diagnosis of the genus. No attempt was made to adequately define Pelethiphis until Ryke and Meyer (1957) reviewed the Eviphidinae associated with South African beetles. Their diagnosis was as follows: "Vertical setae usually not short and spine-like; some dorsal setae long, others minute; metasternal setae on integument or on small metasternal plates; region between anterior margin of sternal shield and base of tritosternum usually sclerotized or modified into one or two large praeendopodal plates; palp tarsus provided with a slender sickle-shaped seta." The close association between Alliphis and Pelethiphis has been mentioned previously as have the means used by various authors to separate the two. The diagnosis given here is very similar to that given by Ryke and Meyer, but it is based on the comparative morphology of many more species.

Diagnosis

The vertical setae are usually long and lanceolate but are always shorter than two or more pairs of long dorsal shield setae. Five or more pairs of setae placed in the marginal part of the dorsal shield are longer than the distance between their insertions (except in P. mozambiquensis). The tritosternal base is longer than wide. The peritremes extend to coxa I but not past it. The labrum is

usually unipartite. The epistome is without a distinct base or if a base is present it has rounded or slanting shoulders.

General Description

Female

The length of the idiosoma is from 400 μ to 975 μ ; the width is 390 μ to 650 μ . The dorsal shield is usually without ornamentation and bears 29-33 pairs of setae. The relative lengths of these setae varies interspecifically. Any reference to "long" setae made in this discussion indicates that these setae are much longer than the distance between their insertions. The verticals are usually long and lanceolate but there are always at least two pairs of setae longer than they are; setae along the postero-lateral margins of the shield are usually the longest and the median setae usually the shortest. The tritosternal base is usually longer than wide. The area between the tritosternum and the sternal shield is commonly thickened and more heavily sclerotized than the rest of the interscutal cuticle. The sternal shield is as wide or wider than long, is usually unornamented, and bears three pairs of simple setae and two pairs of pores. The pores in most species are the lyriform type, however the sternal pores of P. insignis (Lombardini) and P. garretis n. sp. are small and circular. The metasternal setae are situated on the soft

integument or on small free metasternal plates. The genital shield is usually expanded slightly posterior to coxae IV and bears the one pair of genital setae on its lateral margins. The anal shield is quite variable in shape but always bears three pairs of simple setae and a cribrum. The peritremal shields are also quite variable in shape; the peritremes extend to the middle of coxae I. The interscutal portion of the ventral opisthosoma usually bears nine or ten pairs of setae, however in P. insignis Berlese, P. garretis n. sp., and P. pectinatus Ryke there are more than 20 pairs of setae in this region. The epistome has a lanciform median process that may be longer (P. insignis Berlese) or shorter (P. vaneedeni Ryke and Meyer) than the width of the base. A distinct epistomal base may be present or absent; when it is present the shoulders are rounded or steeply slanting. The labrum is a long, unipartite structure that may have a pair of short barbs near the tip. The deutosternal tooth-bearing ridges have more than ten denticles per row. The chelicerae are identical to those in Alliphis and Scarabaspis. The antero-lateral setae of the genu and femur are usually spine-like, but may be chisel-shaped, as they are in the Alliphis species.

All of the species of Pelethiphis have been found in association with dung beetles.

Key to Species of the Genus Pelethiphis

1. Interscutal portion of ventral opisthosoma with ten or fewer setae 2
 Interscutal portion of ventral opisthosoma with 20 or more setae 9
2. Peritremal shields approximately the same width as the peritremes; surface of shields without reticulations . . . 3
 Peritremal shields two or three times as broad as the width of the peritremes; surface of shields with reticulations. 4
3. Vertical setae (D1) short and spinose; all other dorsal setae (except D8 and D9) long. Anal shield very large; its widest point at a level posterior to anal opening (Figure 95) Pelethiphis vaneedeni Ryke and Meyer
 Vertical setae (D1) long and lanceolate; all other dorsal setae (except L1 and Mgl) minute (Figure 97). Anal shield pear-shaped; its widest point at a level with the anal opening Pelethiphis mozambiquensis Ryke
4. Distal hypostomal seta many times thicker than remaining hypostomal setae. Tectal base broader than the length of the median process 5
 Distal hypostomal seta sub-equal in thickness to other

- hypostomal setae. Median process of epistome longer than width of base 6
5. Posterior margin of sternal shield produced into a pair of distinct mammiform lobes (Figure 101).
Twenty pairs of marginally placed dorsal setae long; remaining setae minute (Figure 102)
. *Pelethiphis lobosternis* n. sp.
- Posterior margin of sternal shield not produced into a pair of lobes as described above. All of dorsal setae (except s1, D8 and D9) long (Figure 104)
. *Pelethiphis eiseleni* Ryke and Meyer
6. Vertical setae (D1) stout and lanceolate; dorsal shield with more than ten pairs of long setae 7
Vertical setae (D1) minute; dorsal shield with five pairs of long setae (Figure 107)
. *Pelethiphis berlesei* Ryke and Meyer
7. Femur II of male with a stout conical spine (Figure 122) 8
Femur II of male without a stout conical spine. Anal shield large, subtrapezoidal; cribrum wider than half the width of the anal shield (Figure 110)
. *Pelethiphis gurei* (Costa)
8. Dorsal shield with 18 pairs of long setae; seta D9 minute (Figure 111) *Pelethiphis geyeri* Ryke and Meyer

- Dorsal shield with 14 pairs of long setae; seta D9
long (Figure 124) Pelethiphis ciliatus Berlese
9. Peritremal shields narrower than the width of the
peritremes; peritremes extending to posterior margin
of coxae I. Dorsal setae smooth 10
- Peritremal shields more than twice as broad as the
width of the peritremes; peritremes extending to the
middle of coxae I. Dorsal setae pectinate (Figure 113)
. Pelethiphis pectinatus Ryke
10. Dorsal shield with five pairs of long postero-lateral
setae (Figure 115). Pre-sternal plate well developed.
Anal shield oval (Figure 114)
. Pelethiphis insignis Berlese
- Dorsal shield with nine pairs of long marginal setae
(Figure 117). Without presternal shield. Anal shield
long and subtriangular (Figure 117). Pelethiphis garretis n. sp.

Descriptions of the Species Included in the Genus Pelethiphis

Pelethiphis vaneedeni Ryke and Meyer

Pelethiphis vaneedeni Ryke and Meyer, 1957, Ann. Mag. nat. Hist.

12(10):611.

This species is unique among the other species of the genus

because of the very broad sternitigenital and anal shields. Another distinguishing feature is that the base of the tectum is more than twice as wide as the median process is long. Pelethiphis vaneedeni is known only from the male stage.

Male. The length of the idiosoma is 520 μ and the width is 352 μ . The dorsal shield (Figure 94) bears 29 pairs of setae, mostly long and simple; the verticals (D1) are short and spine-like; setae Mg1, D8 and D9 are minute. The surface of the shield is unornamented. The tritosternal base is about as long as it is wide; the lacinae are long and pilose. The sternitigenital shield is very broad and extends posteriorly just behind coxae IV. It bears the usual five pairs of simple setae and three pairs of pores. The anal shield is also very broad and, unlike the other species in the genus, is widest at a point posterior to the anal opening (Figure 95). The peritremal shield is narrow and is only slightly produced posterior to the stigma. The peritremes extend to the middle of coxae I. The interscutal portion of the ventral opisthosoma bears nine pairs of simple setae. The epistome (Figure 96) has a short, slender median process and a large triangular base which is more than twice as broad as the median process is long. The movable digit of the chelicera has a short spatulate spermatophore transfer process. Legs IV are heavily armed with stout spurs on the trochanters, femur and tarsus.

Habitat and Distribution. This species has been found on

Heliocopris hamadryas, and Heliocopris gigas from Potchefstroom, South Africa (Ryke and Meyer, 1957). It has also been found on Heliocopris antenor from Katanga, Congo.

Type. The types of P. vaneedeni are deposited in the collection of the Dept. of Zoology, Potchefstroom University, Potchefstroom, South Africa.

Pelethiphis mozambiquensis Ryke

Pelethiphis mozambiquensis Ryke, 1959, Mem. Mus. zool. Univ.

Coimbra 258:7.

Female. The length of the idiosoma averages 640μ with a range of $615\mu - 663\mu$; the width averages 445μ with a range of $430\mu - 464\mu$. The dorsal shield (Figure 97) is not entire and bears 29 pairs of simple setae, the majority being minute. The vertical setae (j1) and setae s1 are strongly developed, spinous and subequal; setae z1 are also strongly developed but are about 1.5 times as long as j1 and s1. The intersutal portion of the dorsum bears about 12 pairs of minute setae. The tritosternum has a base that is slightly longer than wide and two long slender laciniae. The sternal shield is wider than long, is unornamented, and bears three pairs of short simple setae. The region between the anterior margin of the sternal shield and the tritosternum is lightly sclerotized. The metasternal setae are situated on small platelets. The genital shield is approximately as broad as

it is long and bears the genital setae on its lateral margins. The anal shield is pear-shaped and bears the usual three setae and a cribrum. The peritremal shields are weakly developed and barely extend caudad of the stigmata; the peritremes extend to the middle of coxae I. The interscutal portion of the ventral opisthosoma bears nine pairs of ventral setae. Leg II is relatively thin and weak looking, however the coxa bears a prominent blade-like seta on its postero-ventral surface which appears to articulate with a hooked spinous seta on the trochanter (Figure 98). The epistome (Figure 99) has a long slender median process and a rounded base with fimbriated edges. The labrum is of the simple unipartite type.

Habitat and Distribution. This species has been found on Catharsius tricornutus from Tinonganine (Maputo), Mozambique (Ryke, 1959) and on Catharsius cassius from the Congo.

Types. The holotype female of P. mozambiquensis is deposited in the collection of the "Museu Dr. Alvaro de Castro," Lourenco Marques.

Pelethiphis lobosternis New Species

This species appears to be most closely related to Pelethiphis eiseleni but may be distinguished from that species by the form of the sternal shield and the chaetotaxy of the sternal and the dorsal shields.

Female. The length of the female idiosoma averages 705 μ with

a range of 655 μ to 774 μ ; the width averages 454 μ with a range of 427 μ to 490 μ . The dorsal shield (Figure 102) is entire and bears 32 pairs of setae; the verticals (D1) are lanceolate; 22 pairs are long and whip-like; the remaining nine pairs are minute. The surface of the shield is without ornamentation. The tritosternum has a base that is longer than wide and a pair of lightly pilose laciniae. The sternal shield (Figure 101) is wider than long and bears the usual three pairs of simple setae and two pairs of pores. The posterior third of the shield is produced into a pair of large mammiform lobes. The surface of the shield appears to be slightly rugose. The simple metasternal setae are located on small, free platelets. The genital shield is flask shaped, is unornamented, and bears the genital setae on its lateral margins. The anal shield is sub-trapezoidal, is reticulated in its anterior half, and bears three setae and a cribrum. The peritremal shields are broad and bear a series of longitudinal striations; the peritremes extend to the anterior margins of coxae I. The interscutal portion of the ventral opisthosoma bears nine pairs of simple setae. The epistome (Figure 100) is like that of Pelethiphis eiseleni Ryke and Meyer. The distal hypostomal setae are enlarged as they are in P. eiseleni. The tooth bearing ridges in the deutosternal series bear four to eight denticles. The labrum is of the unipartite type but has a pair of short barbs near the tip.

Habitat and Distribution. This species has been found on the

following Central African Scarabaeidae: Diastellopalpus infernalis,
Diastellopalpus johnstoni, Diastellopalpus lamellicollis, and
Diastellopalpus quinquedens.

Pelethiphis eiseleni Ryke and Meyer

Pelethiphis eiseleni Ryke and Meyer, 1957, Ann. Mag. nat. Hist.

12(10):613.

Female. The length of the idiosoma averages 618μ with a range of 505μ - 702μ ; the width averages 412μ with a range of 340μ - 465μ . The dorsal shield resembles that of P. vaneedeni (Figure 94), and it bears 30 pairs of setae, the majority being very long; verticals (D1) are lanceolate and about half the length of L1; setae Mg1, D8 and D9 are minute. Three pairs of minute setae are located on the unsclerotized cuticle postero-lateral to the dorsal shield. The tritosternum has an elongate base and a pair of long slender laciniae. The sternal shield is about as wide as it is long (Figure 104) and bears the usual three pairs of setae and two pairs of pores. The metasternal setae are situated on small platelets which may be fused with the postero-lateral corners of the sternal shield. The genital shield is expanded slightly posterior to coxae IV and bears the genital setae on its lateral margins. The anal shield is roughly pear-shaped and has a dense reticulated pattern on its surface; the usual three anal setae and a cribrum are present. The peritremal shield is broad

and reticulated and extends caudad to the middle of coxa IV; the peritreme extends anteriorly to coxa I. The interscutal portion of the ventral opisthosoma bears nine pairs of simple setae. The epistome (Figure 103) is very similar to that of P. vaneedeni. The distal hypostomal seta is very strongly developed; the internal proximal hypostomal seta is of about the same length but much more slender (Figure 105). The femur and genu of the palp each bear a chisel-shaped seta.

Male. The length of the idiosoma is 540 μ ; the width is 350 μ . The dorsal shield and chaetotaxy is as in the female. The shape and chaetotaxy of the sternitigenital shield is typical for the genus. The posterior part of the shield is flanked by a pair of small platelets. The movable digit of the chelicera is provided with a stout spatulate spermatophoral process. Spurs are present on the femur, genu, tibia and tarsus of leg II and on the femur and genu of leg IV. The remaining ventral and gnathosomal characters are as in the female.

Habitat and Distribution. This species has been found on Heliocopris gigas and Heliocopris hamadryas from Potchefstroom, South Africa (Ryke and Meyer, 1957). It has also been found on the following Central African scarabaeids: Diastellopalpus infernalis, Diastellopalpus lamellicollis, Diastellopalpus basilobatus, Diastellopalpus monapoides, Diastellopalpus guinquedens, Diastellopalpus tridens, Heliocopris antenor, Heliocopris colossus,

Heliocopris hamadryas, Heliocopris haroldi, Heliocopris minos,
Heliocopris samsoni, Onitis fabricii, Onitis lycophron, Onitis
vanderkelleni, and Onthophagus parumnotatus.

Types. The holotype female is deposited in the collection of the Dept. of Zoology, Potchefstroom University, Potchefstroom, South Africa.

Pelethiphis berlesei Ryke and Meyer

Pelethiphis berlesei Ryke and Meyer, 1957, Ann. Mag. nat. Hist.
12(10):609.

Specimens of P. berlesei were not available for study, therefore the following is a summary of the original description.

Female. The length of the idiosoma is 770 μ and the width is 580 μ . The dorsal shield (Figure 107) is entire, and it bears 29 pairs of setae. The verticals (D1) are very short and simple as are most of the remaining dorsal setae, however setae Mg6 - Mg10 are extremely long (about 500 μ). The sternal shield is longer than wide, is unornamented, and bears the usual three pairs of simple setae and two pairs of lyriform pores. The tritosternal base is much longer than wide. The metasternal setae are short and simple and are situated on small, free platelets. The genital shield is flask-shaped, has a reticulated pattern on its surface and bears the genital setae on

its lateral margin. The anal shield is large and triangular. It has a reticulated pattern and bears the usual three setae and a cribrum. The peritremal shield is large and well-developed and extends caudad to the posterior margin of coxa IV. The interscutal portion of the ventral opisthosoma bears nine pairs of simple setae. The epistome (Figure 106) has a long slender median process and a base with a single pointed projection on each side. Setae all of the palp genu and tibia are stout and spine-like but not chisel-shaped.

Habitat and Distribution. Female specimens of P. berlesei were collected from Circellum bacchus, Transvaal, and Grahamstown South Africa (Ryke and Meyer, 1957).

Types. The types of P. berlesei are deposited in the British Museum (Nat. Hist.) London.

Pelethiphis gurei (Costa) New Combination

Alliphis gurei Costa, 1963, J. Linn. Soc. (Zool) 45(303):39.

Costa (1963) placed this species in the genus Alliphis even though it showed greater morphological similarity with the genus Pelethiphis because he restricts the name Pelethiphis "for the less sclerotized mites occurring beneath the elytra of their hosts."

Costa's generic concept is not valid in the presence of current comparative morphological data, and Alliphis gurei is to be considered

a typical member of the genus Pelethiphis. Only males and deutonymphs of this species are known.

Male. The dorsal shield (Figure 109) is entire and is 575-670 μ long and 365-435 μ wide. Its surface is finely reticulated and bears 30 pairs of acuminate setae. Setae L1, L2, Mg2-10 are all long, acuminate, and subequal; the verticals (D1) and setae s4 are about half the length of the setae mentioned above; the remaining 17 pairs of dorsal setae are minute. The tritosternum has a very short base and a pair of lightly pilose laciniae. The sternitigenital shield bears five pairs of simple setae and three pairs of pores. The anal shield (Figure 110) is very large (135-145 μ long and 135-150 μ wide) and bears the usual three setae and a cribrum; the post anal seta is about twice the length of the adanals. The peritremal shields are well-developed; the peritremes extend cephalad to the anterior margin of coxae I. The interscutal portion of the ventral opisthosoma bears eight pairs of simple setae. The epistome (Figure 108) has a long, lightly pilose median process and a triangular base with serrated margins. The spermatophore transfer organ is short and terminates in a disc-like structure. The corniculi are rather long and hypoaspidine-like.

Deutonymph. The dorsal shield is entire is 490 μ - 505 μ long and 320 μ - 340 μ wide, and bears 30 pairs of setae. Setae j1 are lancet-shaped; s1 are the longest of the dorsal setae. The marginal

setae except D9 are longer and stouter than the remaining dorsal setae but not as long as the same setae in the male. The holosternal shield is not fused laterally with the endopodals and bears four pairs of simple setae and three pairs of pores. The anal shield and setae are similar to those of the male. The peritremal shields are very narrow and do not extend posterior to the stigma. The chelicerae are as in the male except for the absence of the spumatophore transfer organ. The remaining ventra idiosomal and gnathosomal characteristics are as in the male.

Habitat and Distribution. Males and deutonymphs of Pelethiphis gurei were collected from 43 specimens of Copris hispanus (L.), Mishmas Haemek, Parod and Kissufim, Israel (Costa 1963).

Types. The holotype male is deposited in the collection of M. Costa, Kibbutz Mishma Haemek, Israel; paratypes are deposited in the British Museum (Nat. Hist.), London.

Pelethiphis geyeri Ryke and Meyer

Pelethiphis geyeri Ryke and Meyer, 1957, Ann. Mag. nat. Hist.
12(10):611.

This species is known only from the male and the deutonymph. Specimens of P. geyeri were not available for study, therefore the following is a summary of the original description.

Male. The length of the idiosoma is 572 μ and the width is 385 μ . The dorsal shield (Figure 111) is entire and bears 29 pairs of setae; setae Mg2 - Mg10 are very long as are setae L1-L8, and D2. The verticals (D1) are lanceolate; the remaining setae in the D and M series are minute. The tritosternal base is about as long as it is wide. The sternitigenital shield is typical for the genus. The anal shield (Figure 120) is broad and almost diamond shaped. The post anal seta is at least three times as long as the adanals. The peritremal shield is broad and bears a pattern of longitudinal cells on its surface. The interscutal portion of the ventral opisthosoma bears nine pairs of simple setae. The chelicerae are typical for the genus and bear a short-spermatophore transfer process ending in a disc-shaped structure. The epistome (Figure 121) has a long slender median process and a steeply slanting base with fimbriate margins.

Deutonymph. The length of the idiosoma is 495 μ and the width is 330 μ . The dorsal shield and chaetotaxy is as in the male. The holosternal shield bears the usual four pairs of simple setae and three pairs of pores. The anal shield is smaller and more pear-shaped, however the anal setae are as in the male. The peritremal shields are not as broad as in the male and do not extend caudad of the stigma. The gnathosoma (excepting the spermatophore transfer organ) is as in the male.

Habitat and Distribution. Pelethiphis geyeri males and nymphs

have been collected from Copris elphanor Kling., Potchefstroom and Bloemhof, South Africa (Ryke and Meyer 1957).

Types. The types of Pelethiphis geyeri are deposited in the collection of the Dept. of Zoology, Potchefstroom University, Potchefstroom, South Africa.

Pelithiphis pectinatus Ryke

Pelethiphis pectinatus Ryke, 1959, Mem. Mus. Zool. Univ. Coimbra 258:11.

This species is the only one in the Eviphididae with pectinate dorsal setae in the adult stages. Pelethiphis pectinatus is known only from the original description of a male specimen, therefore the following is a summary of that description.

Male. The length of the idiosoma is 545 μ and the width is 390 μ . The dorsal shield (Figure 113) is nearly entire and bears 29 pairs of setae, mostly long and finely pectinate. The verticals (D1) and setae L1 and L2 are relatively short and are without pectinations. The dorsal setae located off the shield are all short and simple. The tritosternal base is much longer than wide; the laciniae are rather short and lightly pilose. The shape and chaetotaxy of the sternitigenital shield is typical for the genus. The entire surface of the shield bears a reticulated pattern. The anal shield is small and

pear-shaped and bears the usual three setae and a cribrum. The peritremal shield is broad and reticulated but is not produced caudad much farther than the stigma; the peritreme reaches anteriorly to the middle of coxa I. The interscutal portion of the ventral opisthosoma bears about twenty pairs of simple setae. The epistome (Figure 112) has a long slender median process and a base with steeply slanting shoulders. The corniculi are long and are curved inwards. The trochanters of legs II-IV are each provided with a spur. Leg II is short and stout; its femur is armed with two strong spines and a spur.

Habitat and Distribution. This species was found on Catharsius tricornutus Deg. from Tinonganine (Maputo), Mozambique (Ryke, 1959).

Type. The holotype male is deposited in the collection of the "Museu Dr. Alvaro de Castro," Lourenco Marques, Mozambique.

Pelethiphis insignis Berlese 1911

Copriphs (*Pelethiphis*) *insignis* Berlese, 1911, Redia 7:185.

Copriphs rufescens Lombardini, 1941, Miss. Biol. Sagan-Omo

Zool. 6:177 New Synonymy.

Pelethiphis rufescens, Ryke and Meyer, 1957, Ann. Mag. nat. Hist. 12(10):606.

This species was well-described and illustrated as *Pelethiphis*

rufescens (Lomb.) 1941 by Ryke and Meyer 1957. Their description and host data matches identically that given by Berlese (1882). I am therefore considering Pelethiphis rufescens (Lombardini, 1941) to be a synonym of Pelethiphis insignis Berlese 1882.

Female. The length of the idiosoma averages 756μ with a range of 703μ - 950μ ; the width averages 533μ with a range of 482μ - 650μ . The dorsal shield (Figure 115) is entire and bears 33 pairs of setae; the verticals (D1) are strong and lanceolate; setae Mg6 - Mg10 are long and stout; the remaining dorsal setae are minute. The tritosternum is thick and with no clear differentiation of base and laciniae. The sternal shield (Figure 114) is wider than long, is unornamented, and bears the usual three pairs of simple setae. The endopodals between coxae I-II and II-III are large and are fused with the sternal shield. A large presternal shield is present between the sternal shield and the tritosternum. The metasternal setae are situated on the unsclerotized integument. The genital shield is broad and short and bears the genital setae on its postero-lateral margins. The genital shield is broad and short and bears the genital setae on its postero-lateral margins. The anal shield is small and round and bears the usual three setae; a cribrum is not present. The peritremal shield is narrow and without ornamentation; the peritreme extends to the posterior margin of coxa I. The median process of the epistome is long, thick, and lightly pilose; the base is broad with a fimbriated

margin (Figure 116). The corniculi are long, blade-like, and curve slightly inward. The labrum is of the simple unipartite type. The legs are without stout spurs or spines.

Habitat and Distribution. This species has been found on Gymnopleurus pilularis from central Italy (Berlese, 1882) and Gymnopleurus unicolor from Port St. John, South Africa (Ryke and Meyer, 1957). It has also been found on the following Central African scarabaeids: Gymnopleurus coerulescens, Gymnopleurus fulgidus, Gymnopleurus jacksoni, Gymnopleurus virens, Garreta niteus coeruleovirens, Garreta niteus janthinus, and Heteronitis castelmani.

Types. The location of the types for this species is the Stazione di Entomologia Agraria, Florence, Italy.

Pelethiphis garretis New Species

This species appears to be most closely related to Pelethiphis insignis Berlese, 1892. It can be readily separated from that species by the length and placement of the dorsal setae and the ornamentation of the dorsal shield.

