

Keys to the Phytoseiid Mites (Parasitiformes, Phytoseiidae) of Israel*

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Summary

Fifty one species of predacious mites of the family Phytoseiidae are reported from Israel. A key is given for the identification of genera and species. Data on host plants and distribution in Israel are provided for each species.

Riassunto

Chiave dei fitoseidi (Parasitiformes, Phytoseiidae) di Israele

Vengono riportate 51 specie di acari predatori della famiglia Phytoseiidae rinvenute in Israele. Viene fornita una chiave per la identificazione dei generi e delle specie. Vengono inoltre riferite informazioni sulle piante ospiti e sulla distribuzione delle varie specie in Israele.

Key Words: Predacious mites, Phytoseiidae, keys, Israel.

Introduction

This paper keys the adult females of the family Phytoseiidae collected in Israel (Amitai and Swirski, 1966, 1968, 1970, 1978, 1980; Grinberg, 1971; Grinberg and Amitai, 1970; Porath and Swirski, 1965; Rivnay and Swirski, 1980; Swirski and Amitai, 1961, 1965, 1967, 1968, 1984, 1985, 1990, 1997a, b; Wysoki and Swirski, 1971a, b). Data on plant hosts and distribution in Israel are given for each species.

Phytoseiid mites have received global attention since the 1950's, when it became evident that some species play an important role in controlling phytophagous mites, thrips and some other small insects.

The division of the family Phytoseiidae into three subfamilies (Amblyseiinae, Phytoseiinae and Typhlodrominae) follows the system used by

* Partly supported by M.U.R.S.T. (60%) funds.

Chant and McMurtry (1994). It should be pointed out that according to Ragusa and Athias-Henriot (1983) and Ragusa and Tsolakis (1994) (revisions of the genera *Neoseiulus* Hughes and *Kampimodromus* Nesbitt), a genus is characterized by the shape of the insemination apparatus and by some characters related to that shape. That means that specimens which have the same shape of the insemination apparatus, corresponding with a series of similar related characters, belong to the same genus. The various species can be differentiated by some characters (different lengths of setae, little variations in the organotaxie, slight differences in the form of the calyx etc.). According to the above Authors most diagnoses of genera concern with plurigeneric taxa, as the criteria taken into account are too deviant and too variable.

Materials and Methods

Mites were stored in 70% alcohol, cleared in Nesbitt's solution (chloral hydrate 8, hydrochloric acid 0.5, water 5) and mounted in Hoyer's medium. For observations and drawings mites were examined with an interference contrast Zeiss Axioplan microscope. All measurements are given in microns.

Morphological Introduction

Female

The body is separated into an anterior gnathosoma and a posterior idiosoma.

Gnathosoma

Gnathosoma has paired mouthparts - three-jointed chelicerae and six-jointed pedipalps (coxa, trochanter, femur, genu, tibia and tarsus). The chelicera (fig. 3) contains a fixed digit (*digitus fixus*) and a movable digit (*digitus mobilis*). The fixed digit carries teeth and a *pilus dentilis*. The teeth are aligned anterad and often also posterad to the *pilus dentilis*. The movable digit is edentate, or toothed. The teeth of both digits assist in cutting of their prey's cuticle. Chelicerae are generally well developed; rarely the movable digit, or the fixed digit, may be reduced. Pedipalps have chemosensory and thigmotactic setae that assist in locating their food. The mouth is concealed by the pedipalps and the chelicerae. Dorsally the gnathosoma is covered by a thin shield - tectum.

Idiosoma

The idiosoma comprises an anterior podosoma and a posterior opisthosoma; and each of these two sections can be divided further into dorsal and ventral podosoma, dorsal and ventral opisthosoma.

Lateral integument (dorsal interscutal membrane), which may be soft or sclerotized, is situated on either side of the dorsal shield. The setae r3 and R1 are normally inserted on the lateral integument (figs. 7-14, 16-20), but sometimes they may be located on the dorsal shield (fig. 15).

Dorsum

The idiosoma is dorsally covered by a dorsal shield, which is separated into podonotum and opisthonotum (fig. 1) delineated anterior to the bases of setae R1.

The dorsal shield may be sclerotized to a greater or lesser degree; pale or dark in colour; smooth or sculptured by reticulate, imbricate, creased, tuberculate, lunate or other forms of ornamentation.

Venter

The tritosternum, including a basal section and two setiform distal processes, is found posterior to the gnathosoma.

The venter bears three large shields: sternal, genital and ventrianal shields (fig. 2).

The sternal shield bears two or three pairs of setae (ST1, ST2 and ST3) and two pairs of poroides. In case of two pairs of setae, then seta ST3 is either inserted on a small platelet, or is free on the interscutal membrane. Seta ST4 is either free, or placed on a metasternal plate, which has a poroid on its anterior end.

The genital shield is usually trapeziform and bears an oval opening in its anterior part, a pair of setae (ST5) and three pairs of genital sigilla (V-line).

The ventrianal shield always bears an anus, a pair of para-anal setae (PA) and one post-anal seta (PST). The shield is usually provided with one to few pairs of preanal setae and often with punctate or crescent-shaped pores (solenostomes, gv3). The latter are usually placed between the anus and the preanal setae, but sometimes they are shifted anteriorly and can be more or less far apart.

The ventral interscutal membrane is also provided with a pair of primary inguinal sigilla (primary metapodal plates) and a pair of secondary inguinal sigilla (secondary metapodal plates) (fig. 2), which are usually separated, but sometimes united, or the secondary inguinal sigilla are not visible. Between the genital and ventrianal shields, as well as on the membrane flanking the ventrianal shield, other genital sigilla are present, the most important from taxonomic point of view, being those of the 6th pair (sgpa) (fig. 2).

Adult setal idiosomal pattern

In our early works we used the setal terminology of Garman (1948) and Nesbitt (1951). In the present paper the system of Rowell *et al.* (1978) is followed. In 1957 Athias-Henriot and Hirschmann independently distinguished setal homologies in the dorsal chaetotaxy. Following them

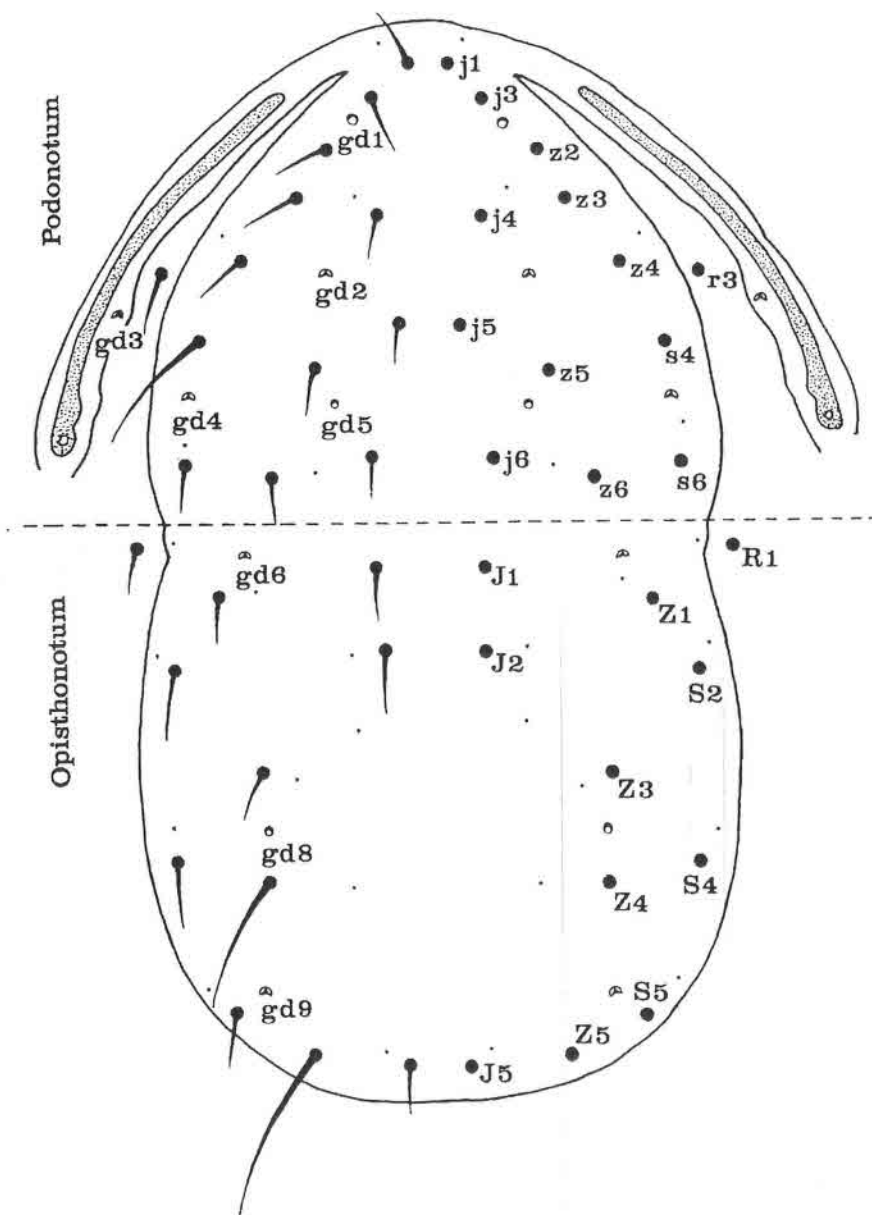


Fig. 1 - Diagrammatic demonstration of dorsal idiosomal setae, solenostomes and poroides in a hypothetical adult female; indicating the maximum number of setae (24) and solenostomes (8) cognizable in the family Phytoseiidae. Solenostomes gd1, gd5 and gd8 are shown as punctiform; solenostomes gd2, gd3, gd6, and gd9 are shown as crateriform.