Female. The length of the idiosoma is about 975 μ and the width is about 580 μ . (All of the specimens were dissected, therefore accurate measurements were not possible.) The dorsal shield (Figure 118) does not cover the entire dorsal surface; its surface

bears a characteristic jigsaw puzzle-like pattern and thirty pairs of setae. All of the setae placed on the margins of the shield (including the verticals) are long and acuminate; the remaining setae are minute. The dorso-lateral interscutal cuticle bears about 50 pairs of stout acuminate setae. The tritosternal base is longer than wide and bears a pair of long lightly pilose laciniae. The sternal shield (Figure 117) is much like that of P. insignis Berlese with the long pointed processes extending between coxae I-II and II-III. The shield is unornamented and bears three pairs of small simple setae and three pairs of small circular pores. The metasternal setae are situated on the integument. The genital shield is expanded slightly posterior to coxae IV and bears the genital setae on its postero-lateral margins; the surface of the shield has a faint pattern similar to that on the dorsal shield. The anal shield is subtriangular and bears the usual three setae and a cribrum; the anal opening and adanal setae are situated in the anterior half of the shield. The peritremal shield is greatly reduced and extends only slightly posterior to the stigma; the peritremes are short, extending to the posterior margin of coxae I. The interscutal portion of the ventral opisthosoma bears about 20 pairs of simple setae. The epistome (Figure 119) is unique among the other species in the genus in that it is a large pyramidal structure with fimbriated margins and a short, pointed median process. The labrum is a simple unipartite structure. The corniculi are long and lanciform; the tooth-bearing

ridges in the deutosternal series bear combs of minute setules.

Habitat and Distribution. This species has been found on the following Central African Scarabaeidae: Garreta azureus, Garreta azureus elenus, Garreta azureus irridimicans, Garreta azureus olivaceus, Garreta azureus viridimicans, Garreta crenulatus, Garreta diffinis, Garreta fabricius, Garreta niteus coeruleovirens.

Pelethiphis ciliatus (Koch)

Iphis ciliatus Koch, 1839, Deutschlands Crustaceen, Myriapoden und Arachniden 27(171):20.

Iphis crinitus Berlese, 1882, Bull. Ent. Ital. 14:343; Berlese, 1882-1892, Acari Myriopoda et Scorpiones hucusque in Italia reperta 28:10.

Copriphis (Pelethiphis) crinitus Berlese, 1911, Redia 7:185.

Pelethiphis ciliatus appears to be most closely related to P. gurei and P. geyeri. It may be distinguished from the former by the possession of a stout spine on the femur of leg II and the latter by the dorsal chaetotaxy. This species is known only from the original description (Koch, 1839) and from Berlese's (1882) description of Iphis crinitus. Specimens were not available for study therefore the following is a summary of these descriptions.

Female. The idiosoma is oval in shape and is about 400 μ long.

The dorsal shield (Figure 124) covers the whole dorsum except for a narrow band around its postero-lateral margin. The margins of the shield bear 14 pairs of long seta, presumably the remaining setae are quite small. The vertical setae are long and lanceolate and are subequal to seta D9. The tritosternal base is longer than wide. The sternal shield is as wide or wider than long and has a slightly concave posterior margin. The epigynial shield is flask-shaped; the anal shield is small and pear-shaped. The peritremes extend cephalad to the middle of coxae I. The epistome (Figure 123) as illustrated by Berlese consists of a simple lanciform projection without a distinct base. The corniculi are relatively long and stout. The chelicerae are typical for the genus.

Male. The male dorsum is as in the female. The only difference between the male and female ventral idiosoma is in the possession of a sternitigenital shield of typical shape by the male. The femur of leg II bears a stout conical spine on its ventral surface (Figure 122). The male chelicera bears a hatchet shaped spermatophore transfer organ on the lateral face of the movable digit.

Habitat and Distribution. This species has been found on Atheucas variolosa from Apulia, Italy (Berlese, 1882) and on Atheucus semipunctatus from Italy.

Types. The location of the type material for P. ciliatus is unknown.

Species Formerly Included in the Genus Pelethiphisbristowi

Copriphis (Pelethiphis) bristowi Finnegan, 1933, Proc. Zool. Soc.

London 2:413.

According to the descriptions and illustrations of this species it is not in the family Eviphididae but is probably in the subfamily Hypoaspidinae, family Laelapidae.

equestris

Copriphis (Pelethiphis) equestris Berlese, 1911 Redia 7:186.

Pelethiphis equestris, Hyatt, 1958, Ent. mon. Mag. 95:22.

This species is a typical member of the genus Alliphis as it is defined in this paper.

fragilis

Copriphis (Pelethiphis) fragilis Vitzthum, 1926, Treubia Batavia 8:80.

This species has 33 pairs of long fine setae on the dorsum, 14 pairs located on a reduced dorsal shield. The shape and size of all of the ventral plates as well as the length of the ventral setae is not characteristic of the genus Pelethiphis nor of the family Eviphididae. This species is apparently in the Laelapidae, near the genus

Coleolaelaps Berlese.

siculus

Eviphis siculus Oudemans, 1905, Ent. Ber. 2(25):7.

Eviphis siculus, Oudemans, 1915, Arch. Natg. 81A(H.1):150.

Pelethiphis siculus, Gotz and Hirschmann, 1957, Mikrokosmos 46:115.

Alliphis siculus, Karg, 1963, Zool. Anz. 168:273.

This species is a typical member of the genus Alliphis and was placed there by Karg (1963).

Species Incertae sedis

Copriphis (Pelethiphis) analis Berlese, 1921, Redia 14:172.

The original description of this species was very general and was presented without illustrations. C. (P.) analis is probably an eviphidid, however Berlese's description fits species that could occur in either the genus Eviphis or Pelethiphis. The type for this species is located in the Stazione di Entomologia Agraria, Florence, Italy but was unavailable for study.

Copriphis (Pelethiphis) degenerans Berlese, 1910, Redia 6:262.

This species was found on the legs of Catharsius sabaei from "India Orientale." The original description was very short and general

and was without illustrations, making it impossible to determine the validity or the taxonomic placement of this species. The type is in the collection of the Stazione di Entomologia Agraria, Florence, Italy.

Copriphis (Pelethiphis) dermanyssoides Berlese, 1911, Redia 7:186.

Berlese's description of this species was very general and without illustrations. He indicates that the dorsum is clothed with short, fine setae; this means that this species is probably not in the genus Pelethiphis. It was found beneath the elytra of Atheucus cuvieiri from America. The type is in the collection of the Stazione di Entomologia Agraria, Florence, Italy but was unavailable for study.

Copriphis (Pelethiphis) puer Berlese, 1910, Redia 6:262.

Berlese's description of Pelethiphis puer is very similar to that given by Costa (1963) for Alliphis gurei; the host beetle in both cases was Copris hispanus. It is possible that the two species are synonymous; however there is a size difference; 450 x 365 μ for P. puer and 575 μ - 670 μ x 365 μ - 435 μ for Alliphis gurei. I feel that size alone is not a valid criterion for delimiting species but in this case I am hesitant to synonymize the two until the type of P. puer can be studied.

Copriphis (Pelethiphis) undulatus Berlese, 1921, Redia 14:172.

Berlese's description of this species indicates that it is

definitely in the genus *Pelethiphis*, however the description is too general to determine the position of *C. (P.) undulatus* within the genus. It was found on *Atheucus semipunctatus* from Germany. The type is in the collection of the Stazione di Entomologia Agraria, Florence, Italy.

PHYLOGENY OF THE FAMILY EVIPHIDIDAE

The construction of a phylogenetic scheme properly supposes a knowledge of ancestral forms, but in the Eviphididae this is not possible due to the complete lack of a fossil record. The following speculations concerning the relationships of the groups and the primitive or advanced nature of characters are therefore subjective.

The species were first grouped together into genera based upon the largest number of characters possible. The closeness of the relationship between genera was estimated by noting the genera sharing the largest number of characters with other genera.

Inferences as to the degree of primitiveness or specialization of characters found useful in making phylogenetic assumptions were reached by comparison of the Eviphididae with laelapoid families considered to be closely related, and by utilizing the assumption that characters occurring most frequently within a group are more likely to be the result of descent from a common ancestor. Table III gives a list of characters using these methods.

The eviphidids appear to have evolved from mites much like the recent Hypoaspidae and probably from mites similar to Hypoaspis and Coleolaelaps as indicated by the large number of characteristics held in common by the two groups.

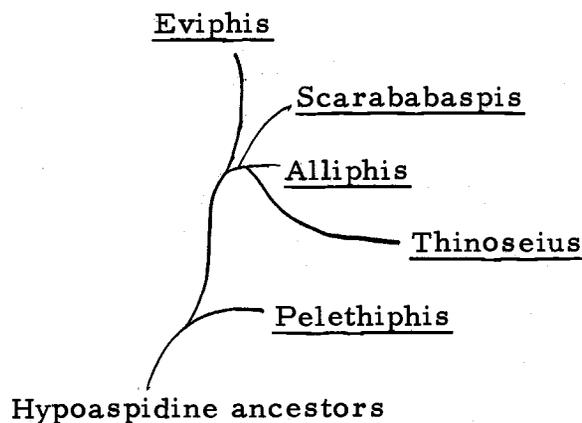
Table III indicates that the mites similar to Pelethiphis

Table 3. List of Primitive and Derived Characters in the Eviphididae

Primitive	Derived
1. Corniculi long and blade-like	1. Corniculi short and thorn-like
2. Epistome without distinct "shoulders"	2. Epistome with distinct, usually angular "shoulders"
3. Labrum unipartite	3. Labrum tripartite
4. Tritosternum with a long thick base	4. Tritosternal base wider than long, not thick
5. All setae on palp tarsus simple and acuminate	5. Palp tarsus with one or two rod-like, sickle-shaped setae
6. Ventral idiosomal setae simple and acuminate	6. Some of ventral setae modified into "spurs," spines, or rounded oval protuberances
7. Dorsal idiosomal setae much longer than the distances between their insertions	7. Dorsal idiosomal setae short
8. Tendency toward phoretic relationships involving males, females and nymphs	8. Phoresy not present or phoresy involving only the female
9. Chelicerae stout and strong	9. Chelicerae long and tapering generally not strong
10. Large idiosoma size, usually oval in shape	10. Small to medium idiosoma size usually egg-shaped

insignis are the more primitive of the eviphidids since this group contains the largest number of primitive characteristics. They are very similar morphologically to members of the genera Hypoaspis and Coleolaelaps. The possession of very similar types of phoretic behavior in both hypoaspidines and eviphidids also seems to indicate a close kinship.

Fully recognizing the hazards of constructing phylogenetic trees based on recent evidence, I am still inclined to construct one to graphically illustrate the relationships between the genera of the Eviphididae.



The closeness of the relationship between Pelethiphis and Alliphis has been discussed previously. The two maintain their distinctness only by the use of combinations of characteristics, a fact that tends to indicate that the two genera are the result of an explosive type of evolution in which many of the same "adaptive experiments" were tried. If we consider that genera are groups of species that somehow are ecologically isolated from other related

species, then it is relatively easy to see how a situation as it now exists between Alliphis and Pelethiphis could develop. Krantz (1965) feels that the host and habitat specificity of phoretic mites could well be the mechanism for this ecological isolation.

The Eviphis ancestors gave rise to Alliphis stock which diverged into Scarabaspis, Alliphis, and Thinoseius. Some authors (Ryke and Meyer, 1957; Evans 1957b) have indicated that a close relationship exists between Scarabaspis and Eviphis because of the possession of paired rod-like, sickle-shaped setae on the palp tarsus. However, on the basis of the comparative morphology (especially of the gnathosoma) of the genera, Scarabaspis appears to be more closely related to Alliphis.

Thinoseius shows many characters in common with Alliphis, but has very distinctive epistomal and dorsal idiosomal characteristics. The associations of species in Thinoseius with Crustacea also is a very unique characteristic and probably is the means of ecological isolation that led to the development of the distinct morphological characteristics.

Within the genus Eviphis, the species E. uropodinus, E. convergens, and E. ostrinus are biological oddities. All of the other species are known from dung and dung beetles; however these three species are found in rotting wood or leaf litter and have never been found associated with beetles. They appear to be highly specialized

forms which through adaptation to a type of habitat more permanent and widespread than dung or rotting flesh have not developed phoretic behavior.

SUMMARY

A complete taxonomic review of the Family Eviphididae (Acarina: Mesostigmata) is presented for the first time. An attempt is made to bring together the scattered literature pertaining to this family and to define its limits on the basis of morphological characters. Thirty-seven species of five genera are included as valid and twelve new species are described. An additional twelve species and four genera which have been associated with the family Eviphididae in the past are listed, and reasons for their exclusion are given.

Keys are furnished for the five valid genera and their species. Each genus is treated as to diagnostic characters, general external morphology, descriptions of the species included therein, species no longer considered valid, and species of uncertain status.

Speculations as to the generic relationships and phylogeny of the family are also given.

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APPENDIX

Figure 1. Chelicera of female Eviphis mullani

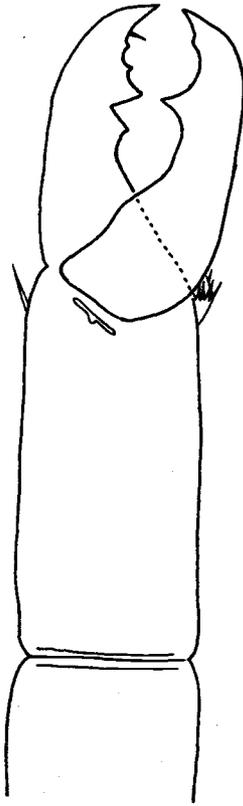
Figure 2. Chelicera of female Alliphis halleri

Figure 3. Chelicera of male Alliphis punctisternis

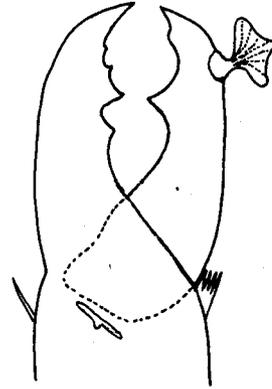
Figure 4. Ventral view of the gnathosoma of Alliphis mellotti



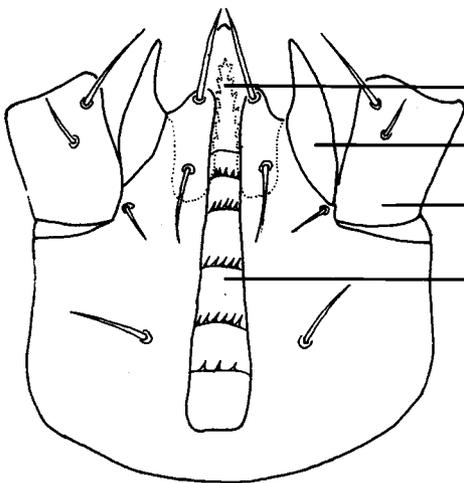
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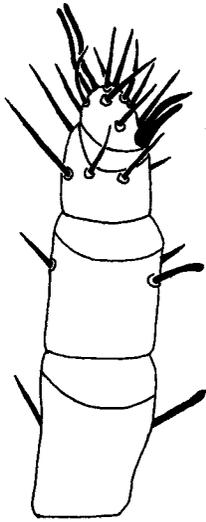
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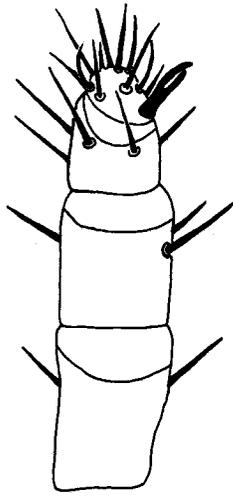
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- **Labrum**
- **Corniculus**
- **Palp Trochanter**
- **Deutosternal Groove**

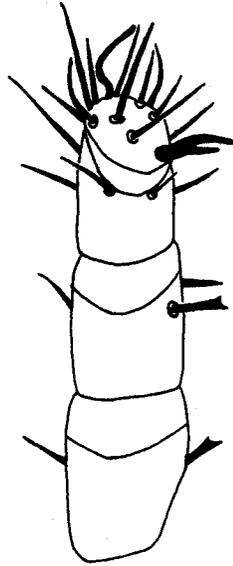
5. Ventral view of the left palp of Eviphis ostrinus
6. Ventral view of the left palp of Pelethiphis
7. Ventral view of the left palp of Alliphis
8. Ventral view of the left palp of Thinoseius brevisternalis
9. Epistome of Eviphis ostrinus
10. Epistome of Scarabaspis inexpectatus
11. Epistome of Thinoseius brevisternalis
12. Epistome of Pelethiphis gurei



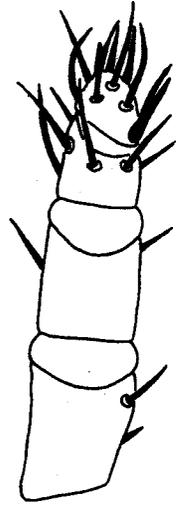
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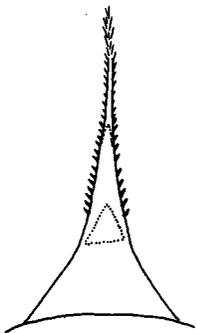
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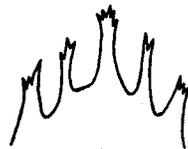
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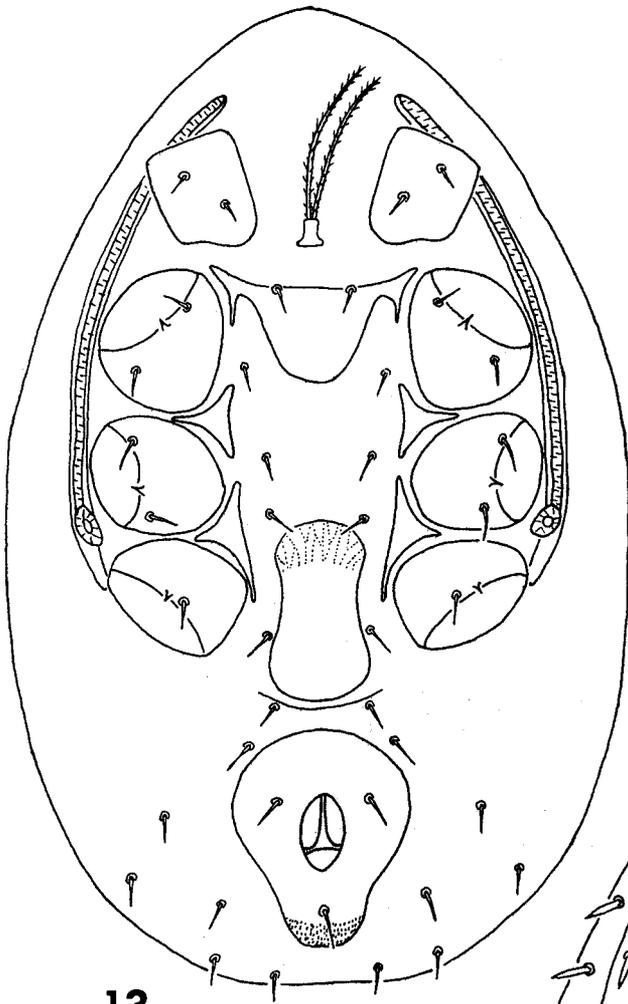


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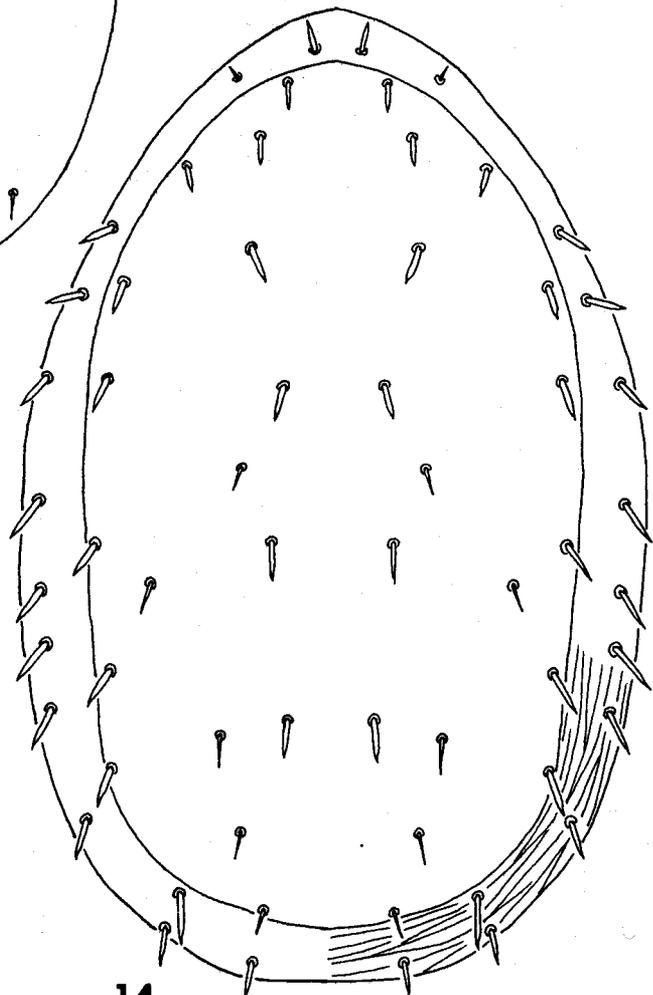
13. Ventral View of idiosoma of female Thinoseius brevisternalis
14. Dorsal view of idiosoma of Thinoseius brevisternalis
15. Epistome of Thinoseius brevisternalis



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Figure 16. Ventral view of the idiosoma of female Thinoseius spinosus