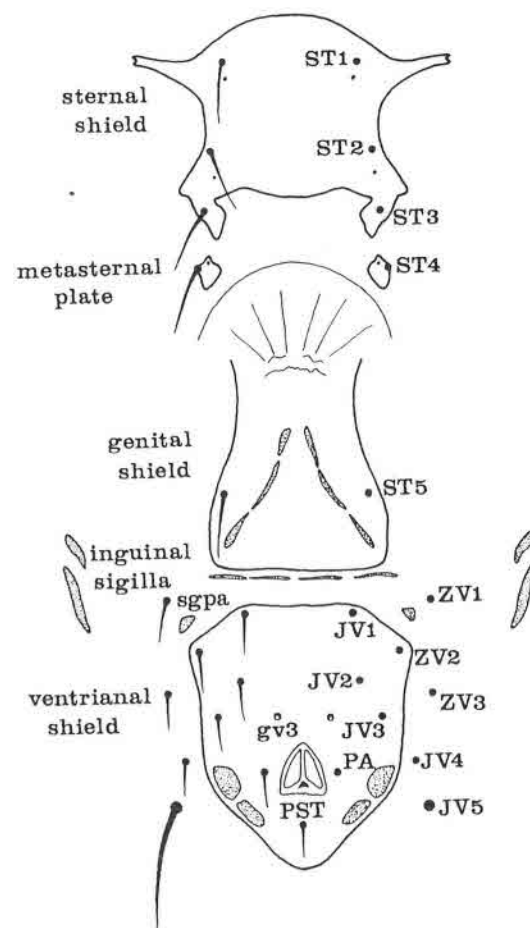


Fig. 2 - Diagrammatic demonstration of ventral idiosomal setae, shields, plates, sigilla and solenostomes in a hypothetical adult female indicating the maximum number of setae (29) cognizable in the family Phytoseiidae.

Lindquist and Evans (1965) offered a system of idiosomal setal nomenclature for various families of Gamasina, which is based under the notion of transverse idiosomal metameres and longitudinal setal series. Rowell *et al.* (1978) adopted the Lindquist and Evans system for the family Phytoseiidae. The chaetotactic pattern included six paired longitudinal series of setae; a pair of para-anal setae (PA) and the single post-anal seta (PST) (both on the ventrianal shield) (figs. 1, 2). The six longitudinal series consist of the j-J, z-Z, s-S series (on the dorsal shield) the r-R series [on the lateral integument (fig. 1)] and the ST-JV-ZV series (on the ventral surface) (fig. 2). The names

of the podonotal setae are in lower case letters and the names of opisthonotal setae in capital letters.

Chant and Yoshida-Shaul (1989, 1991, 1992) and Chant and McMurtry (1994) studied the idiosomal chaetotaxy in many genera and species of the subfamilies Phytoseiinae, Typhlodrominae and Amblyseinae.

Sizes of the idiosomal setae are very variable from microchetae (5-15 in length) to very long whip-like macrochetae. Their form can be setaceous (hair-like), serrate (toothed), knobbed, blunt, whip-like etc.; or they can show combination of the above traits.

Adenotaxie, poroidotaxie and sigillotaxie

A variable number of solenostomes is present on the dorsal shield and their position is almost stable (fig. 1). They are named by Athias-Henriot (1975) as follows: gd1, gd2, gd4, gd5, gd6, gd8 and gd9. Solenostomes gd3 are located on the peritremal shield (fig. 1), while solenostomes gd7 are absent in the family Phytoseiidae. When all the above dorsal solenostomes are present, we have an orthadenic species; while when one or some of them are missing, we have a meriadenic species. The shapes of the solenostomes can be crateriform, punctiform or crescent.

In the drawings of the dorsal shields (figs. 1, 21-40) we indicate the location of poroides (poroidotaxie) and sigilla (sigillotaxie), which have a well-nigh stable position and number (Athias-Henriot, 1975). But it should be pointed out that in the present paper they are not used as taxonomic criteria.

Insemination apparatus (Spermatheca)

The insemination apparatuses in the adult female are internal paired organs (fig. 4). Dosse (1958) determined their function. The terminology applied to the different constituents of the insemination apparatus by Athias-Henriot (1971, 1977) is followed in this paper. A comparatively large duct, the adductor duct (major duct) opens on the venter between the coxae III and IV. Its external opening (sperm induction pore, or solenostome) may be altered to form a receptacle. The atrium, which follows the adductor duct, is of varying size and structure and is either inserted in the distal portion of the insemination apparatus - the calyx (cervix) (figs. 106, 111) or fastened to it (fig. 83), or linked to the calyx through a neck (figs. 81, 101). The calyx, which is covered by a membrane - the vesicle, has different characteristic forms and can be sclerotized to a lesser or more degree. A thin duct, the spermatic channel (minor duct), originating in the atrium, is not distinct in some mounted specimens within boundaries of the same species and not notable at all in certain species.