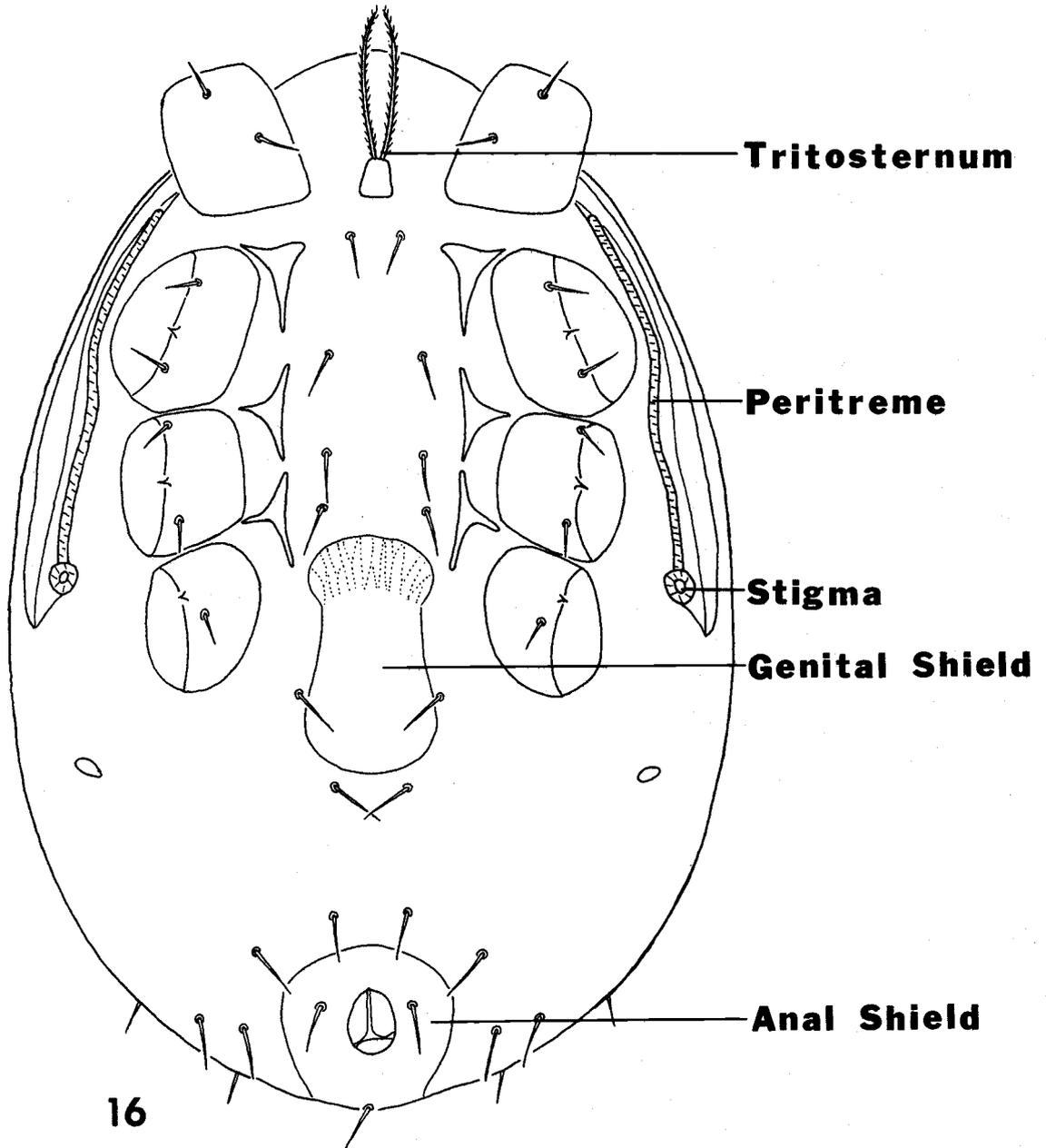


Figure 17. Ventral view of the idiosoma of female Eviphis ostrinus

Figure 18. Ventral view of the idiosoma of female Eviphis uropodinus

Figure 19. Epistome of Eviphis ostrinus

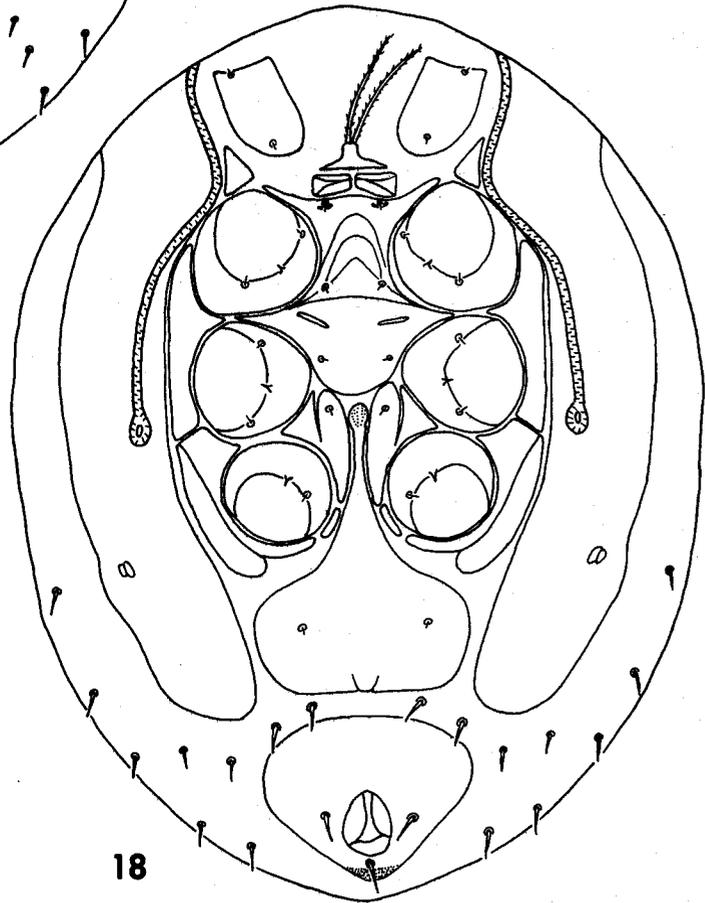
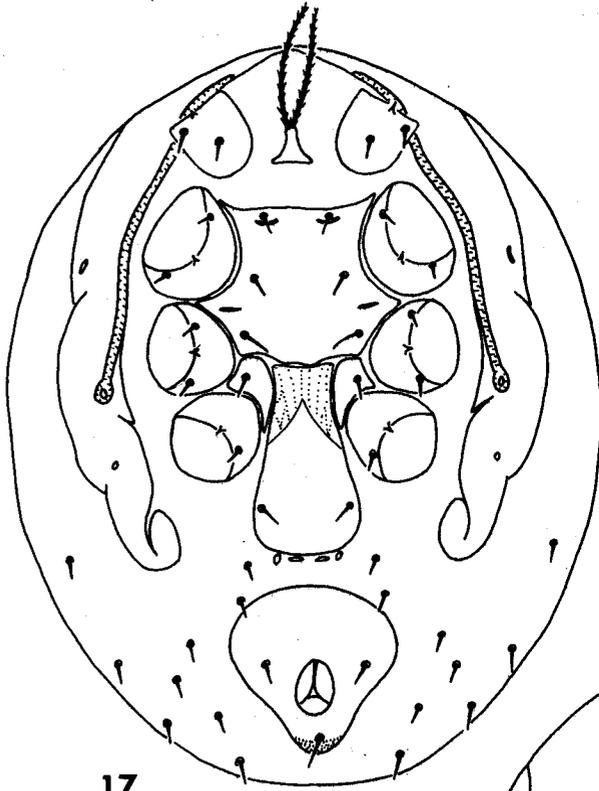
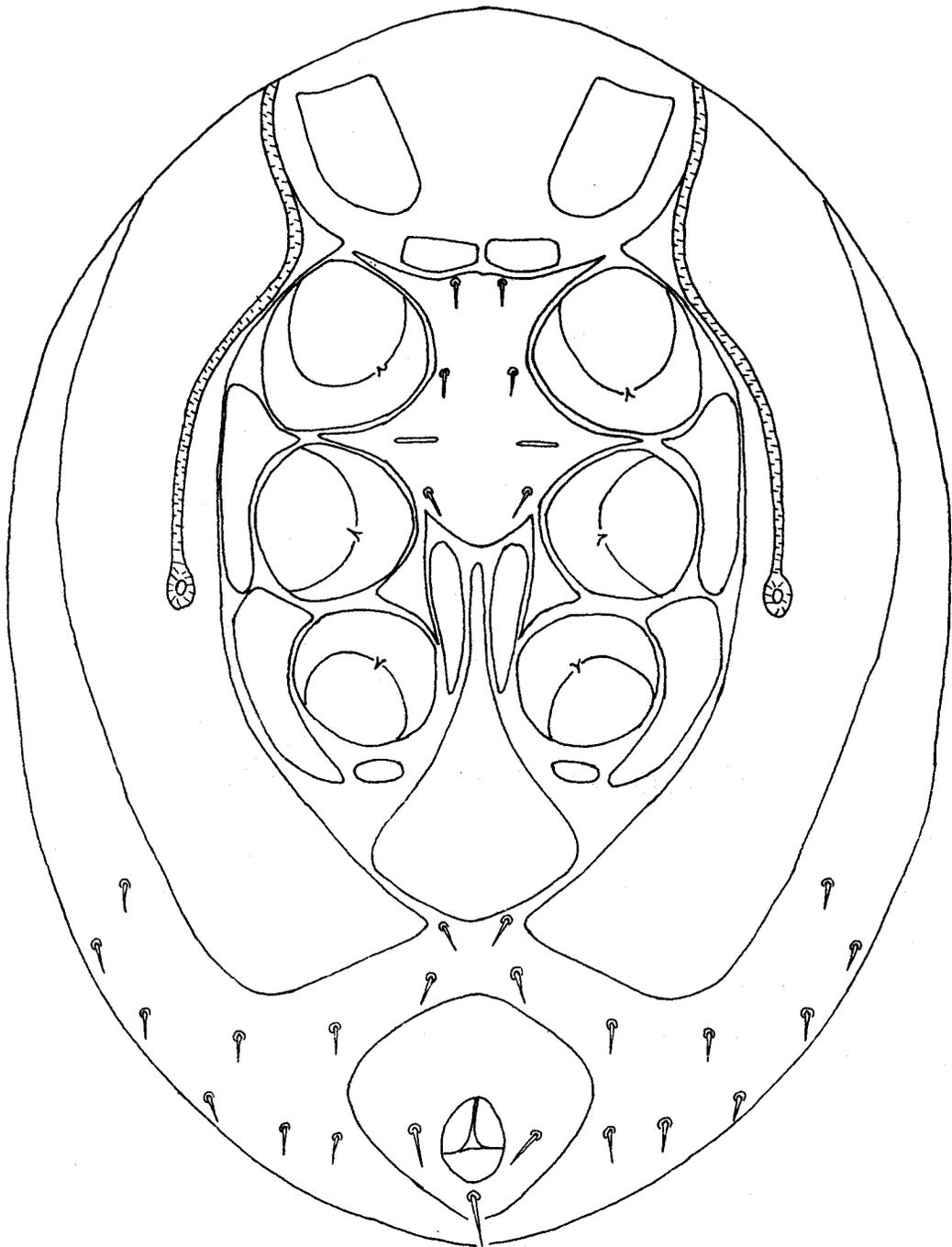
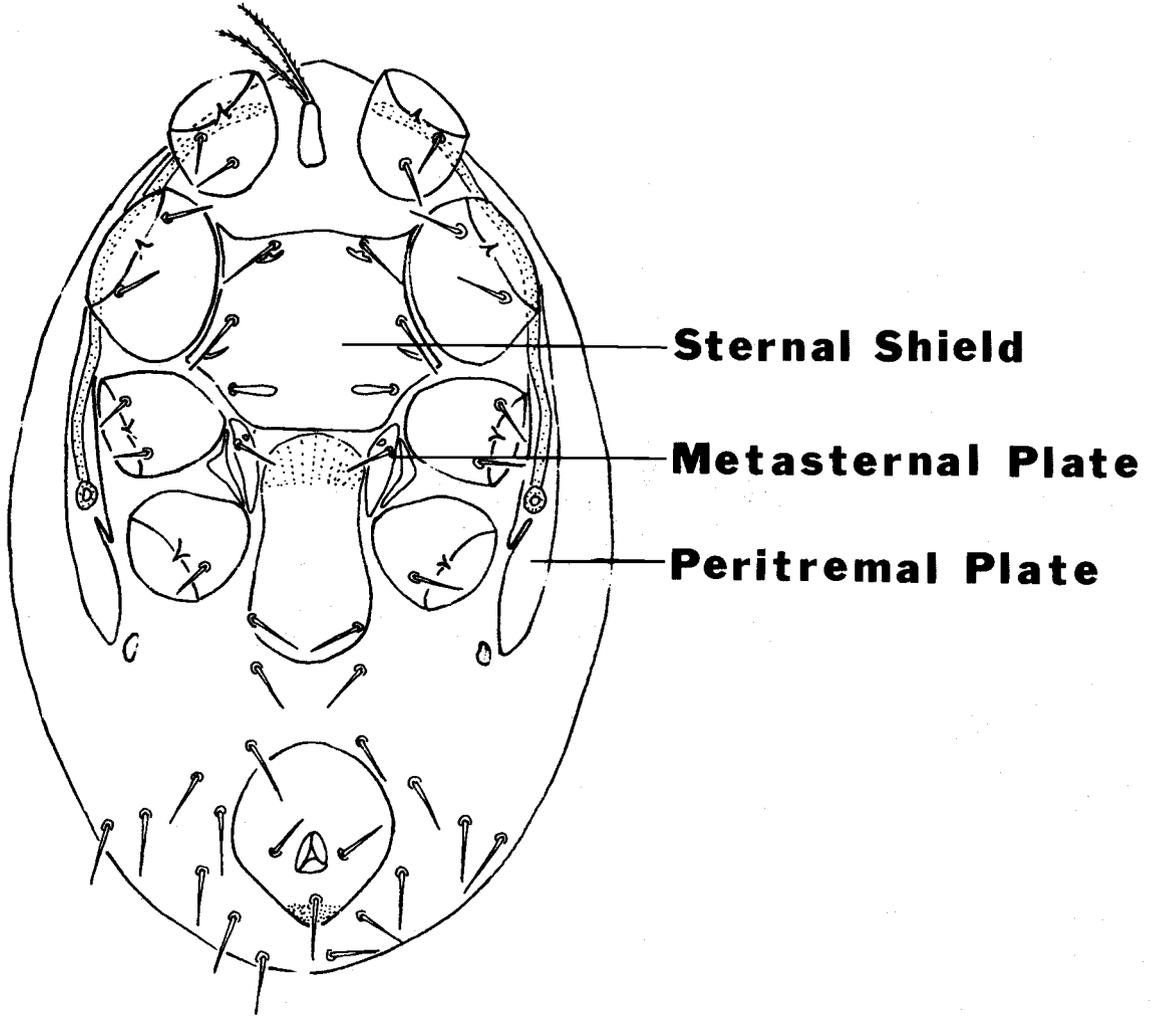


Figure 20. Ventral view of the idiosoma of female Eviphis
convergens (After Berlese 1913)



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Figure 21. Ventral view of the idiosoma of female Eviphis
oregonensis



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Figure 22. Ventral view of the idiosoma of female Eviphis hastatellus

Figure 23. Epistome of Eviphis hastatellus

Figure 24. Dorsal view of the idiosoma of Eviphis hastatellus

Figure 25. Sternal shield and coxae I and II of Eviphis transvaalensis

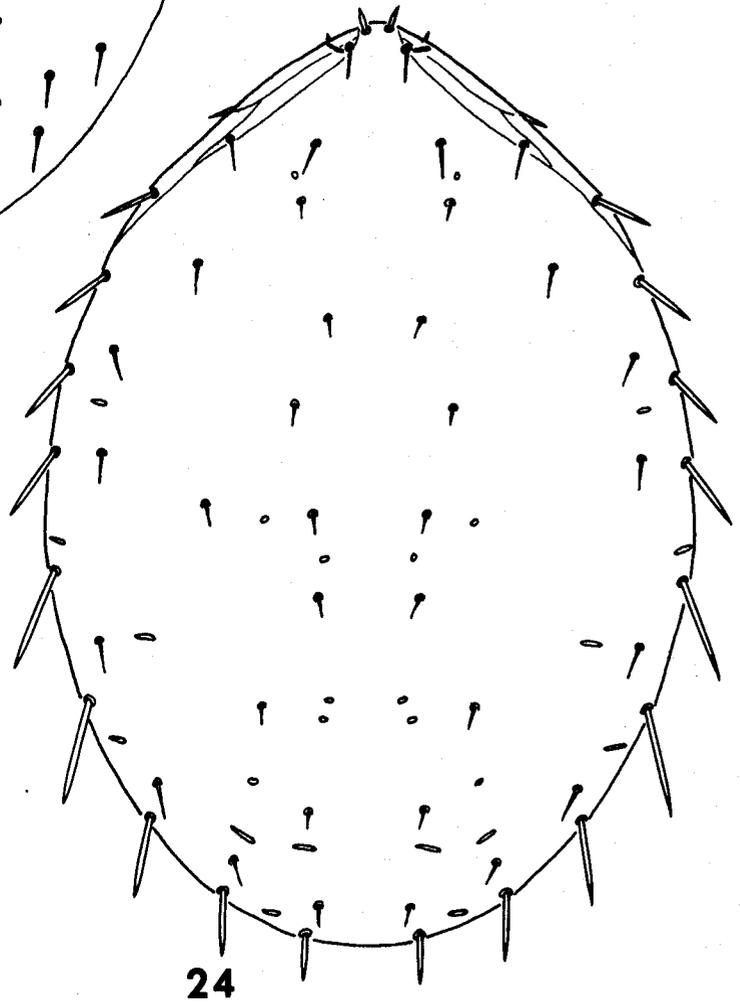
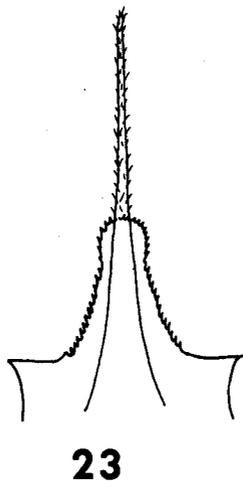
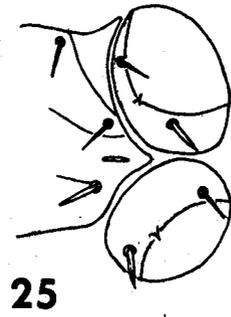
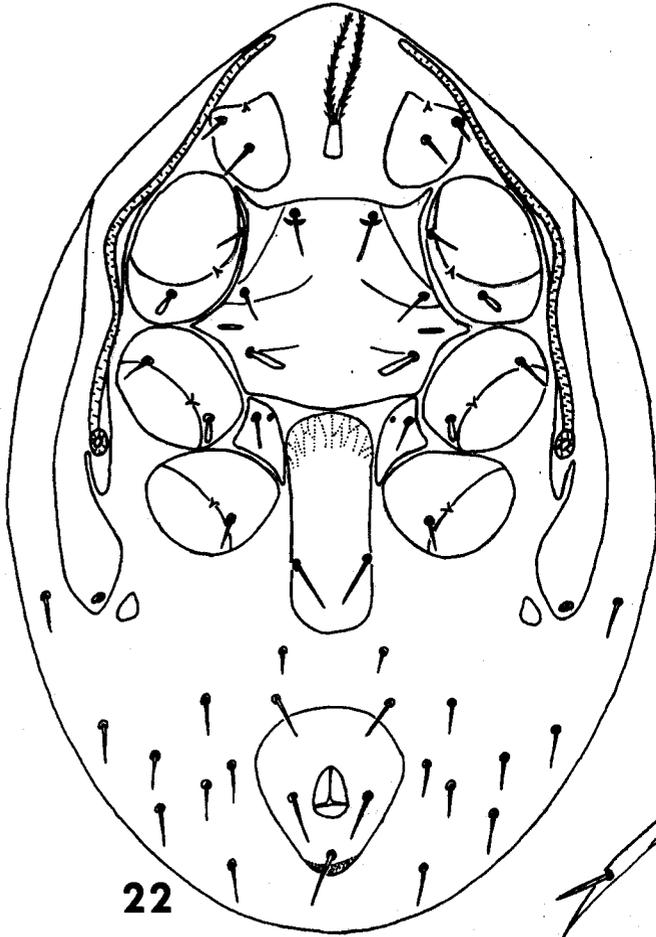
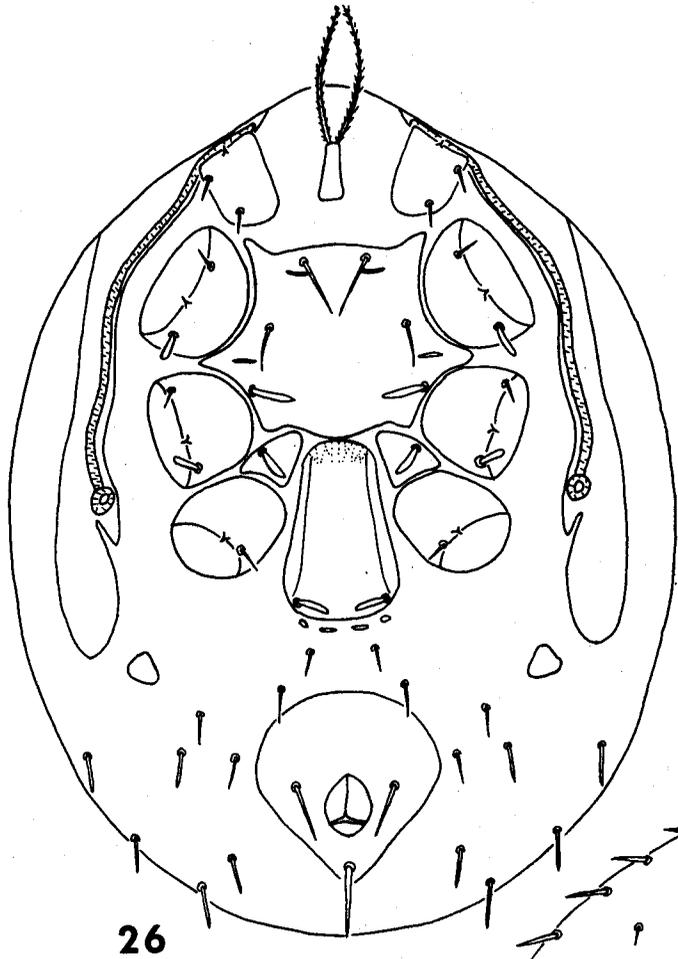


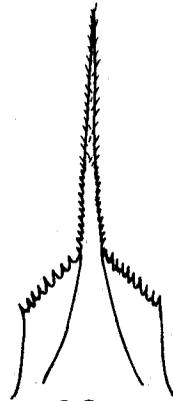
Figure 26. Ventral view of the idiosoma of female Eviphis
cultratellus

Figure 27. Dorsal view of the idiosoma of Eviphis cultratellus

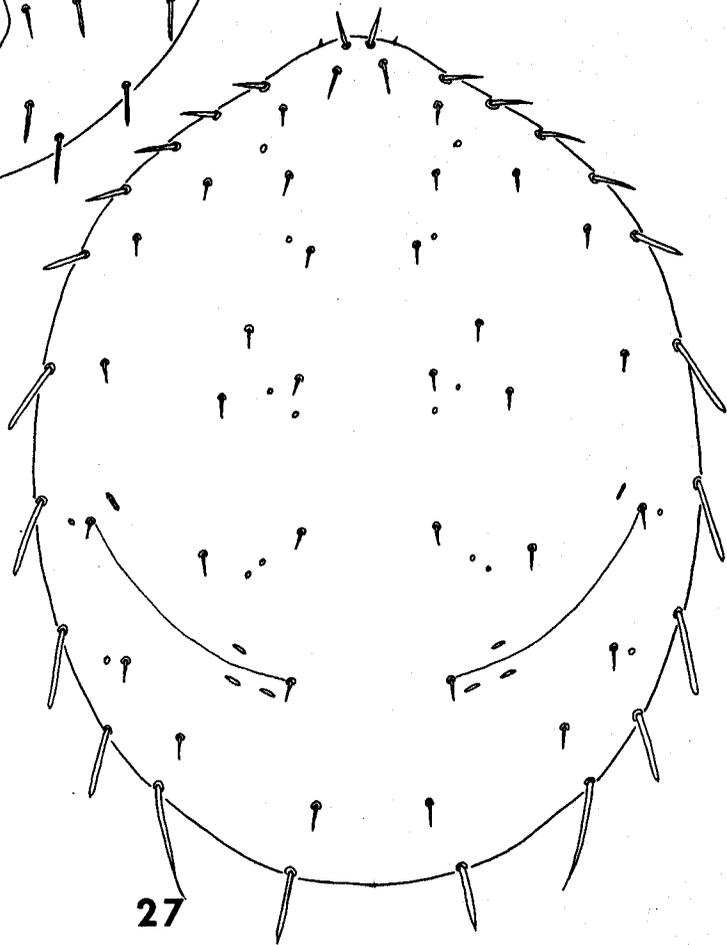
Figure 28. Epistome of Eviphis cultratellus



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Figure 29. Ventral view of male Eviphis cultratellus