The insemination mechanism is quite complicated. Dosse (1959) claimed erroneously that the spermatophore is inserted into the genital opening of the female in lieu of the sperm induction pore. "... it is common among researchers of phytoseiids to refer to the endospermatophore deposited in the spermatheca as the "spermatophore". In other words, they believe that the whole spermatophore (exospermatophore in this paper)... is

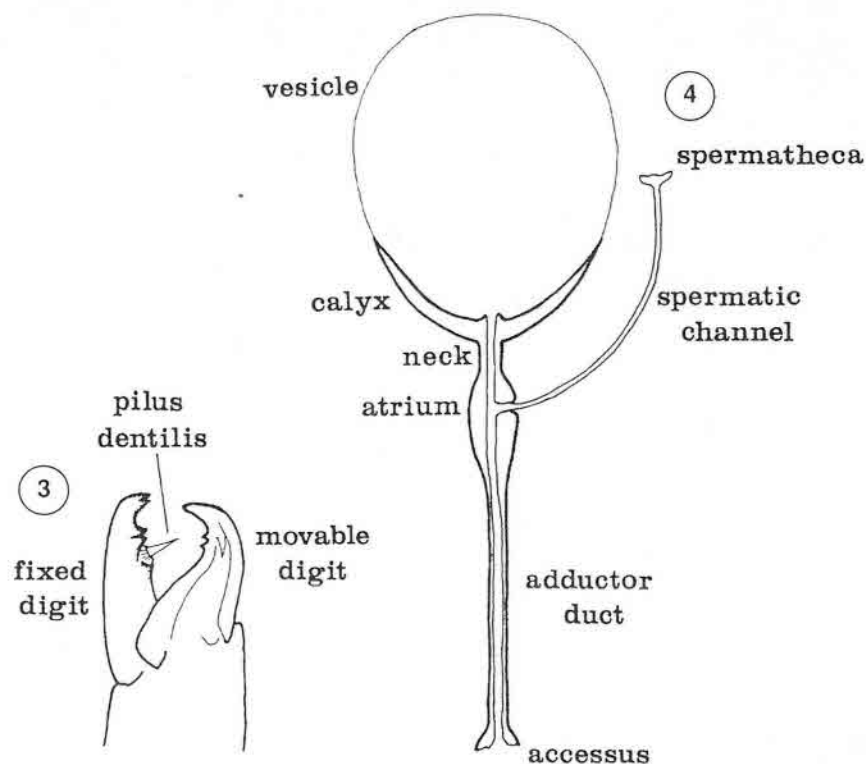


Fig. 3 - Cheliceral structure in a female.

Fig. 4 - Structure of the insemination apparatus in a female.

deposited in the female spermatheca" (Amano and Chant, 1979). The latter Authors suggest that the ectospermatophore stays behind at the base of male's chelicera in the course of, and following, insemination. Spermatozoa are probably carried in the spermatic channel to a small structure considered by Athias-Henriot (1971) as the spermatheca, in which they accumulate. From the latter site the spermatozoa proceed to the genital system through an incomprehensible course.

Respiration

Respiration of phytoseiids is attained by the aid of tracheal system, a network of tracheae and tracheoles. Tracheae open outside in a pair of stigmata, which are found on the lateral integument at the level of coxae III and IV. Associated with the stigmata there is a chitinous tube - the peritreme (fig. 1). The stigmata and the peritreme are placed on the peritremal shield, which may be accreted anteriorly to the dorsal shield and posteriorly curves around coxa IV. The peritremes extend anteriorly, sometimes to or

beyond the bases of setae j1. In some species they are short. Position of the apex of peritreme has an important taxonomic value.

Legs

Larvae have three pairs of legs, while the nymphs and adults possess four pairs. Each leg includes the following six segments: coxa, trochanter, femur, genu, tibia and tarsus. The latter is subdivided into basitarsus and telotarsus, as well as the third one into basifemur and telofemur.

The chaetotaxy of the legs is helpful in identification of genera and species. Number of setae on genu II is often used in the present key. In many species genu, tibia and basitarsus of leg IV and at times also those segments of legs II and III carry macrosetae. Setae are considered macrosetae if they differ remarkably from other setae of the segment on which they are inserted by their lengths and/or by their thickness, apices and other modifications.

Male

In the male the sternal and genital shields are united into one genitosternal shield, bearing five pairs of setae (ST1, ST2, ST3, ST4 and ST5) (fig. 5). The genital opening is located on the anterior margin of the shield. The usually triangular ventrianal shield (fig. 5) bears the anus, a pair of para-anal setae (PA) a post-anal seta (PST), a number of preanal setae and sometimes solenostomes. Since the ventrianal shields of the males show little interspecific variation, they are of little taxonomic value. Ventral interscutal membrane flanking the ventrianal shield and the anterior part of the latter are provided with eight pairs of setae (JV1, JV2, JV3, JV4, JV5, ZV1, ZV2 and ZV3) (fig. 5), some of them missing in various species.

The movable digit of chelicera is provided with the spermatodactyl (fig. 6), which has an important role during insemination [see insemination apparatus (spermatheca)]. The morphology of the spermatodactyl is used for species determination.

Keys to the subfamilies, genera and species

Key to the subfamilies in the family Phytoseiidae

1. Podonotum (figs. 7-14) with four pairs of z-s setae (z2, z4, z5, s4 and without z3, s6, z6) **Amblyseiinae**
- Podonotum (figs. 15-20) with more than four pairs of setae z-s (z2, z4, z5, s4 and with z3 and/or s6 and in some also z6) **2**
2. Opisthonotum (fig. 15) with two pairs of setae Z (Z4, Z5 and without Z1, S2, Z3, S4, S5). In most species the ventrianal shield (fig. 56) elongate, waisted, bearing three pairs of preanal setae, which are laterally aligned in a vertical row **Phytoseiinae**
- Opisthonotum (figs. 16-20) with at least three pairs of Z-S setae (Z4, Z5, and one, or usually more pairs of the following setae: Z1, S2, Z3, S4, S5)..... **Typhlodrominae**

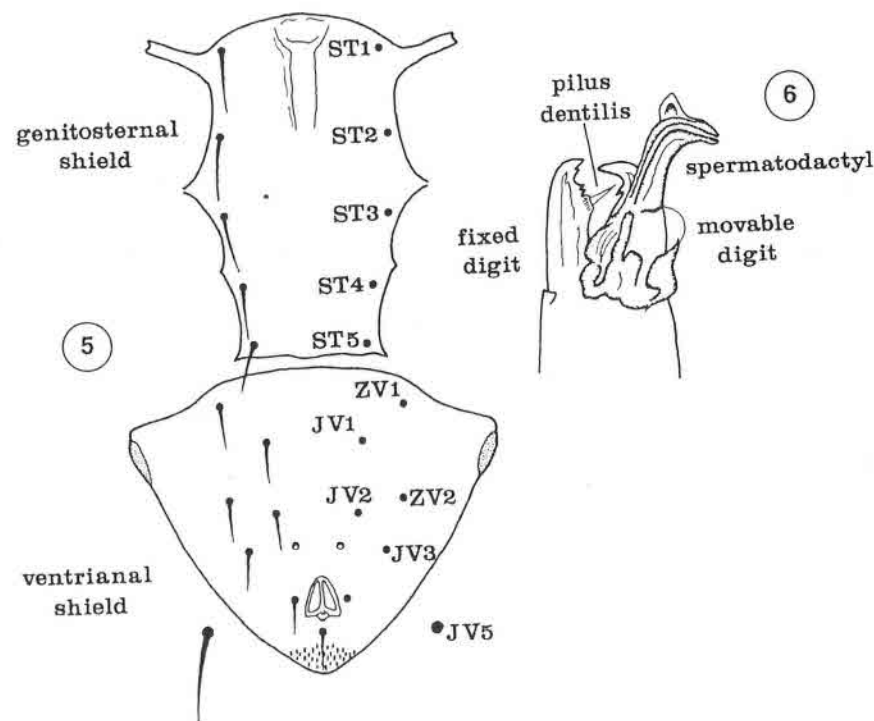


Fig. 5 - Diagrammatic demonstration of ventral idiosomal setae and shields in a hypothetical male. Maximum number of setae known to appear - 29 (ST1-ST5, JV1-JV5, ZV1-ZV3, PA, PST; setae JV4 and ZV3 are missing in the drawing).
Fig. 6 - Cheliceral structure in male.

Key to the adult females of the subfamily Amblyseiinae

1. "Wax plates" (fig. 21) present on the dorsal shield, on its setae and on setae of legs.
Opisthonotum (fig. 7) with six pairs of Z-S setae (Z4, Z5, Z1, S2, S4, S5). Lateral integument not sclerotized. Setae r3 and R1 on the lateral integument. Three pairs of preanal setae on the ventrianal shield (fig. 41). Macrosetae on leg IV scarcely differentiated. Sternal shield carries three pairs of setae. Chelicerae of normal size, paucidentate; *pilus dentilis* medially located. **Phytocerus** Amitai and Swirski
- Dorsal shield (fig. 21) strongly sclerotized, podonotum and opisthonotum covered with "wax plates"; with five pairs of small crateriform solenostomes (gd1, gd2, gd6, gd8 and gd9). All setae of the dorsal shield of moderate length, thick and situated on tubercles. Apex of peritreme reaches the bases of setae j1. Ventrianal shield (fig. 41) vase-shaped, broad at the post-anal level; smooth; solenostomes not visible. Ventral interscutal membrane flanking the ventrianal shield is provided with four pairs of setae. In the insemination apparatus (fig.