Figure 30. Ventral view of nymph Eviphis cultratellus

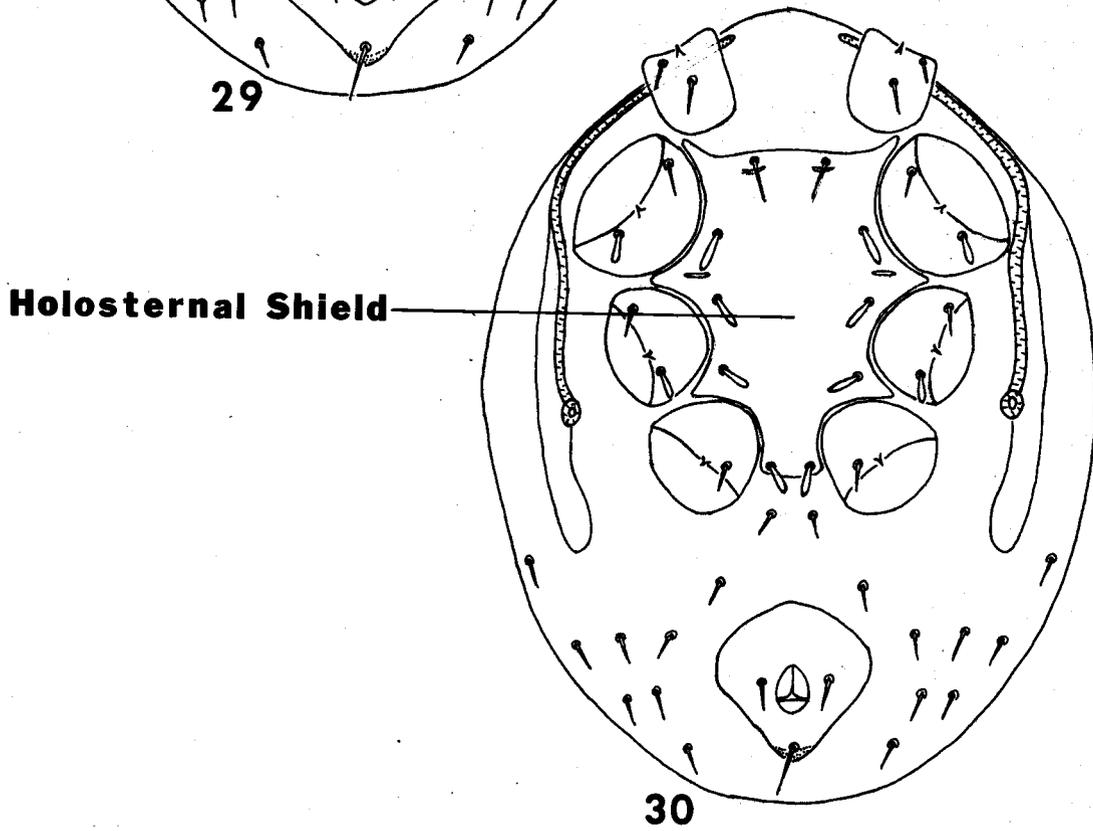
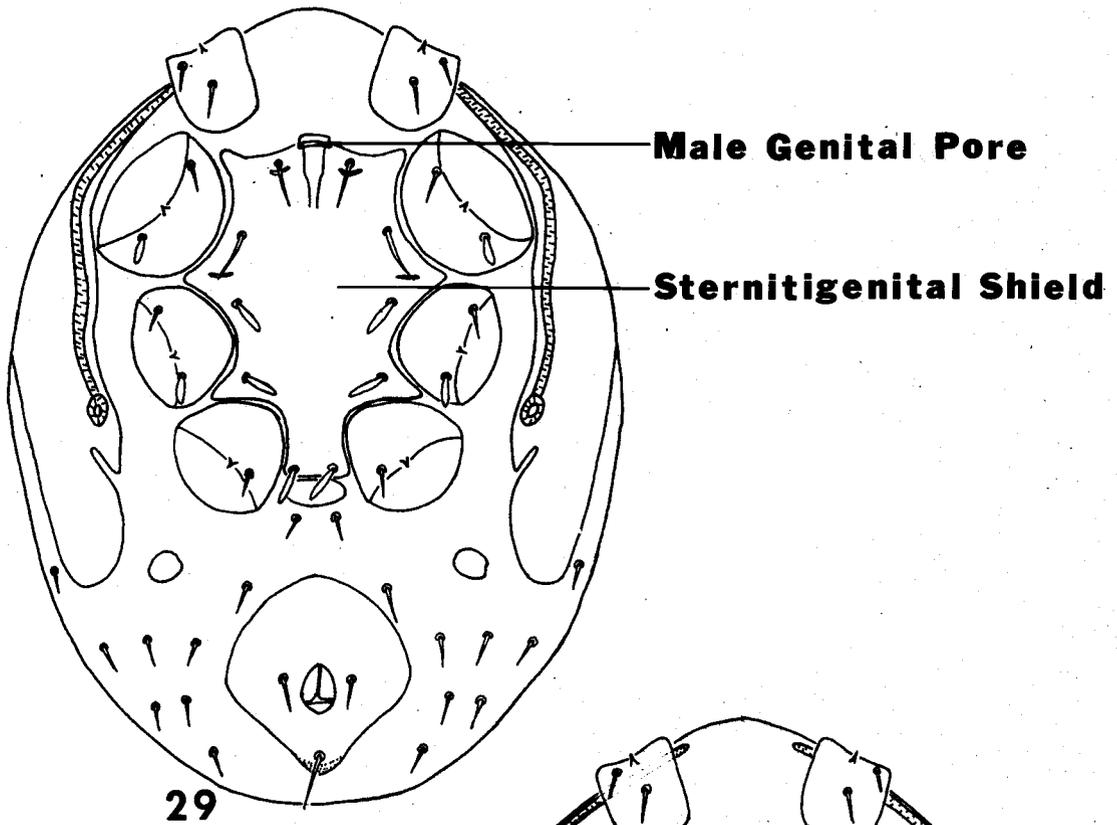
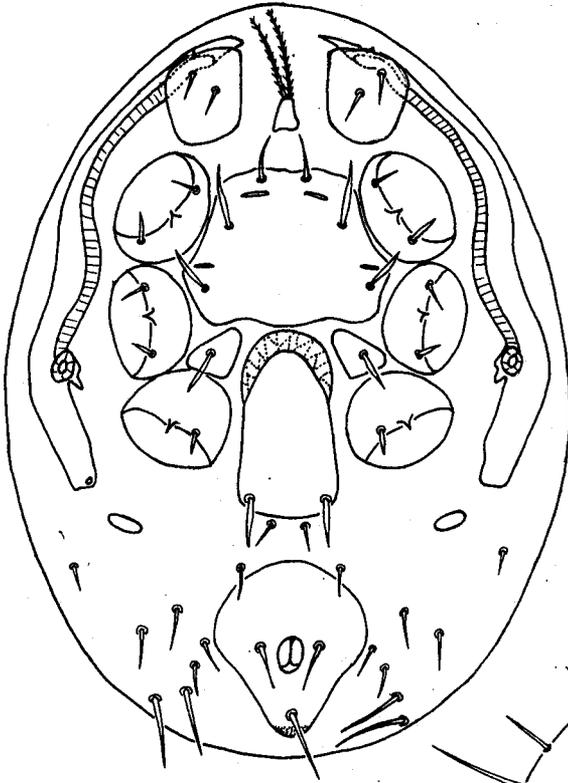


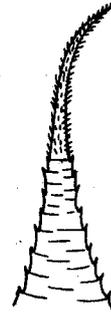
Figure 31. Ventral view of the idiosoma of female Eviphis pugiosetosis

Figure 32. Dorsal view of the idiosoma of Eviphis pugiosetosis

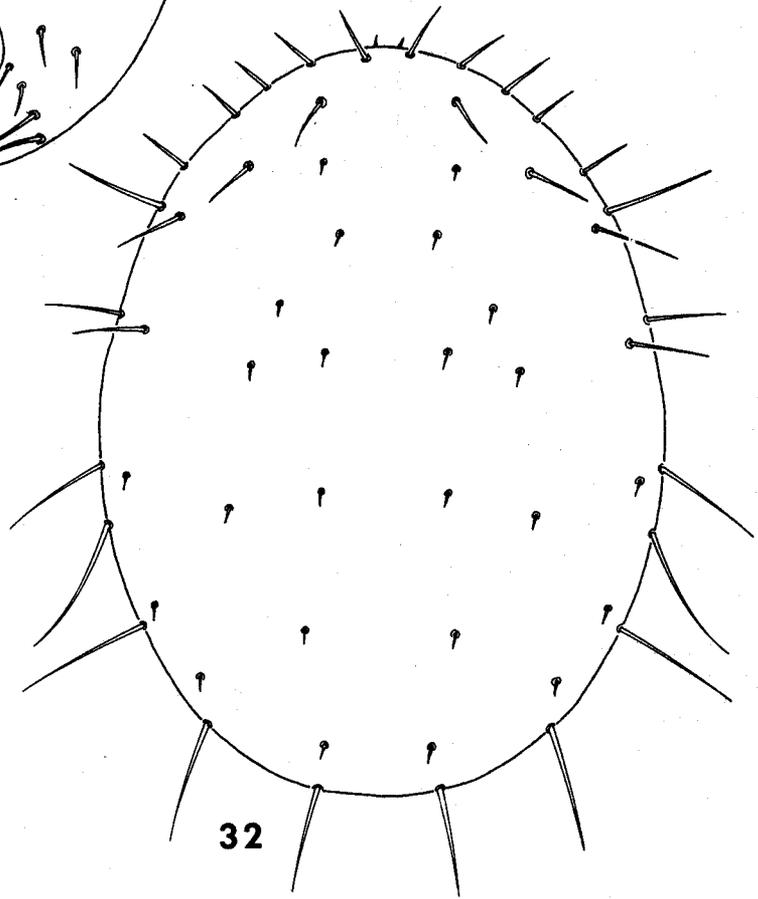
Figure 33. Epistome of Eviphis pugiosetosis



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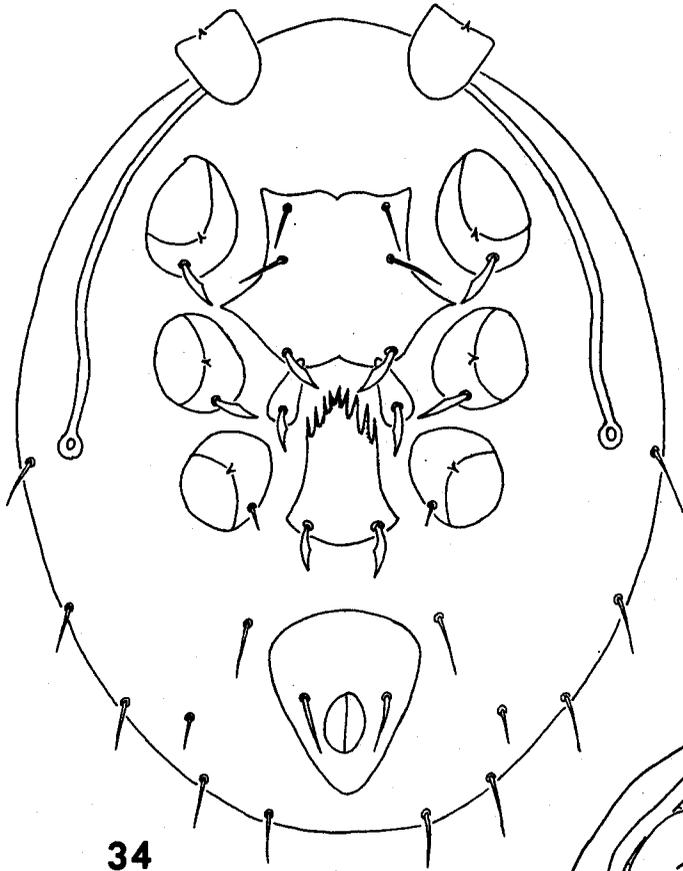


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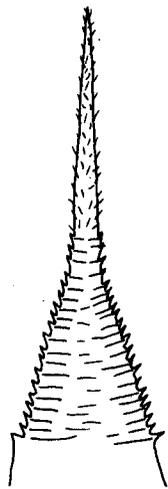
Figure 34. Ventral view of the idiosoma of female Eviphis falcinellus (after Berlese 1882-1892)

Figure 35. Ventral view of the idiosoma of female Eviphis mullani

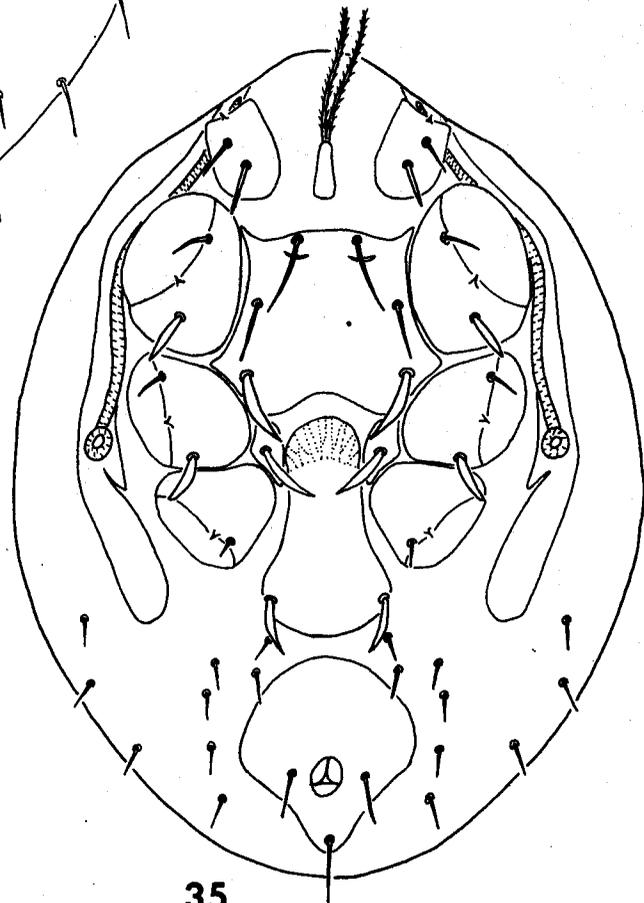
Figure 36. Epistome of Eviphis mullani



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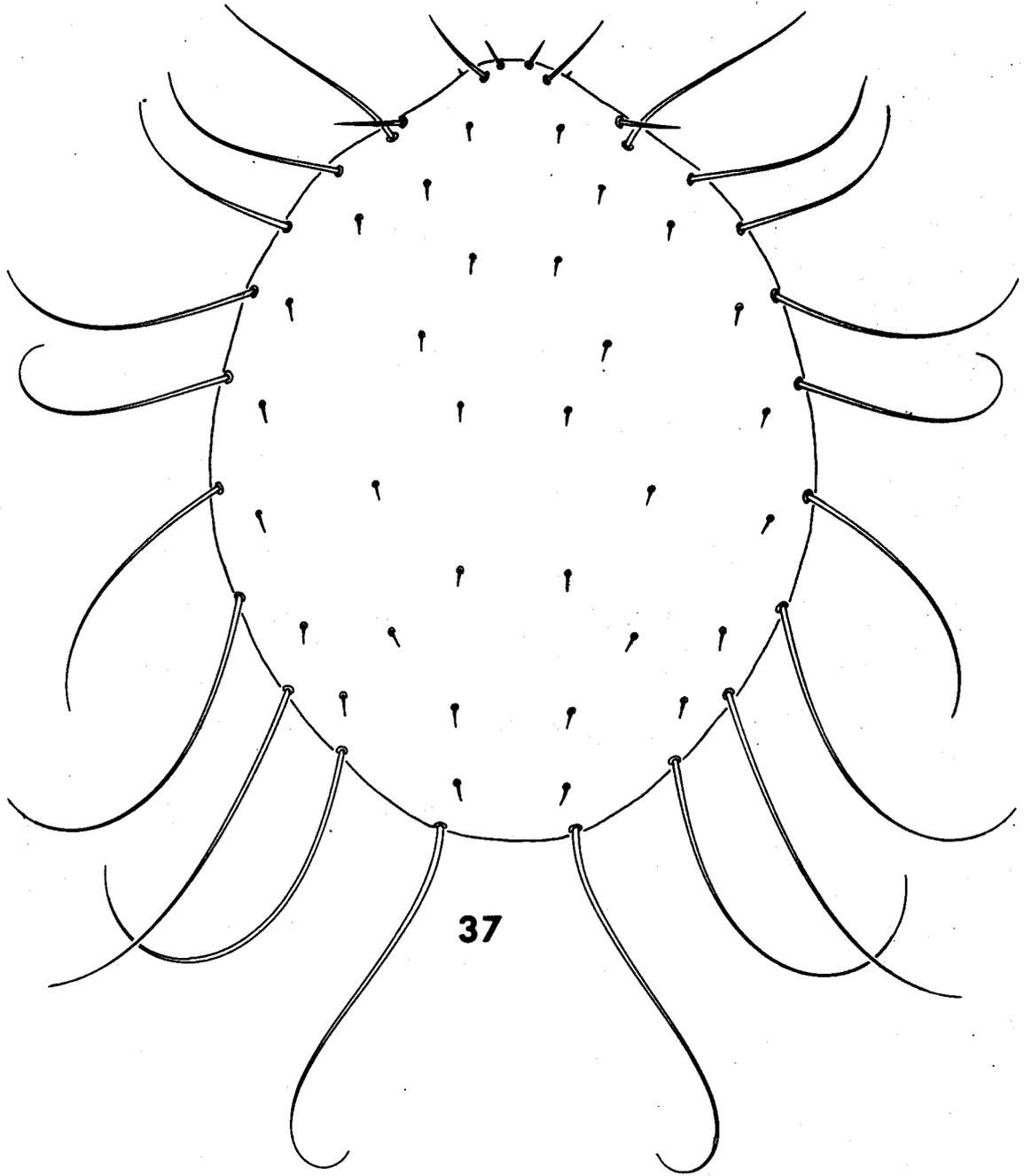


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Figure 37. Dorsal view of the idiosoma of Eviphis mullani



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- Figure 38. Dorsal view of the idiosoma of Eviphis meyeri
- Figure 39. Detail of the sculpturing on the dorsal shield of Eviphis meyeri
- Figure 40. Epistome of Eviphis meyeri
- Figure 41. Chelicera of female Eviphis meyeri
- Figure 42. Ventral view of the gnathosoma of female Eviphis meyeri
- Figure 43. Ventral view of the idiosoma of female Eviphis meyeri

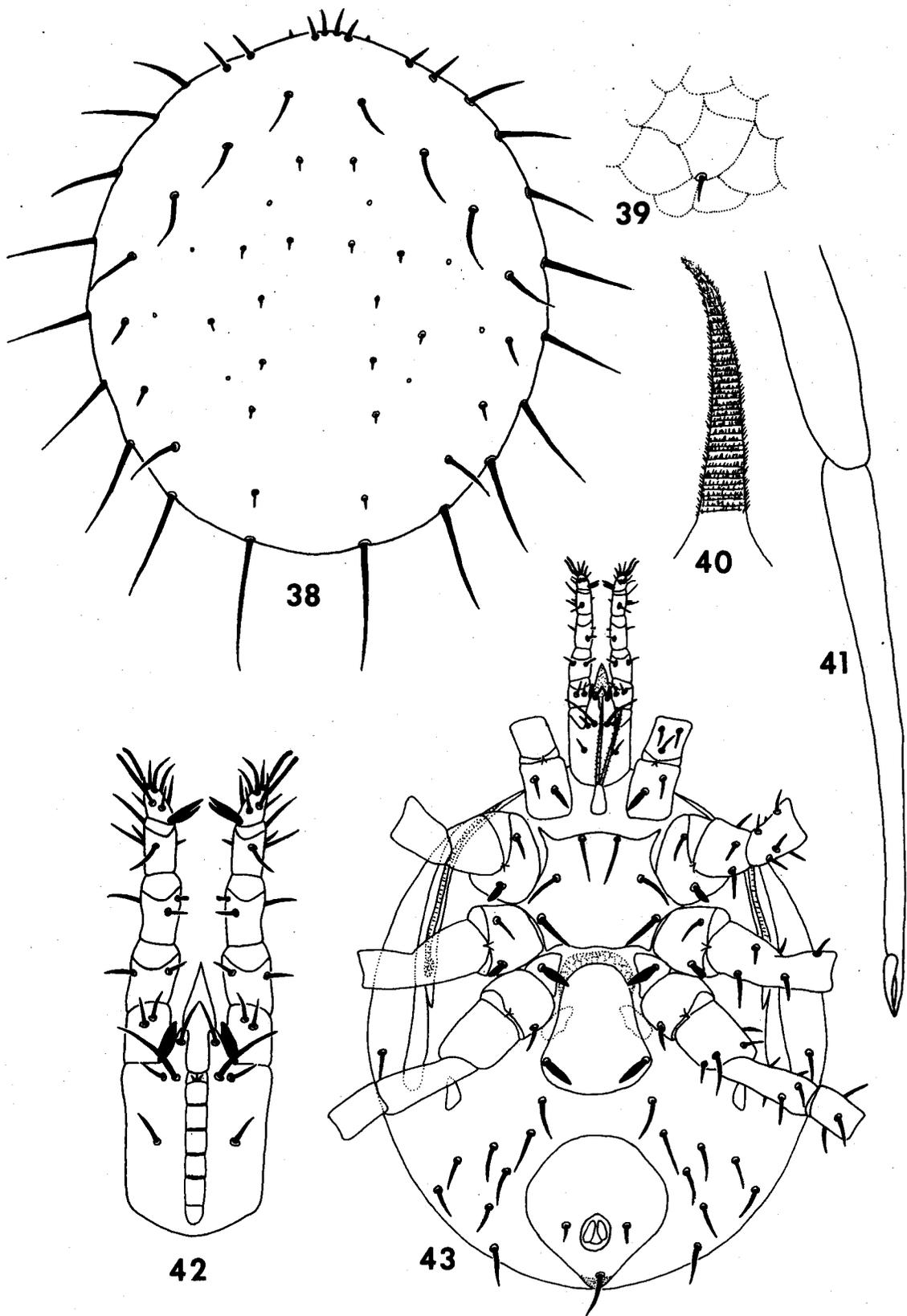
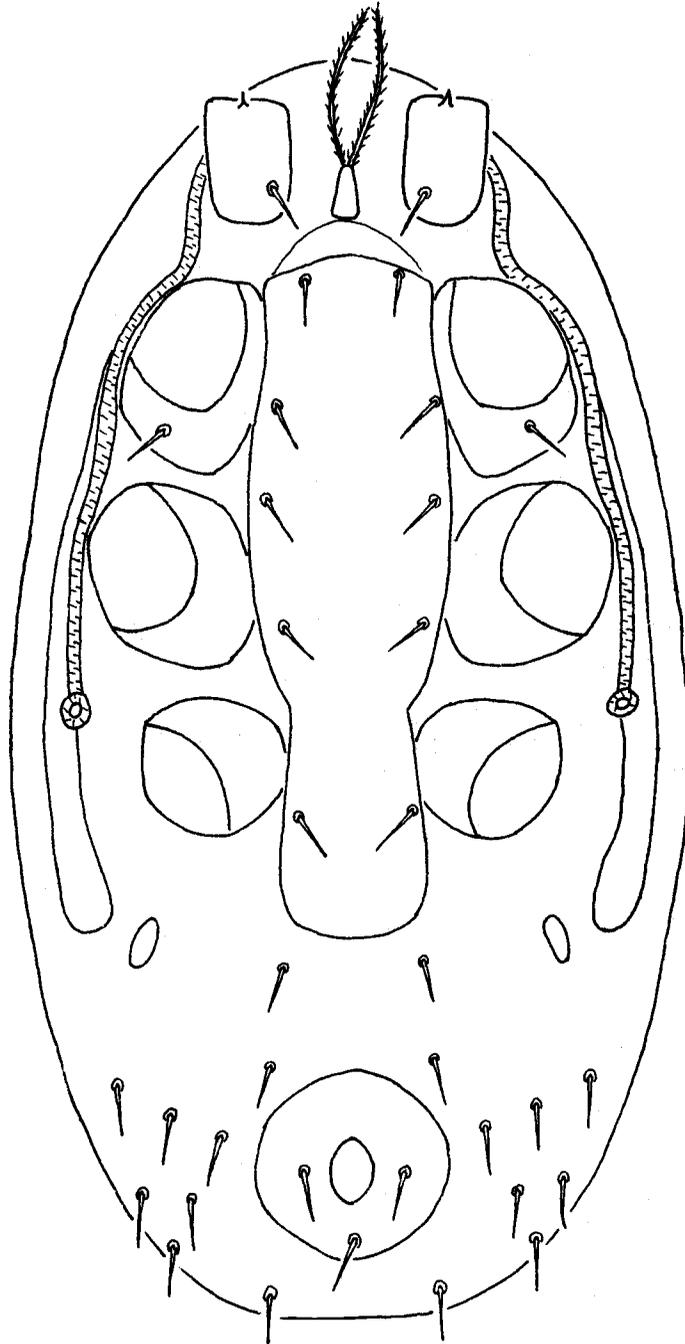


Figure 44. Ventral view of nymph Eviphis longus



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- Figure 45. Dorsal view of the idiosoma of Eviphis stefaninianus
- Figure 46. Epistome of Eviphis stefaninianus
- Figure 47. Ventral view of the idiosoma of female Eviphis stefaninianus
- Figure 48. Ventral view of male Eviphis stefaninianus
- Figure 49. Chelicera of male Eviphis stefaninianus
- Figure 50. Ventral view of the gnathosoma of Eviphis stefaninianus