67) the calyx shallow, subhemispherical; a long neck present; atrium small; adductor duct cylindrical; spermatic channel discernible. Hypostome and palp 133-199 (usually 166-181), 0.59-0.80 (usually 0.72-0.79) of leg I length; fixed digit of the chelicera is provided with one bifid tooth and a *pilus dentilis*; the movable digit edentate. Genu II carries seven setae. J2 33-43, Z4 45-55, Z5 45-66. On *Acacia*. Dead Sea and Arava Valley

P. desertorum Amitai and Swirski, 1978

- "Wax plates" absent on the dorsal shield, on its setae and on the setae of legs

2. Hypostome and palp long, 199-265, 0.8-1.08 of leg I length. Leg IV without macrosetae, or with a scarcely pronounced stIV; with short thick setae on genu, tibia, basitarsus and telotarsus. Length of the ventrianal shield (fig. 44) exceeds its width; with two pairs of preanal setae (some specimens carry three preanal setae). Setae on the dorsal shield (figs. 8, 24) thorn-like, inserted on tubercles. Seta Z5 short (23-28); remaining setae on the dorsal shield short (J2, Z4 20-25).

Five pairs of setae on the ventral interscutal membrane flanking the ventrianal shield (JV1, ZV1, ZV3, JV4, and JV5). Chelicera paucidentate

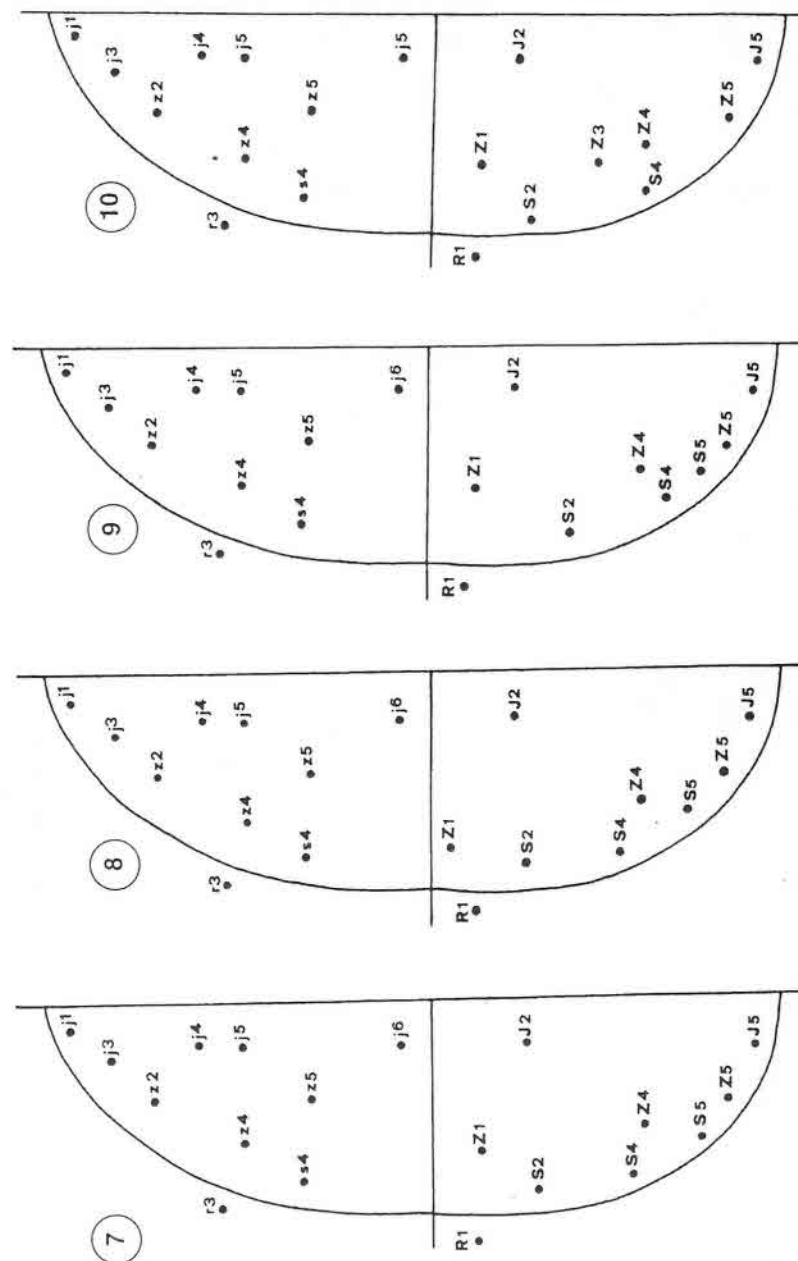
Paragigagnathus Amitai and Grinberg

Dorsal shield (fig. 24) strongly sclerotized and ornamented with striated and lunate structures; with five pairs of very small crateriform solenostomes (gd1, gd2, gd6, gd8 and gd9); some of the setae blunt and some pointed. Three pairs of setae on the sternal shield. Apex of peritreme reaches the bases of setae j1. Ventrianal shield (fig. 44) vase-shaped, widest at the anal level, usually waisted; its anterior margin with a notch, or convex, or concave, or less often straight; sclerotized, smooth; with a pair of minute solenostomes (in some specimens not visible). Calyx of insemination apparatus (fig. 70) shallow; a long neck present; adductor duct cylindrical and broad; spermatic channel usually not prominent, in few specimens small and scarcely seen. Seta stIV, if pronounced, pointed, short, not reaching the dorsal lyriform fissure, 22. Fixed digit of the paucidentate chelicera is provided with one tooth (sometimes with an additional one, scarcely discernible) and a *pilus dentilis*; movable digit unidentate. On *Tamarix* and *Atriplex*. Jordan Valley, Judean Desert, Central Negev, Dead Sea and Arava Valley

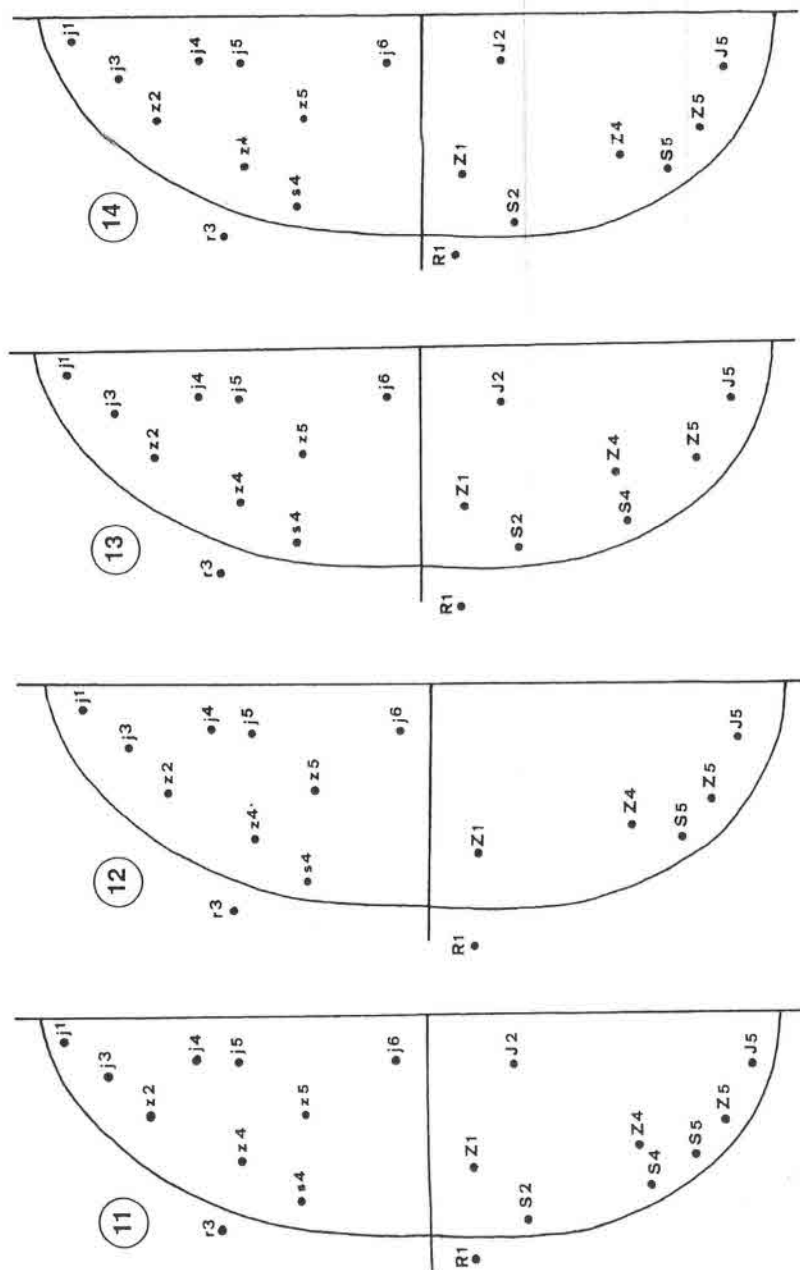
P. tamaricis Amitai and Grinberg, 1971

- Hypostome and palp much shorter. Leg IV usually carries one or few macrosetae. Combination of the structure of ventrianal shield and setae on the dorsal shield not as above
3. Opisthonotum (figs. 9-11) with six pairs of Z-S setae (Z4, Z5, Z1, S2, S4, S5 or Z3)
 4. Opisthonotum (figs. 12-14) with less than six pairs of Z-S setae
 4. Lateral integument strongly sclerotized.