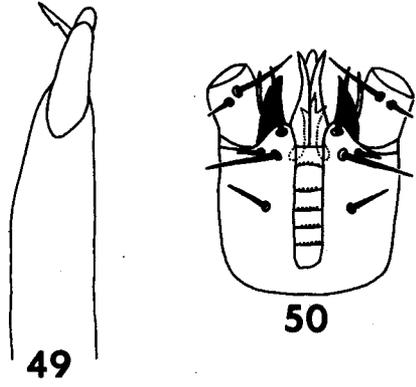
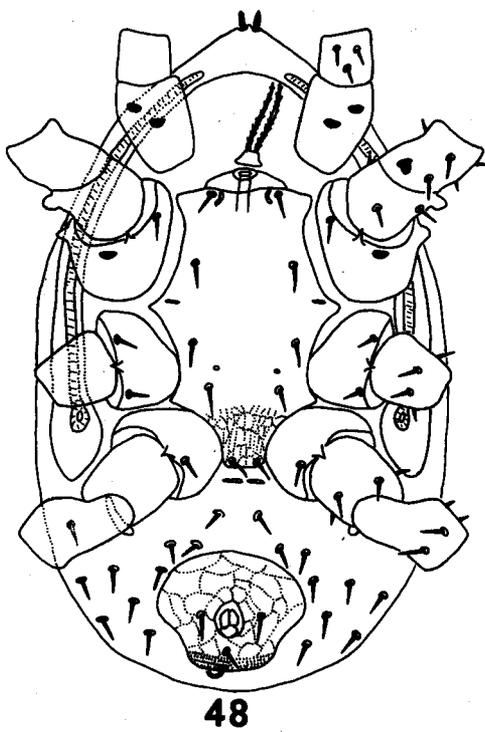
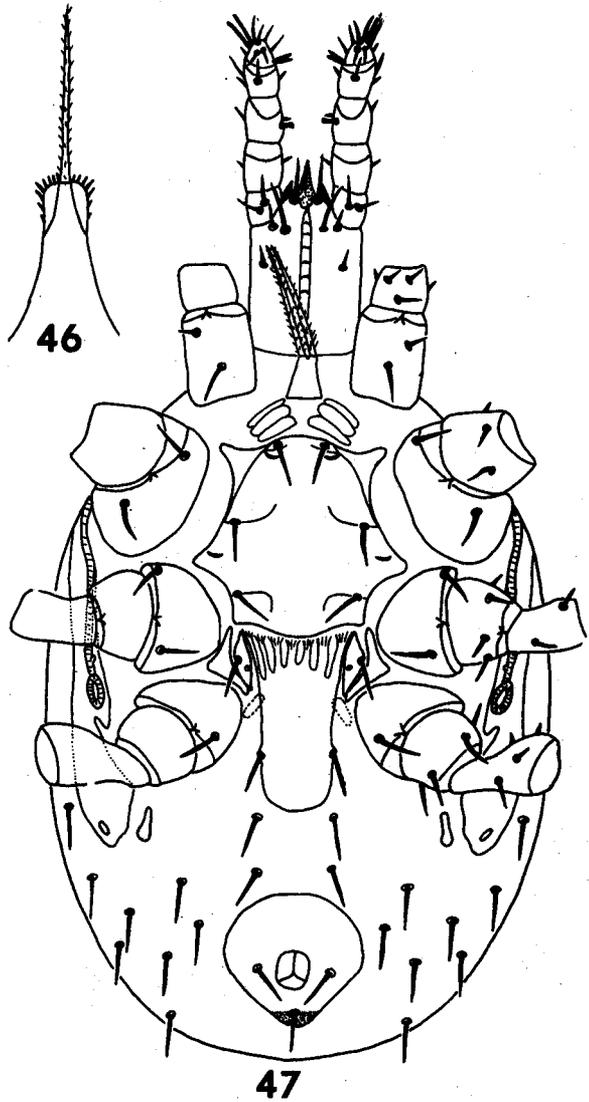
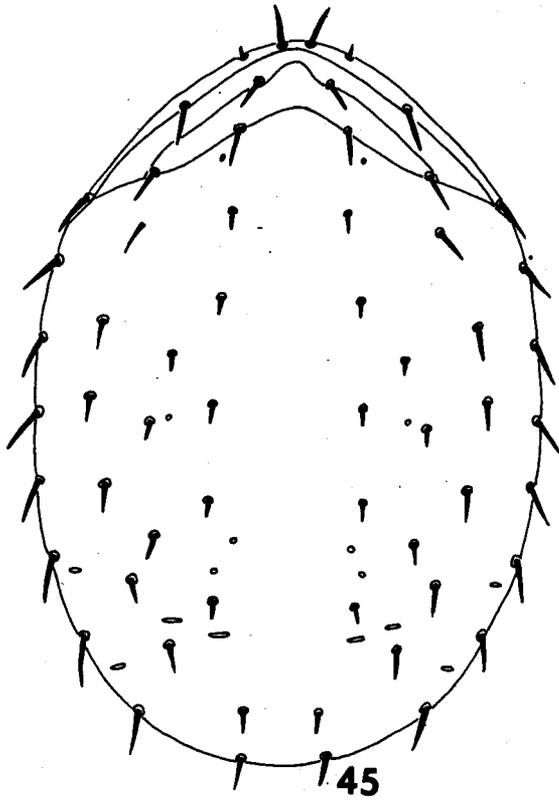


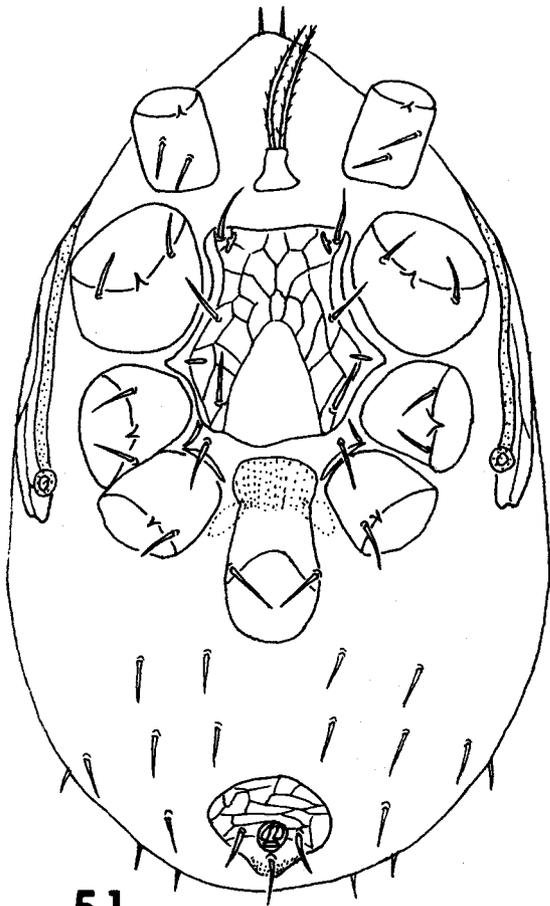
Figure 51. Ventral view of the idiosoma of female Alliphis reticulosternis

Figure 52. Detail of the sculpturing on the dorsal shield of Alliphis reticulosternis

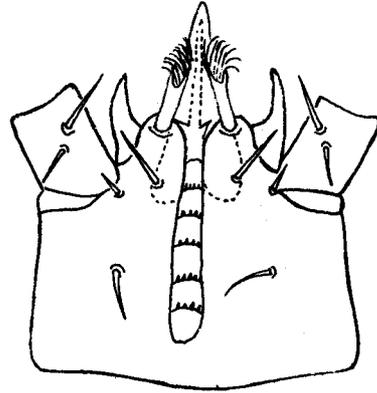
Figure 53. Epistome of Alliphis reticulosternis

Figure 54. Dorsal view of the idiosoma of Alliphis reticulosternis

Figure 55. Ventral view of the gnathosoma of Alliphis reticulosternis



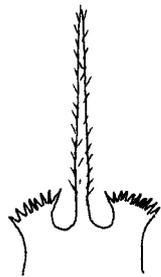
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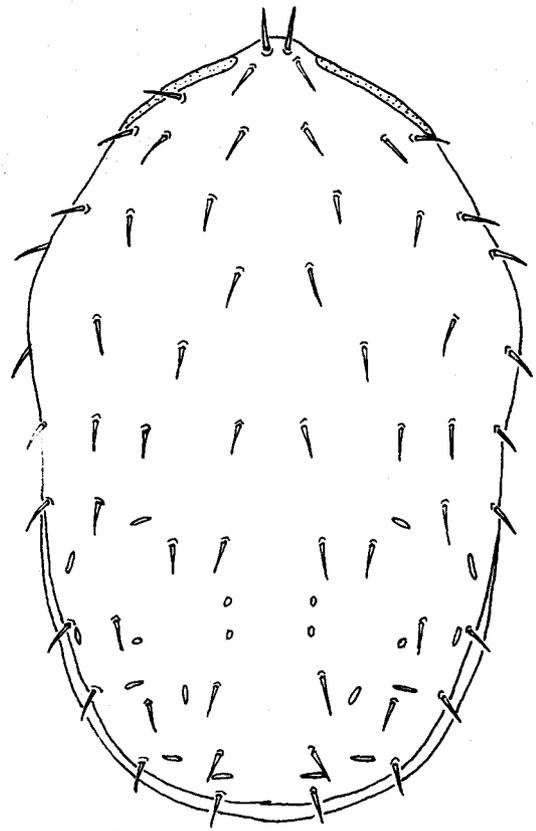
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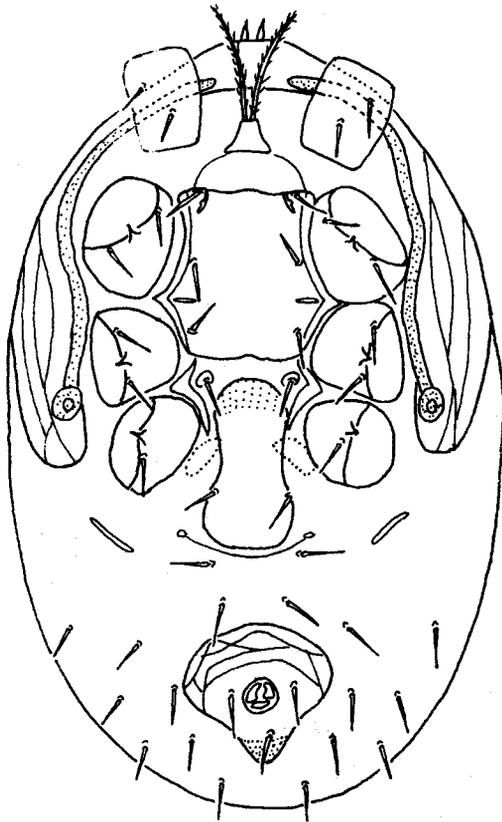
Figure 56. Ventral view of the idiosoma of female Alliphis halleri

Figure 57. Epistome of Alliphis halleri

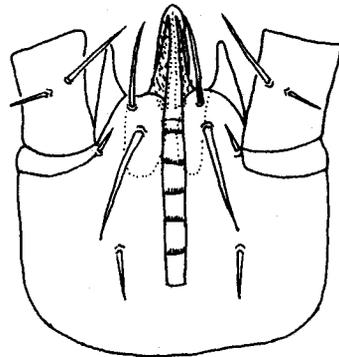
Figure 58. Dorsal view of the idiosoma of Alliphis halleri

Figure 59. Detail of the sculpturing on the dorsal shield of Alliphis halleri

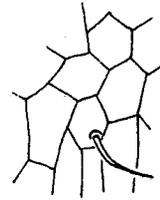
Figure 60. Ventral view of the gnathosoma of Alliphis halleri



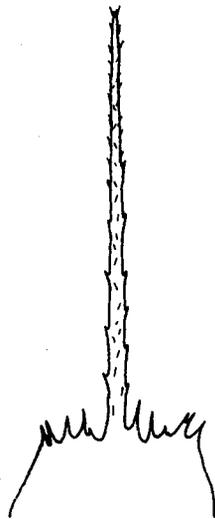
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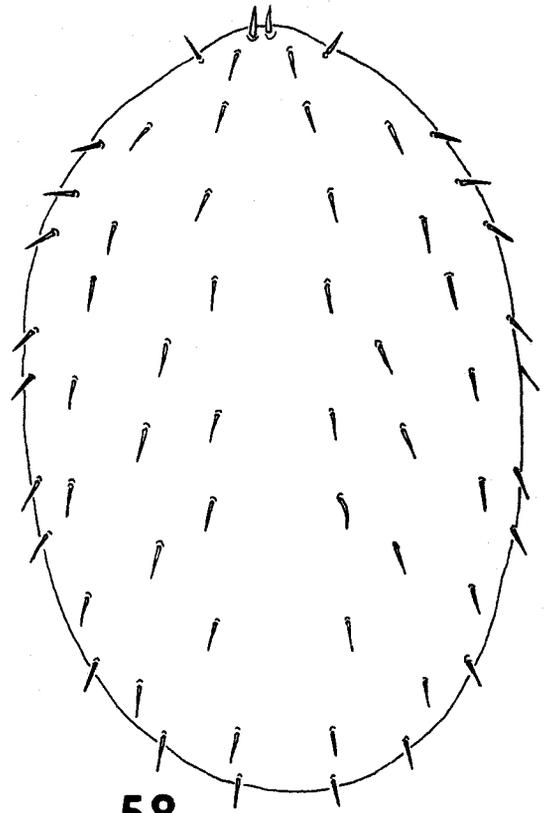
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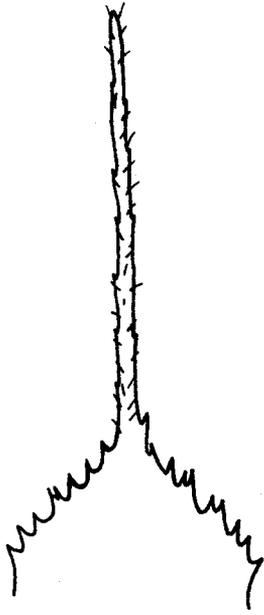
Figure 61. Epistome of Alliphis sculus

Figure 62. Epistome of Alliphis chirophorus

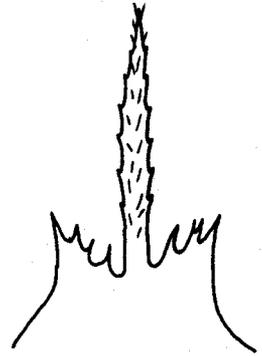
Figure 63. Epistome of Alliphis santosdiasi

Figure 64. Genital shield area of female Alliphis santosdiasi

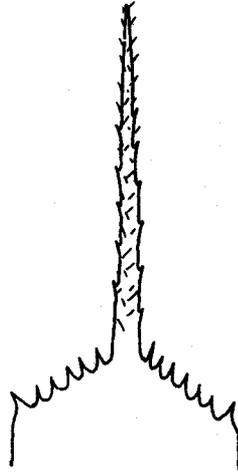
Figure 65. Area around stigma of Alliphis santosdiasi



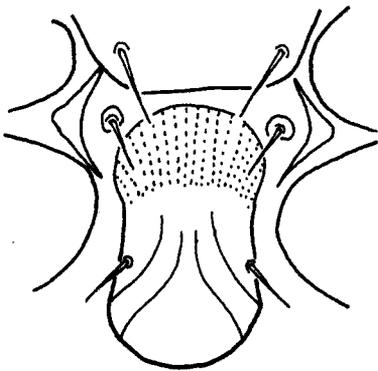
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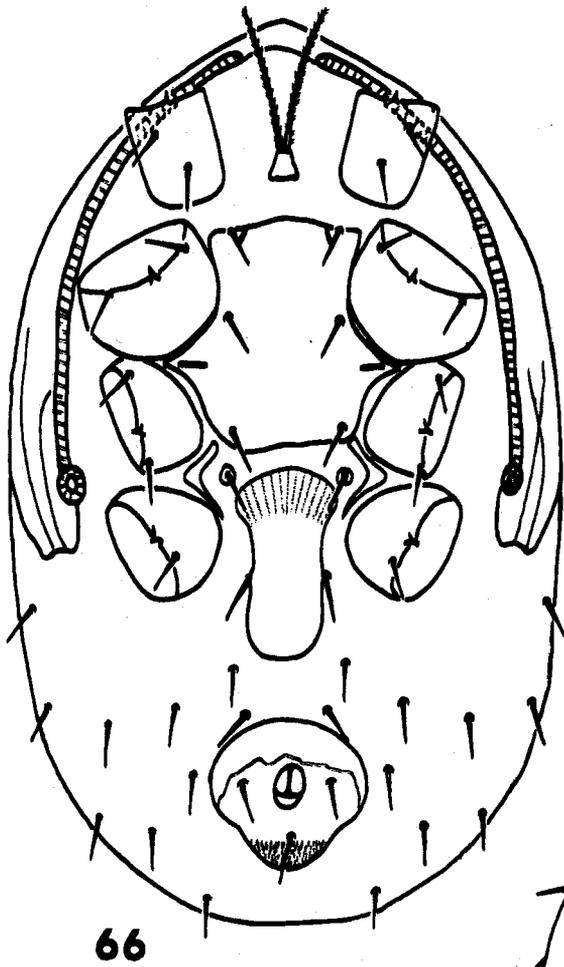


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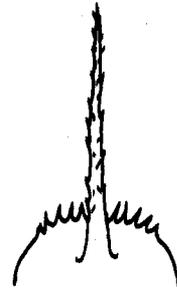
Figure 66. Ventral view of the idiosoma of female Alliphis evansi

Figure 67. Dorsal view of the idiosoma of Alliphis evansi

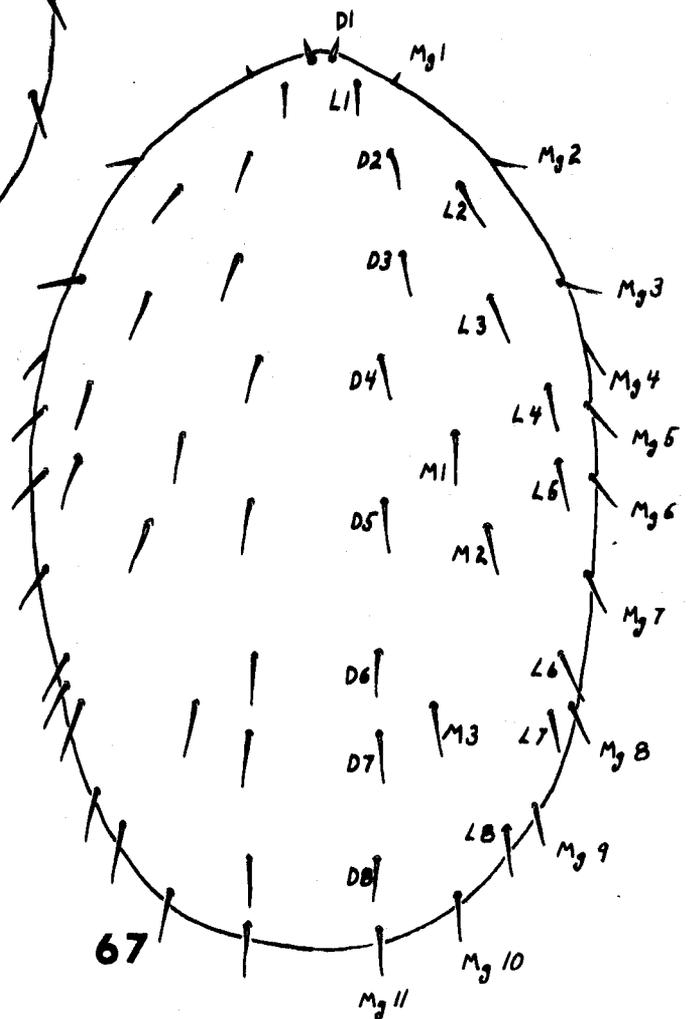
Figure 68. Epistome of Alliphis evansi



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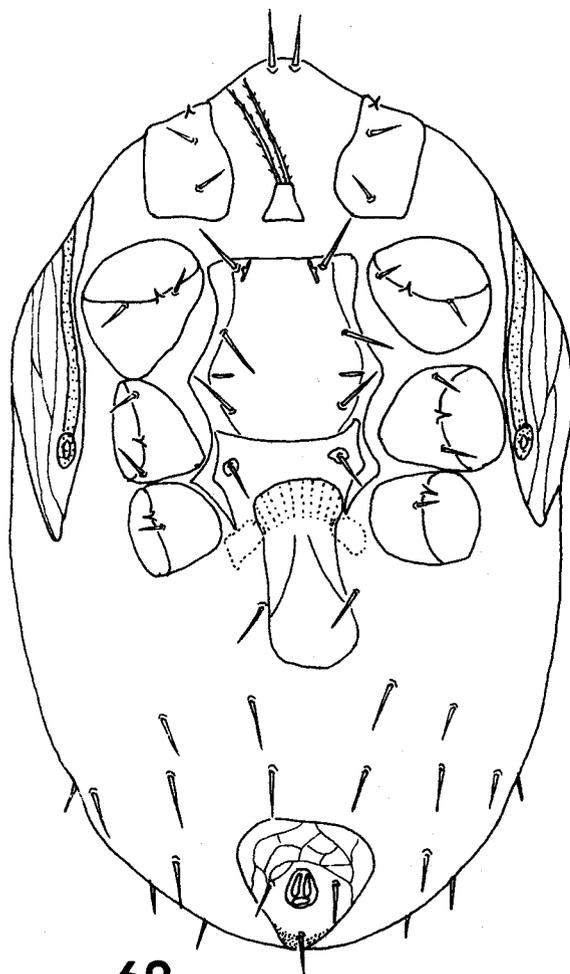
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Figure 69. Ventral view of idiosoma of female Alliphis intermedius

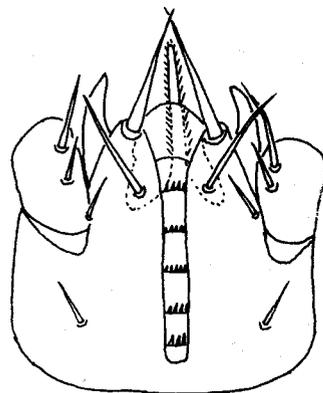
Figure 70. Epistome of Alliphis intermedius

Figure 71. Dorsal view of idiosoma of Alliphis intermedius

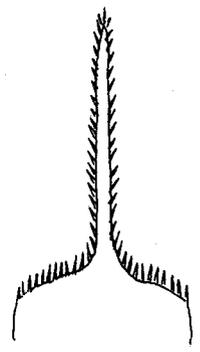
Figure 72. Ventral view of gnathosoma of Alliphis intermedius



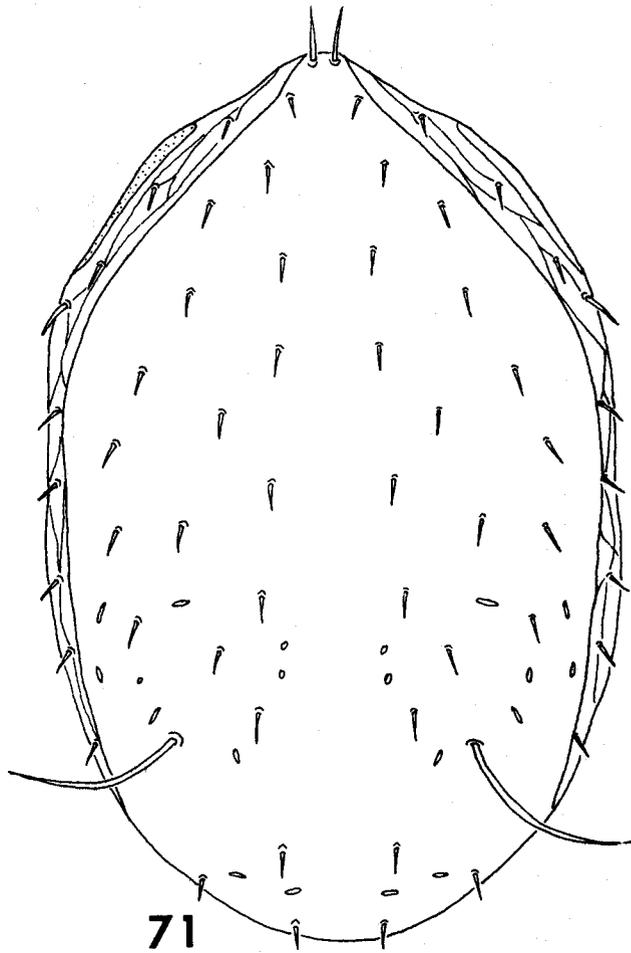
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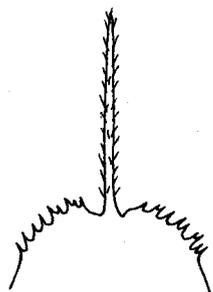


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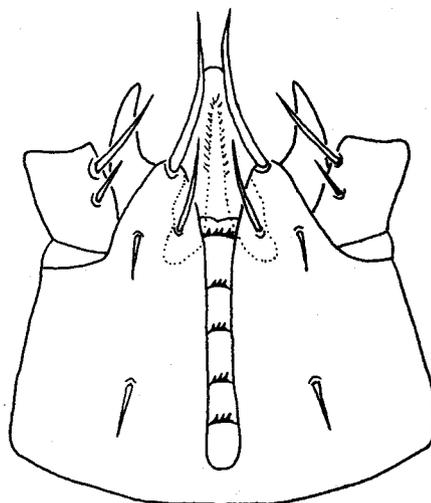
Figure 73. Epistome of Alliphis krantzi

Figure 74. Ventral view of idiosoma of female Alliphis krantzi

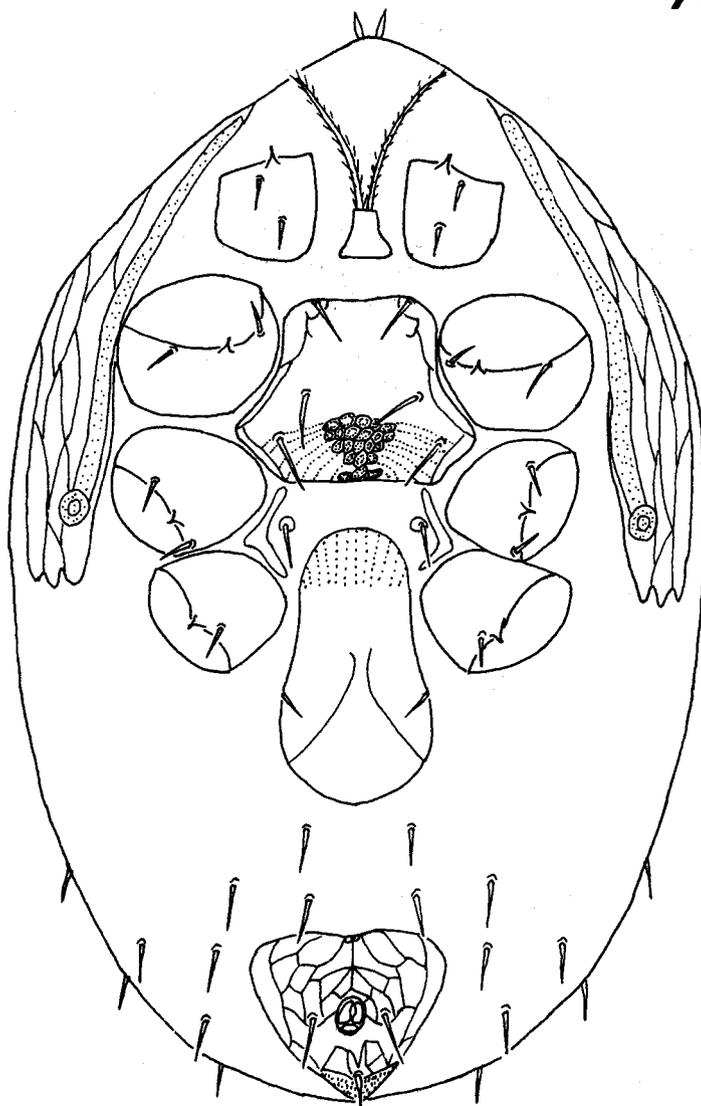
Figure 75. Ventral view of gnathosoma of Alliphis krantzi



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Figure 76. Ventral view of the idiosoma of female Alliphis punctisternis

Figure 77. Ventral view of the gnathosoma of Alliphis punctisternis

Figure 78. Epistome of Alliphis punctisternis

Figure 79. Ventral view of gnathosoma of Alliphis ritcheri

Figure 80. Ventral view of the idiosoma of female Alliphis ritcheri

Figure 81. Epistome of Alliphis ritcheri

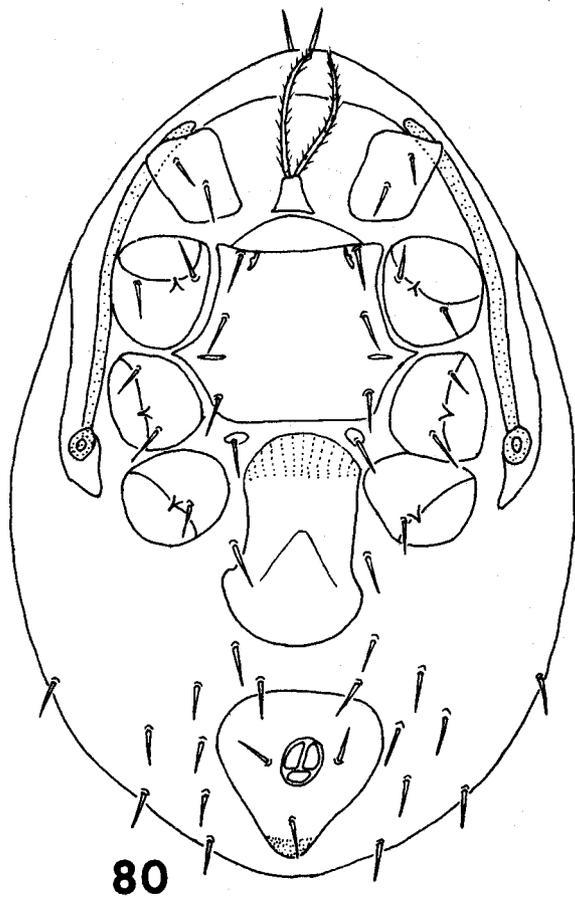
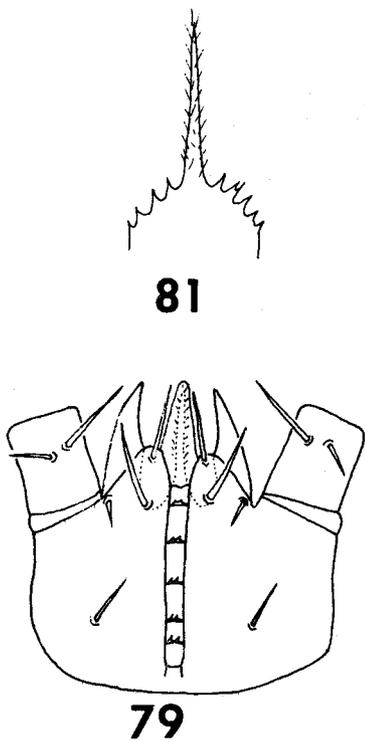
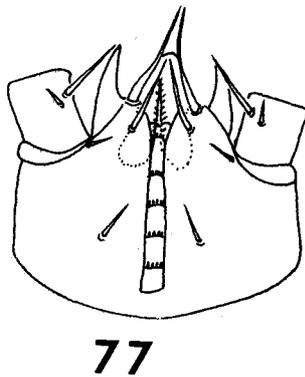
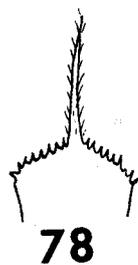
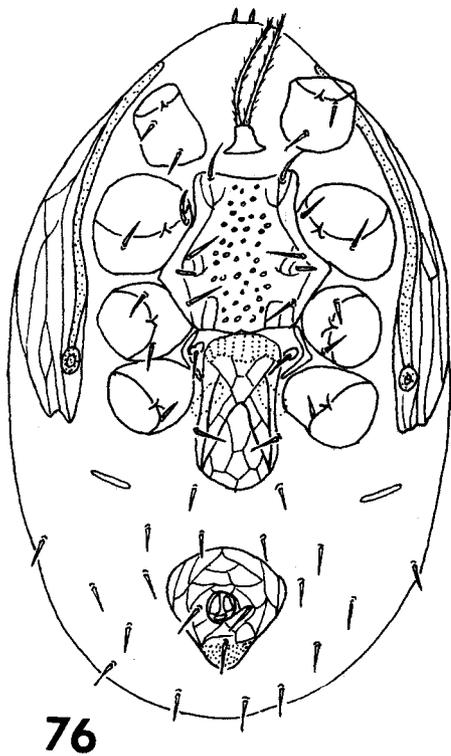
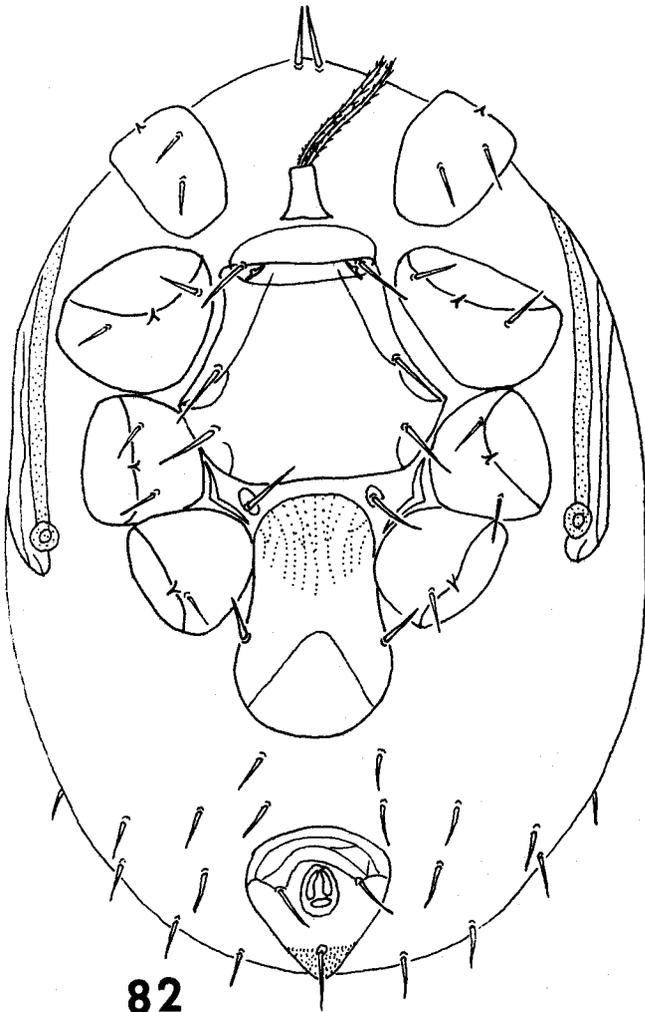


Figure 82. Ventral view of the idiosoma of female Alliphis mellotti

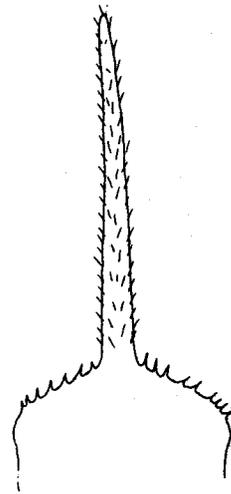
Figure 83. Anterior portion of the dorsal shield of Alliphis mellotti

Figure 84. Ventral view of the gnathosoma of Alliphis mellotti

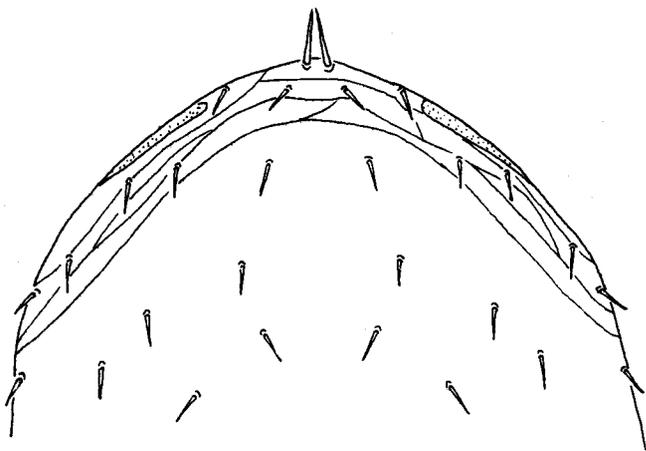
Figure 85. Epistome of Alliphis mellotti



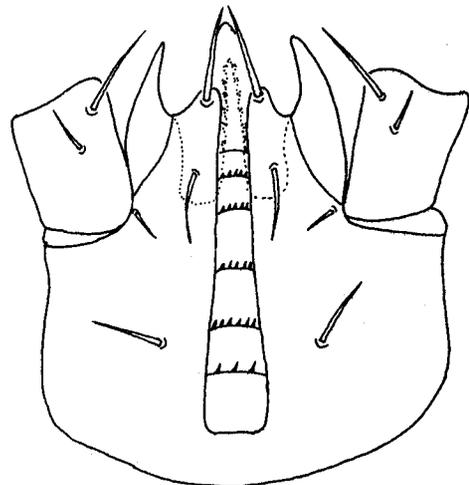
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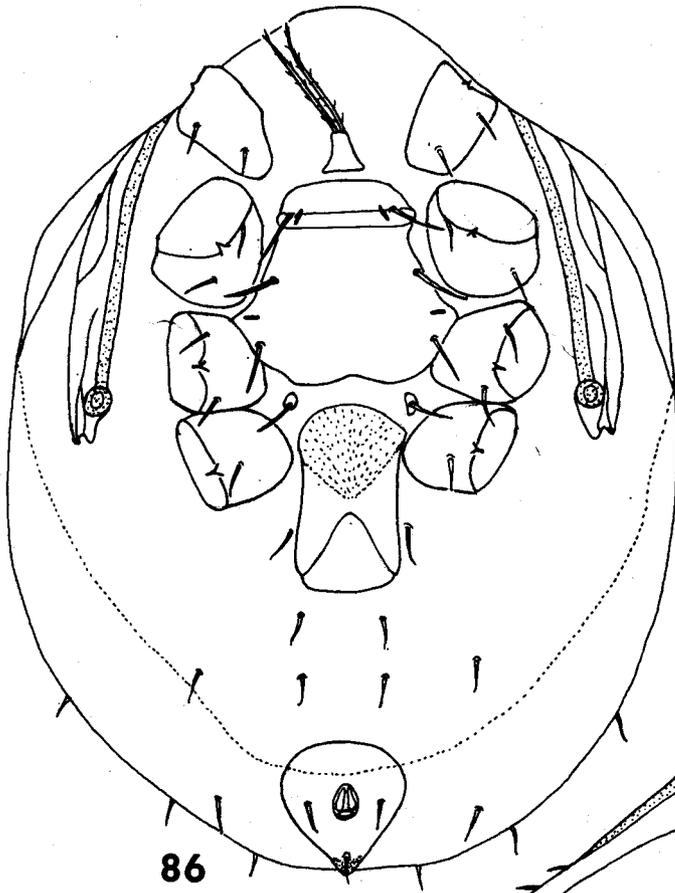
Figure 86. Ventral view of the idiosoma of female Alliphis
obesus

Figure 87. Chelicera of female Alliphis obesus

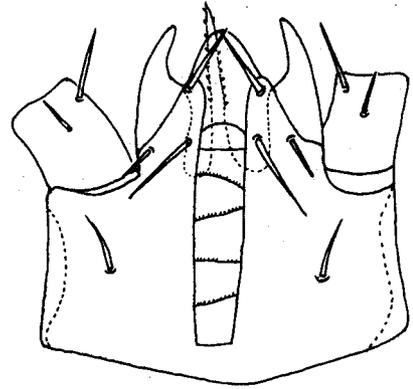
Figure 88. Epistome of Alliphis obesus

Figure 89. Dorsal view of the idiosoma of Alliphis obesus

Figure 90. Ventral view of the gnathosoma of Alliphis obesus



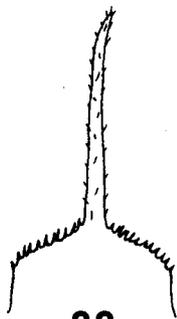
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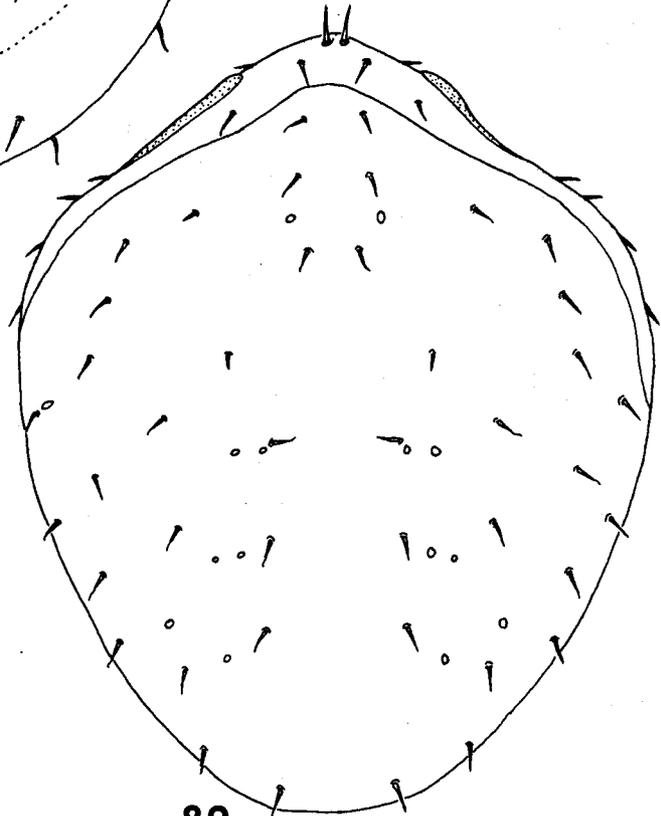
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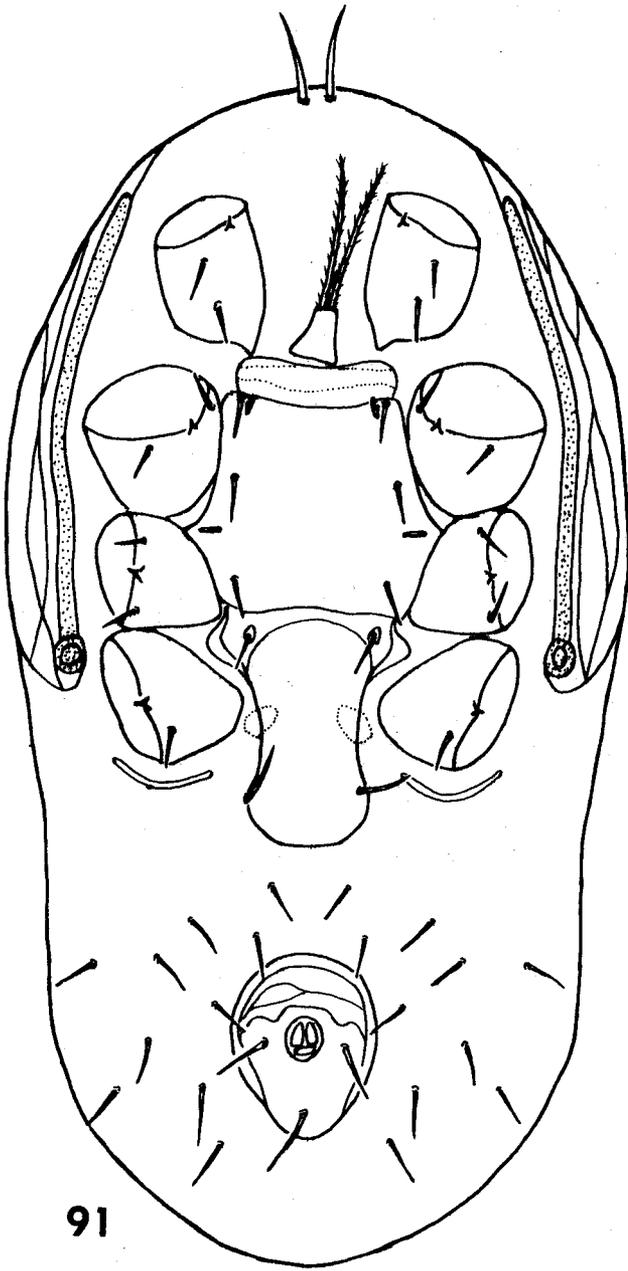


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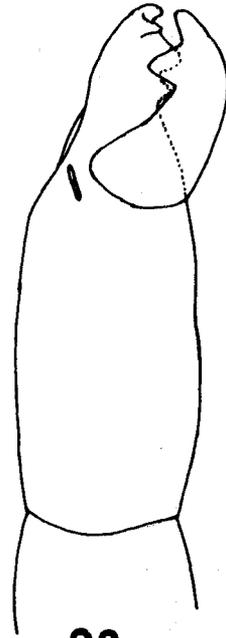
Figure 91. Ventral view of the idiosoma of female Alliphis crassicheles

Figure 92. Ventral view of the gnathosoma of Alliphis crassicheles

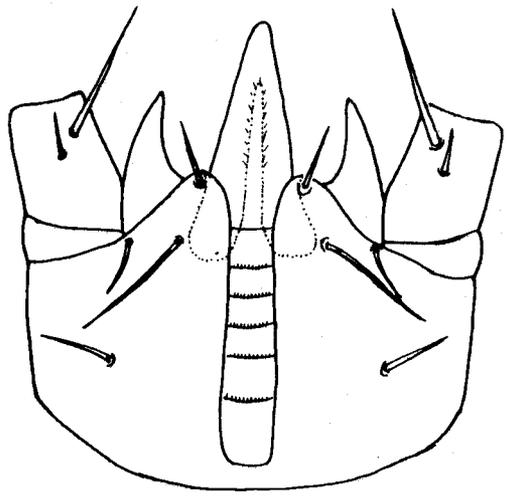
Figure 93. Chelicera of female Alliphis crassicheles



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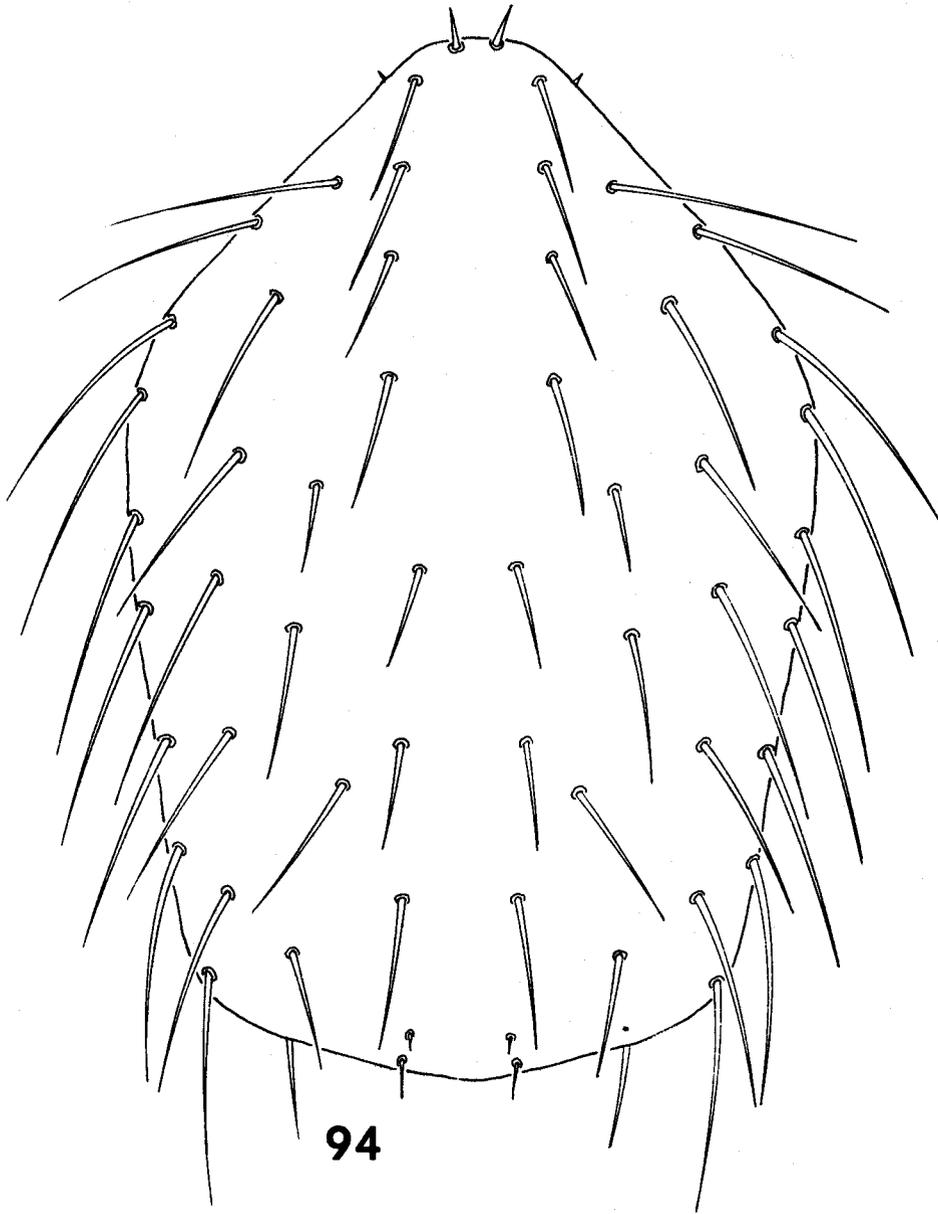


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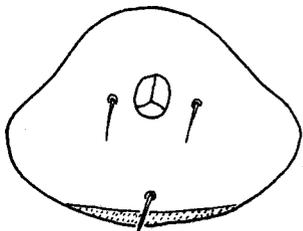
Figure 94. Dorsal view of the idiosoma of Pelethiphis vaneedeni

Figure 95. Anal shield of Pelethiphis vaneedeni

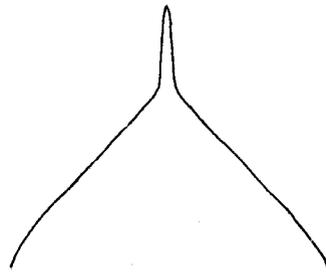
Figure 96. Epistome of Pelethiphis vaneedeni



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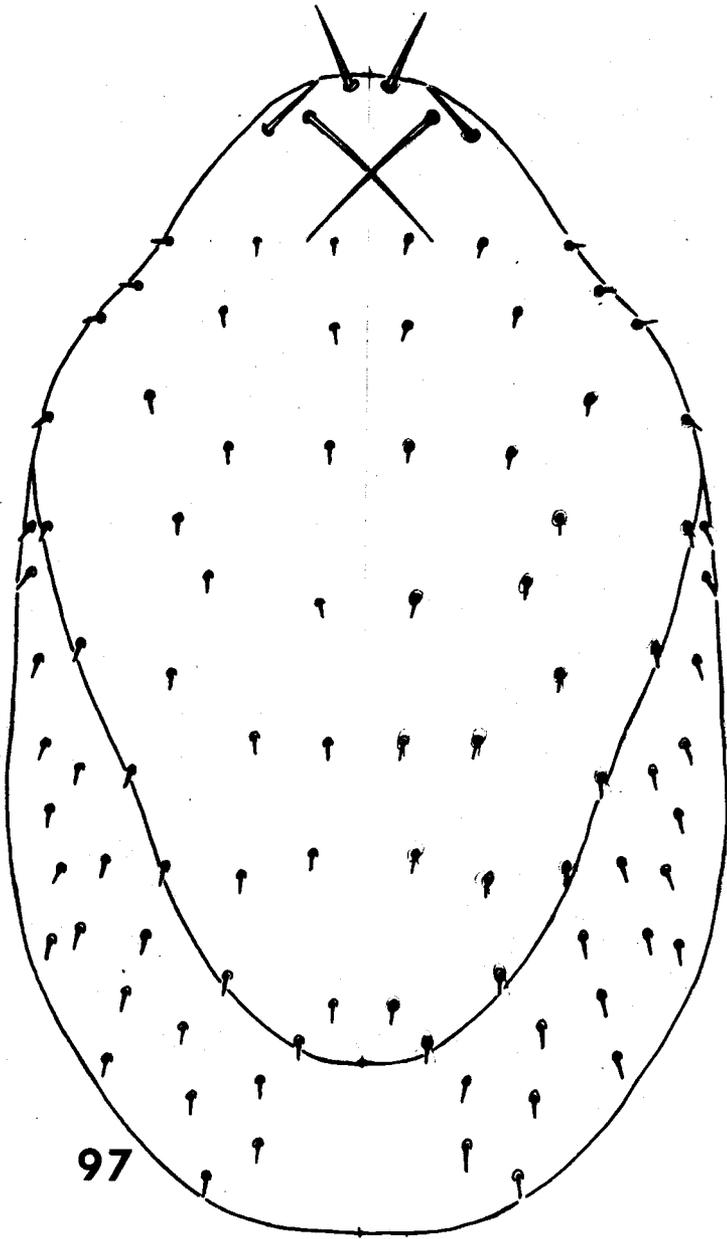


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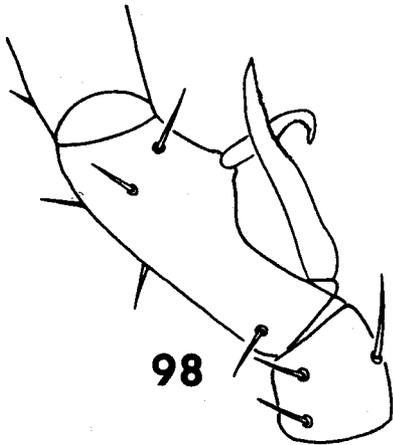
Figure 97. Dorsal view of the idiosoma of Pelethiphis mozambiquensis

Figure 98. Detail of the trochanter of leg II of female Pelethiphis mozambiquensis

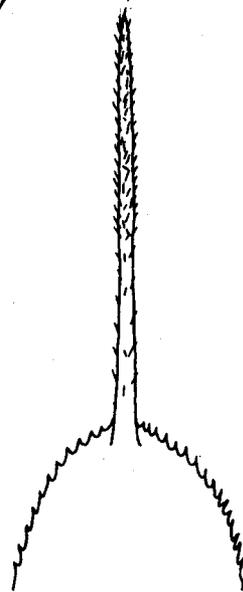
Figure 99. Epistome of Pelethiphis mozambiquensis



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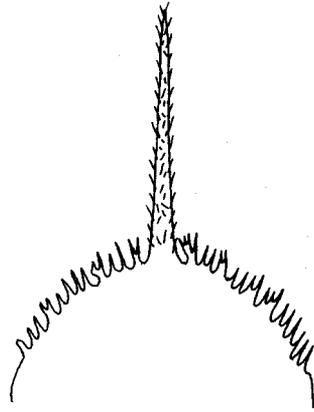
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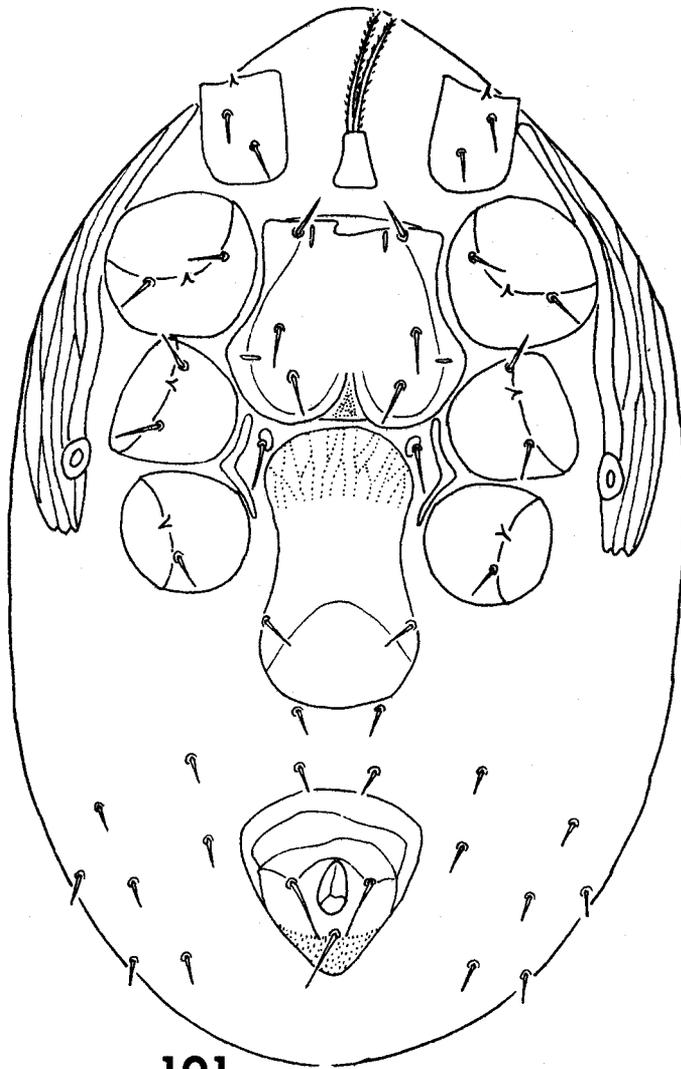
99

Figure 100. Epistome of Pelethiphis lobosternis

Figure 101. Ventral view of the idiosoma of female
Pelethiphis lobosternis

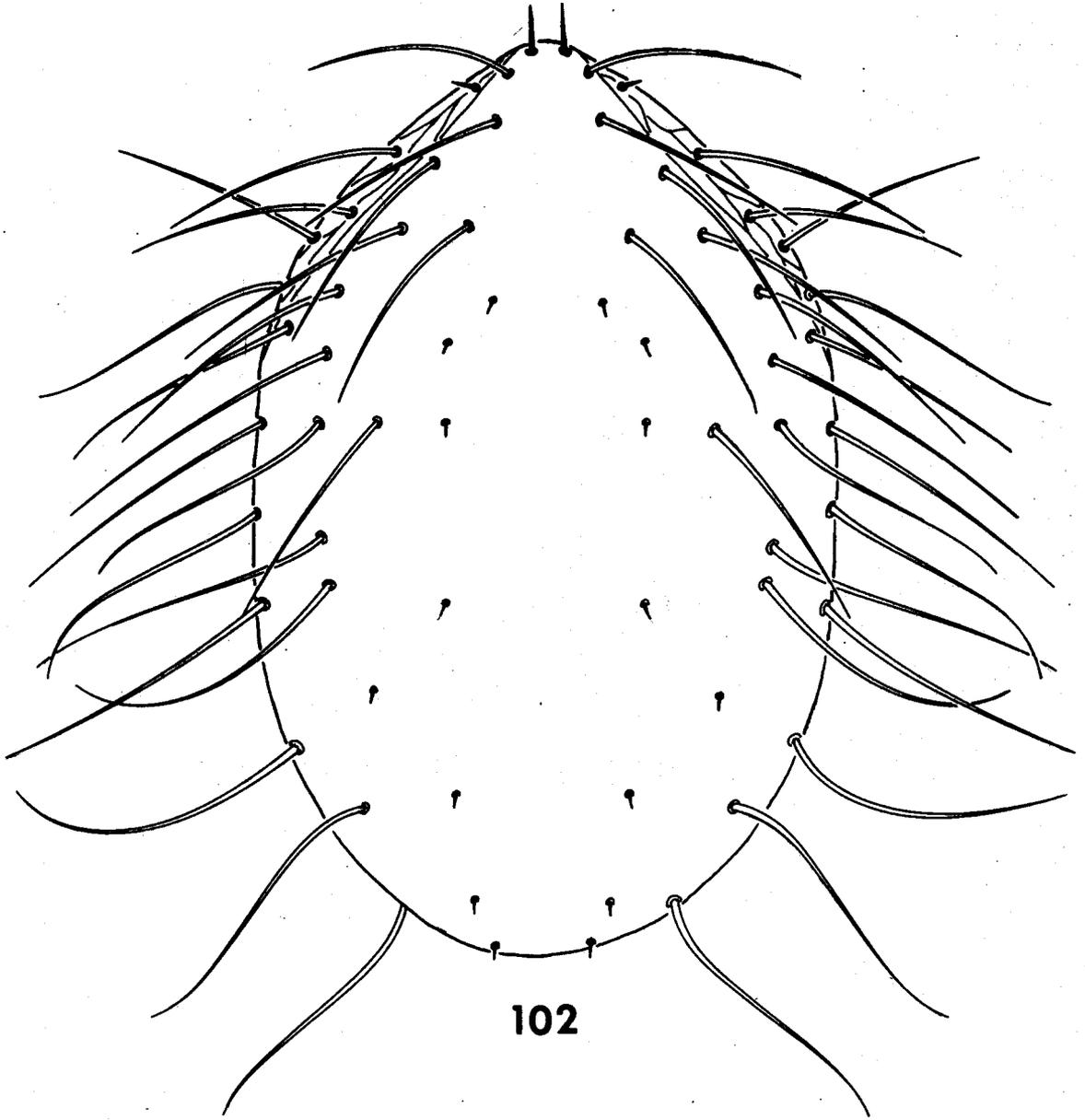


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Figure 102. Dorsal view of the idiosoma of Pelethiphis lobosternis

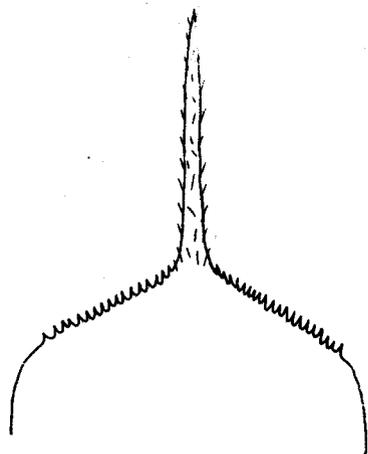


102

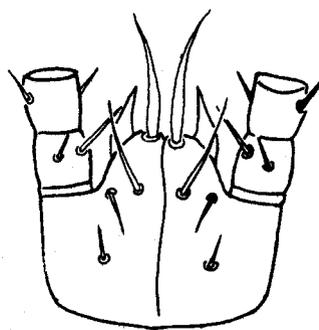
Figure 103. Epistome of Pelethiphis eiseleni

Figure 104. Ventral view of the idiosoma of female Pelethiphis eiseleni

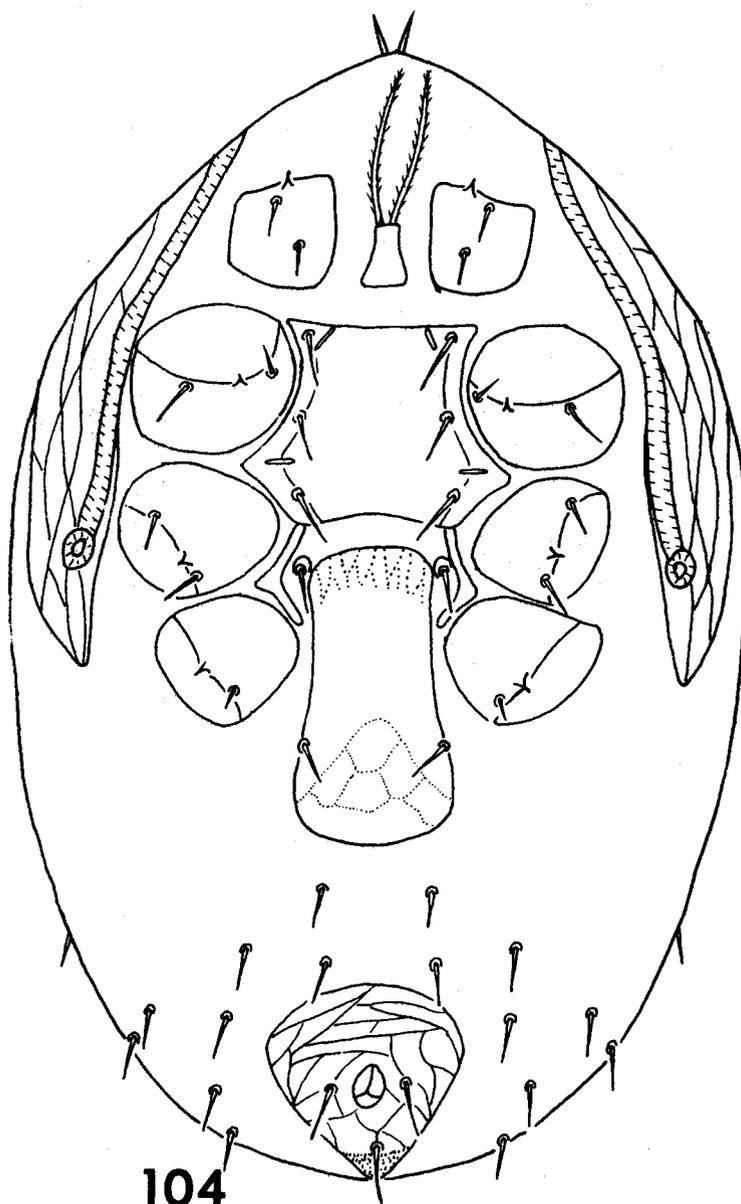
Figure 105. Ventral view of the gnathosoma of Pelethiphis eiseleni



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Figure 106. Epistome of Pelethiphis berlesei

Figure 107. Dorsal view of the idiosoma of Pelethiphis berlesei

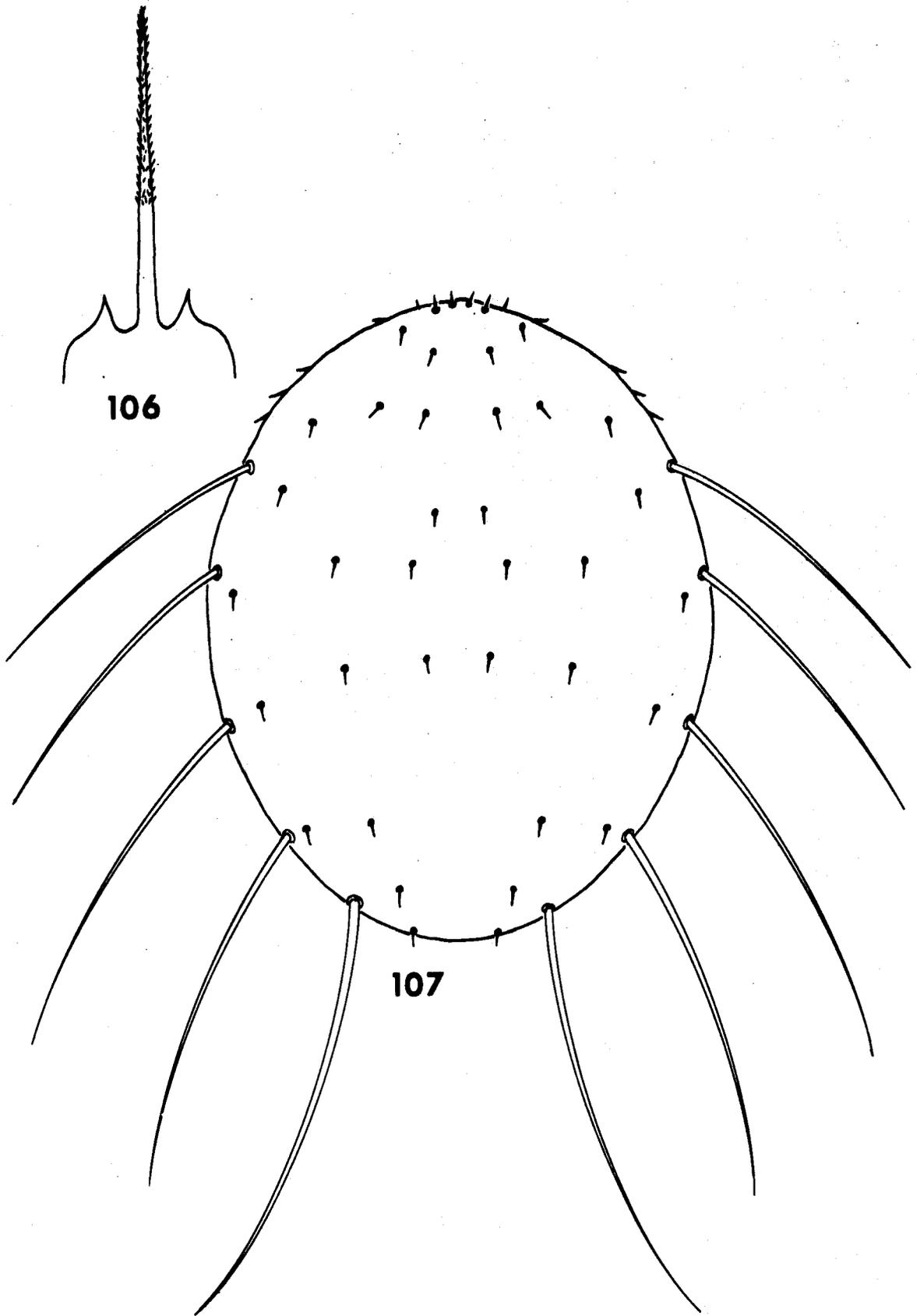
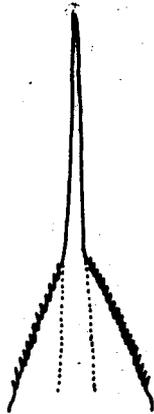


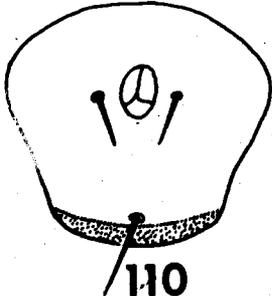
Figure 108. Epistome of Pelethiphis gurei

Figure 109. Dorsal view of the idiosoma of Pelethiphis gurei

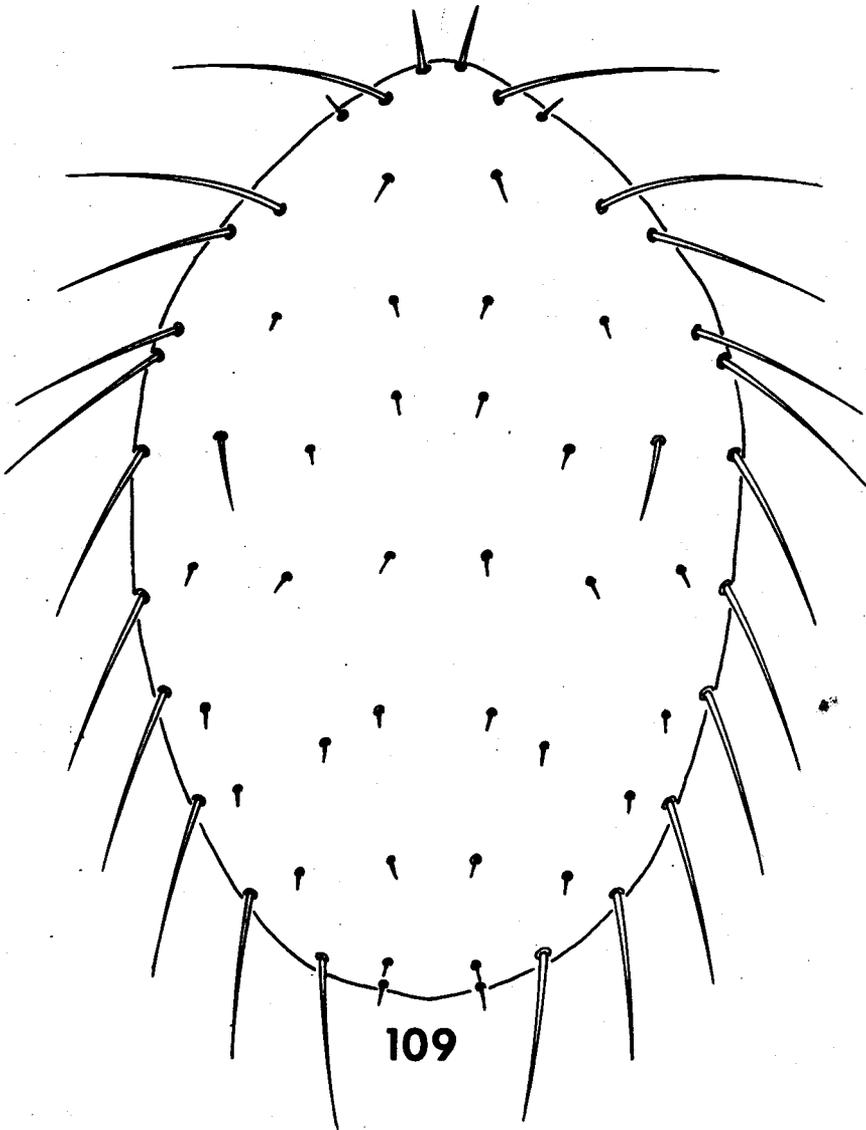
Figure 110. Anal shield of Pelethiphis gurei



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Figure 111. Dorsal view of the idiosoma of Pelethiphis geyeri
(after Ryke and Meyer 1957)

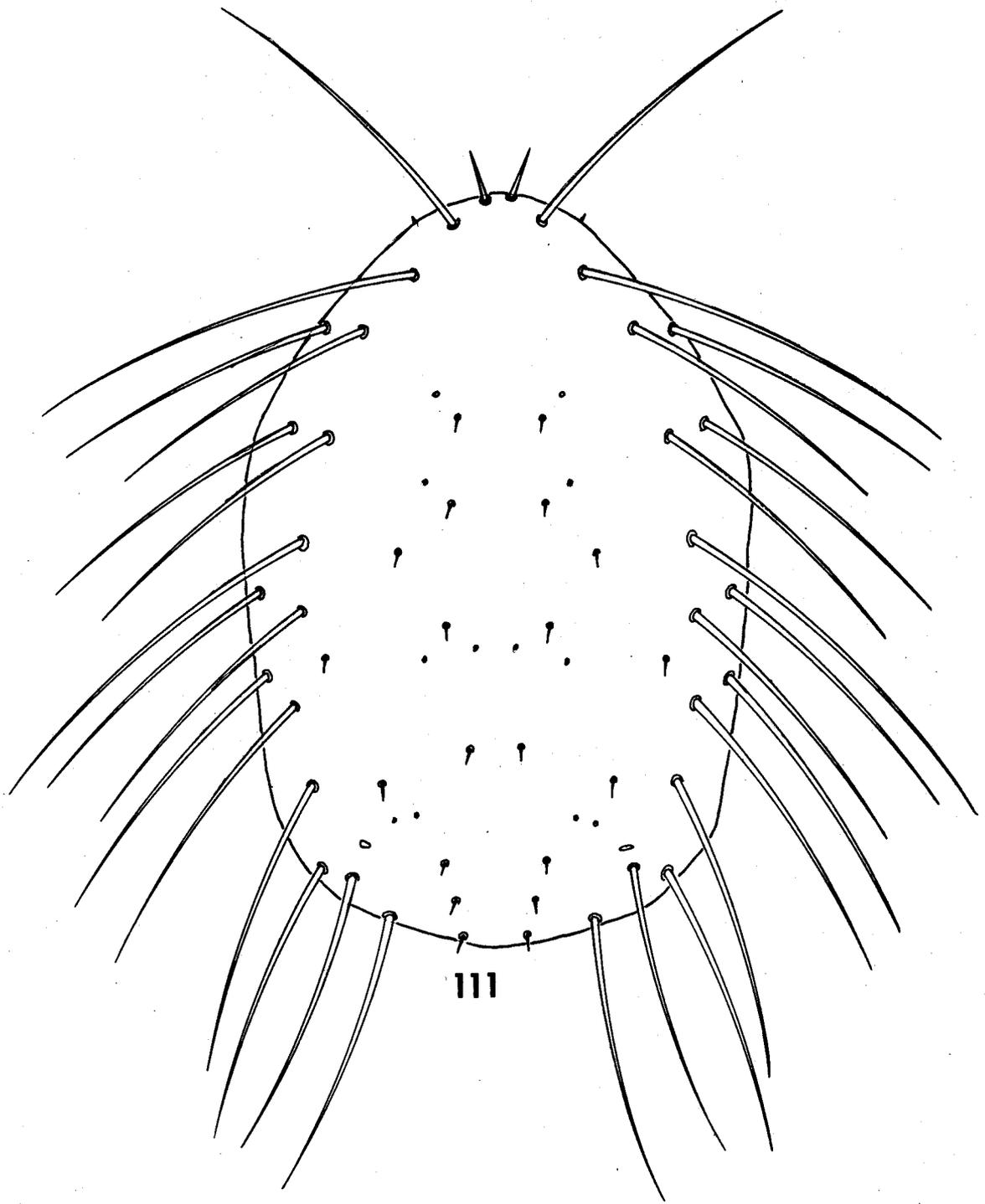
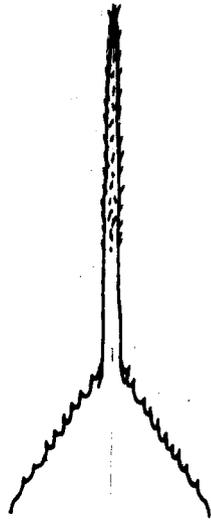
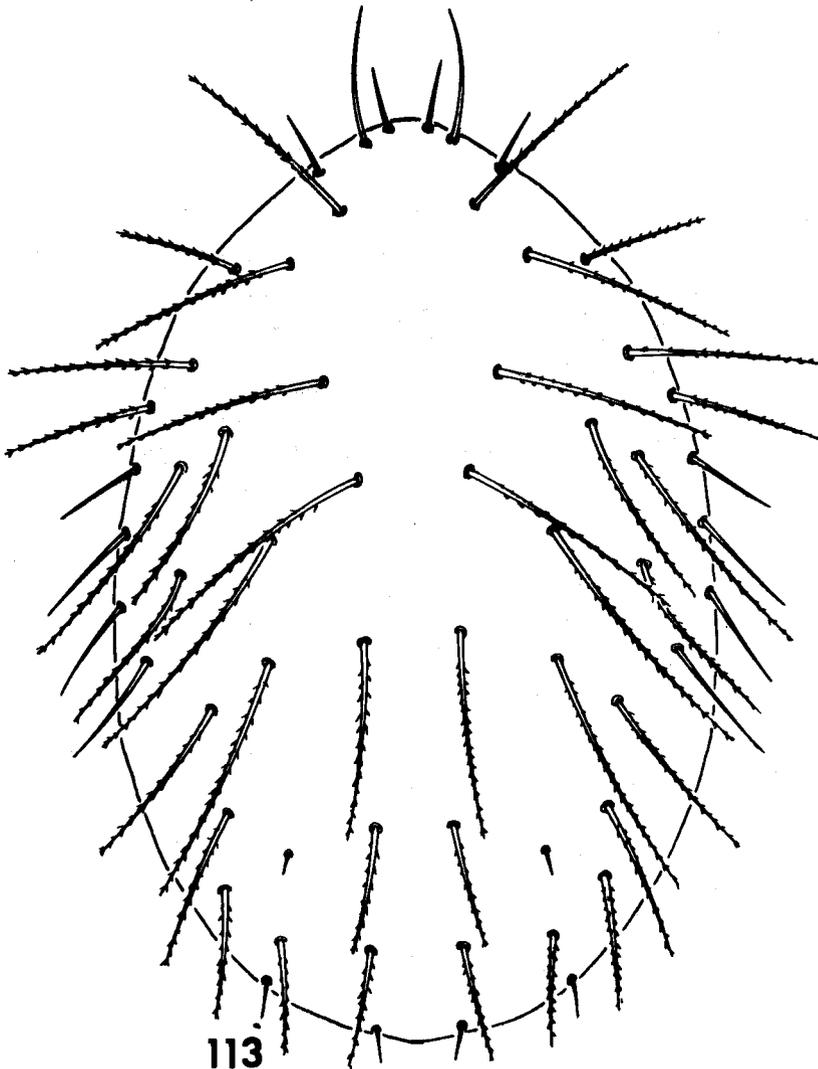


Figure 112. Epistome of Pelethiphis pectinatus

Figure 113. Dorsal view of the idiosoma of Pelethiphis pectinatus



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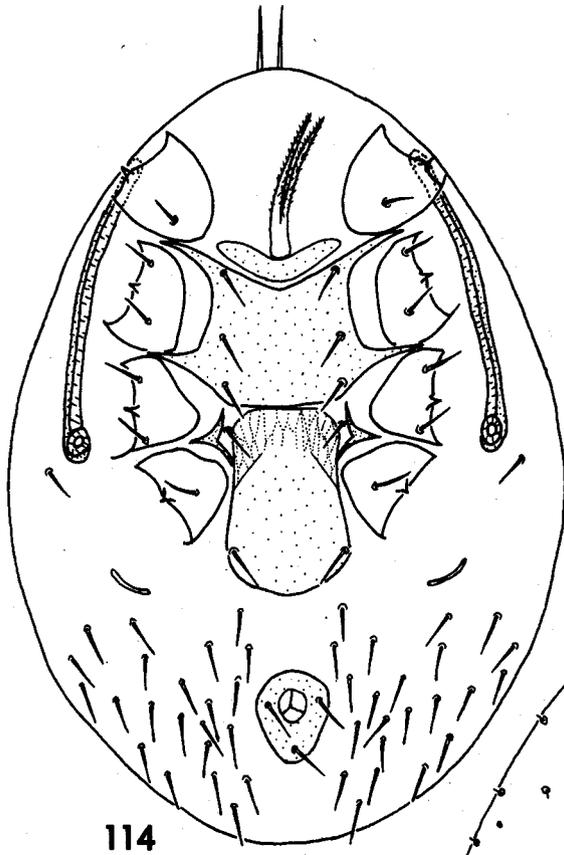


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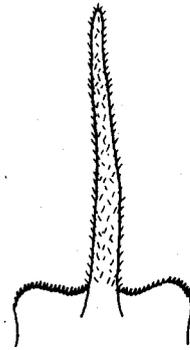
Figure 114. Ventral view of the idiosoma of female Pelethiphis insignis

Figure 115. Dorsal view of the idiosoma of Pelethiphis insignis

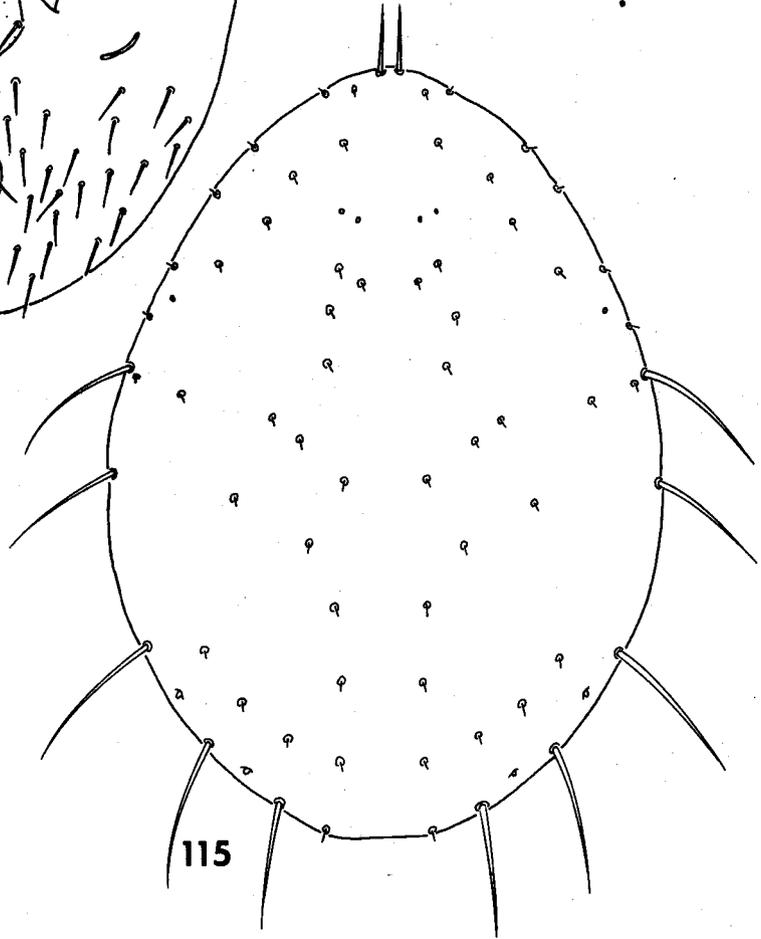
Figure 116. Epistome of Pelethiphis insignis



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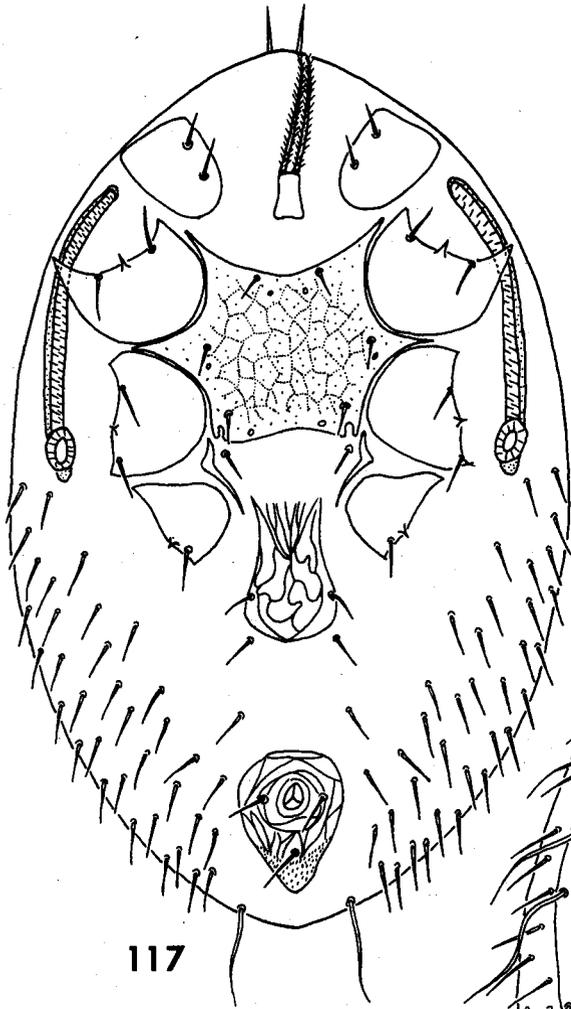


115

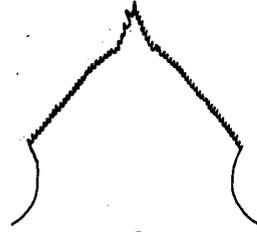
Figure 117. Ventral view of the idiosoma of female Pelethiphis garretis

Figure 118. Dorsal view of the idiosoma of Pelethiphis garretis

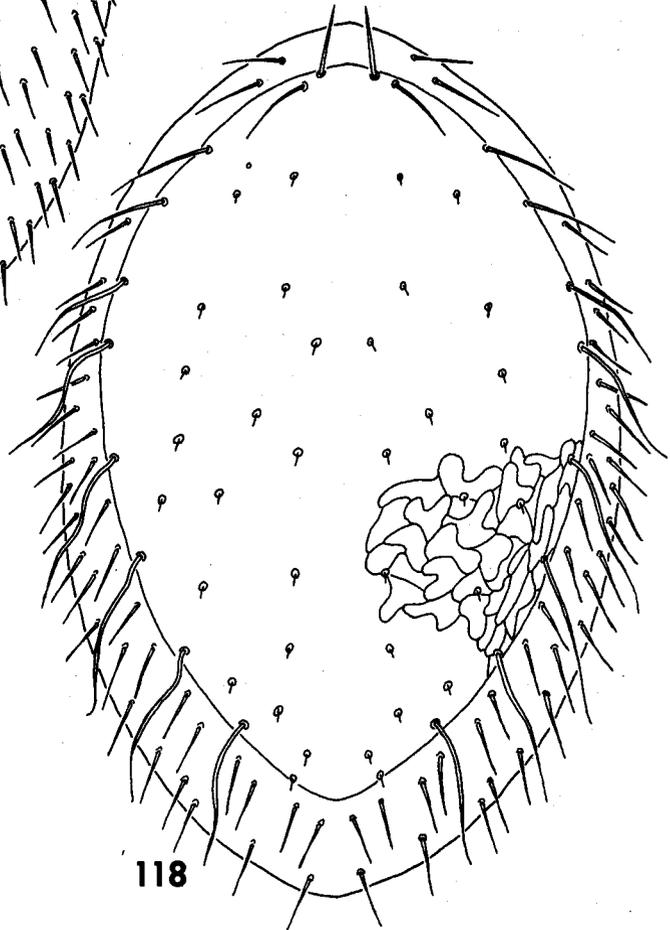
Figure 119. Epistome of Pelethiphis garretis



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- Figure 120. Anal shield of Pelethiphis geyeri
- Figure 121. Epistome of Pelethiphis geyeri
- Figure 122. Femur of leg II of male Pelethiphis ciliatus
- Figure 123. Epistome of Pelethiphis ciliatus
- Figure 124. Dorsal view of the idiosoma of Pelethiphis ciliatus
(after Berlese, 1882)

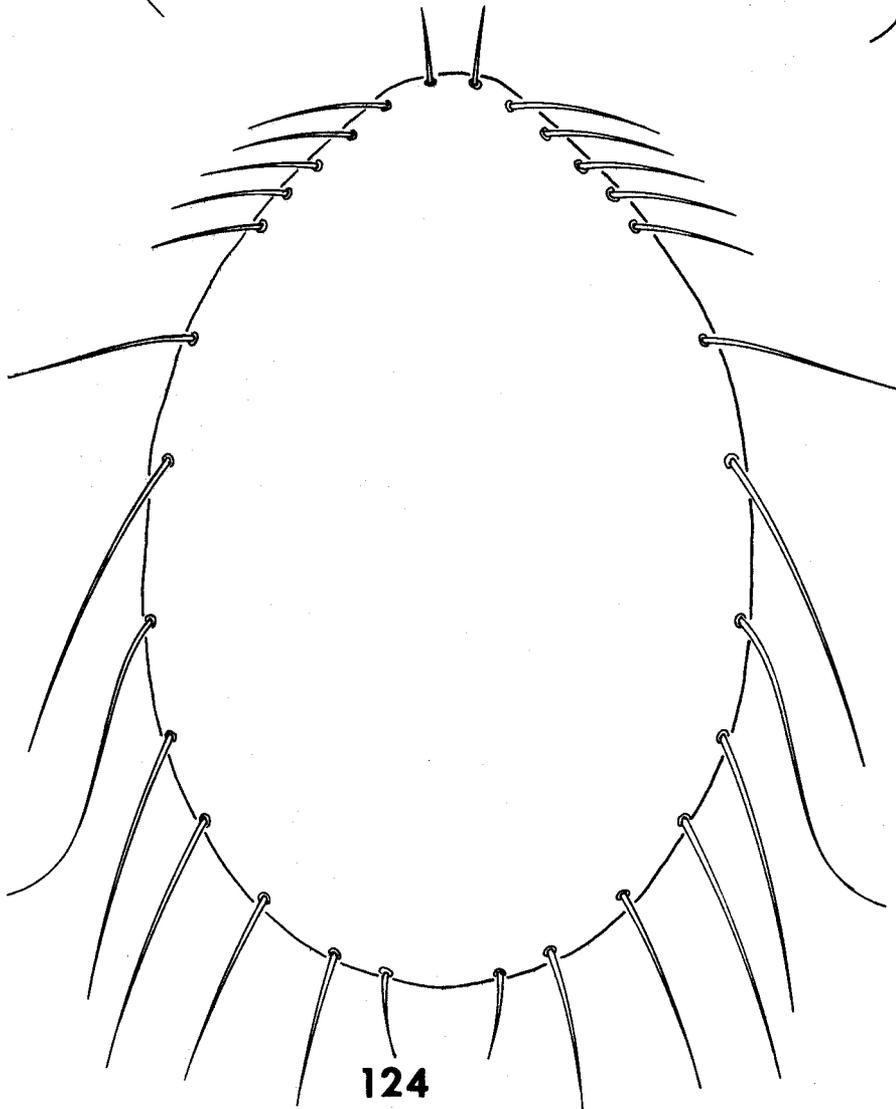
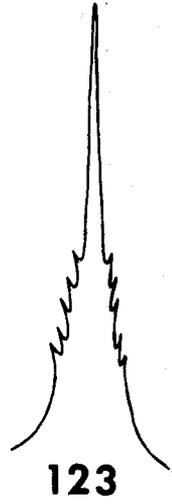
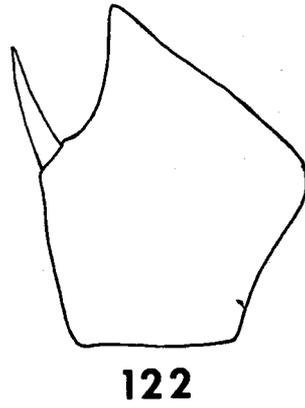
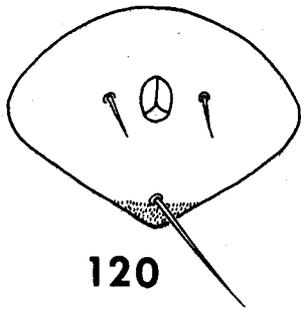
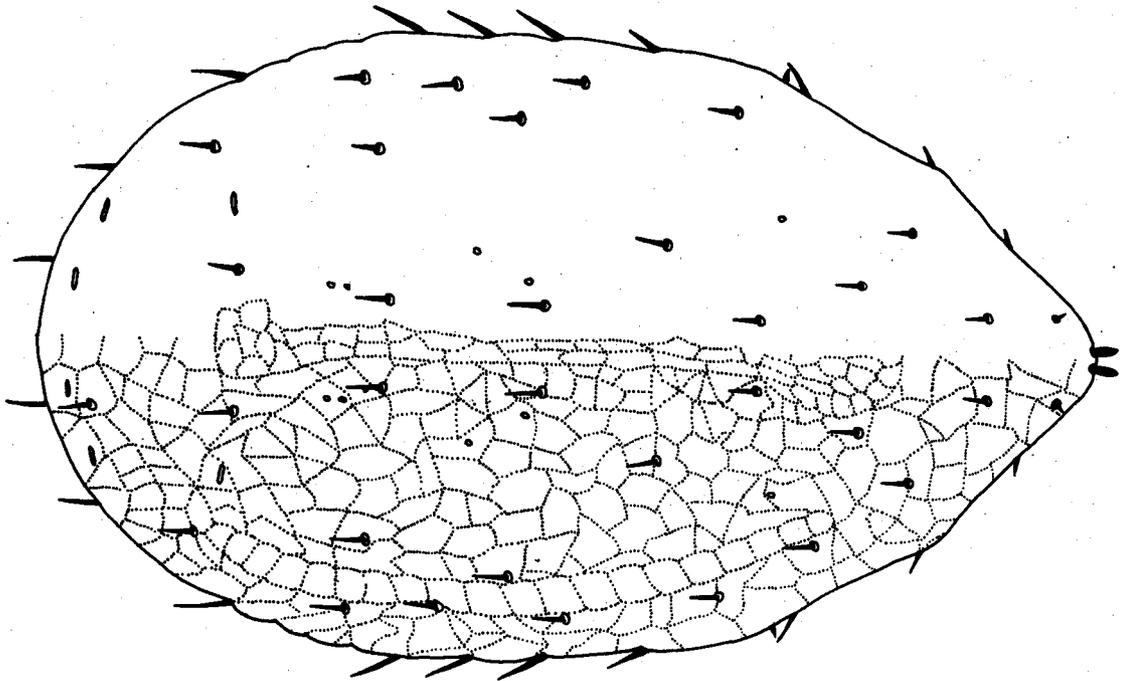


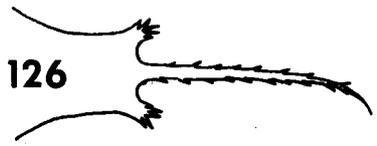
Figure 125. Dorsal view of the idiosoma of Scarabaspis rykei

Figure 126. Epistome of Scarabaspis rykei

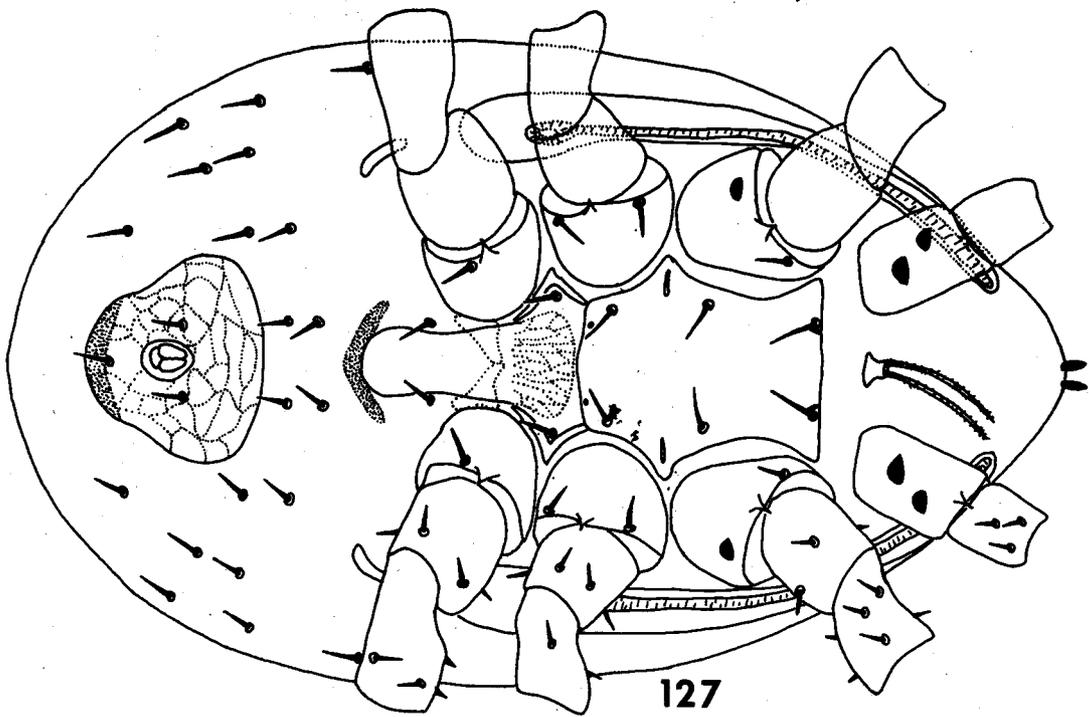
Figure 127. Ventral view of the idiosoma of female Scarabaspis rykei



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