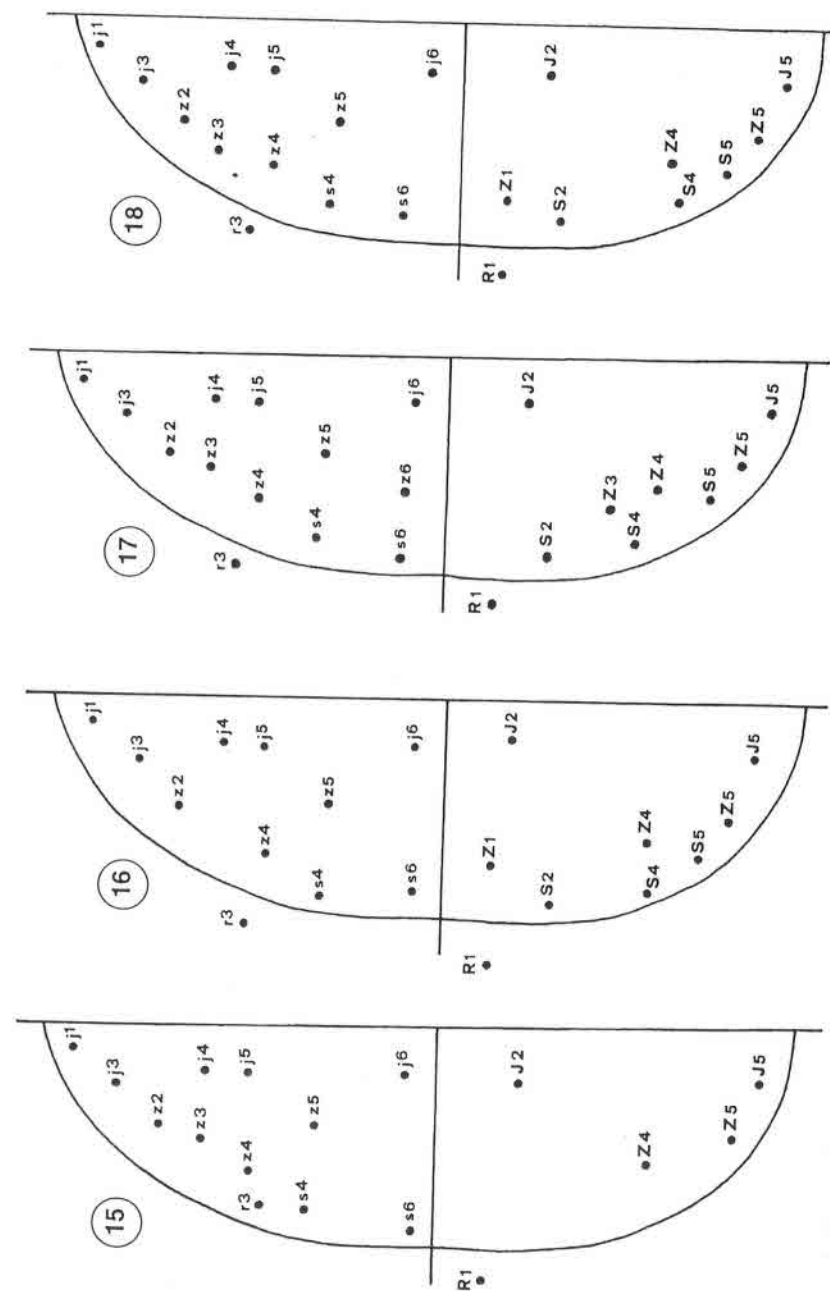
On the opisthonotum (fig. 9) seta S5 present and seta Z3 absent. Three pairs of setae on the sternal shield. Ventral interscutal membrane flanking the ventrianal shield is provided with four pairs of setae. Setae r3 and R1 on the lateral integument. Legs normal, with macrosetae on leg IV *Iphiseius* Berlese
Dorsal shield (fig. 22) moderately to strongly sclerotized (less often weakly sclerotized), smooth. Seta j1 of moderate length (27-30) and seta Z5 is short (10-13), the other setae are minute microchetiae (2-4); with seven pairs of small crateriform solenostomes (gd1, gd2, gd4, gd5, gd6, gd8 and gd9). Apex of peritreme



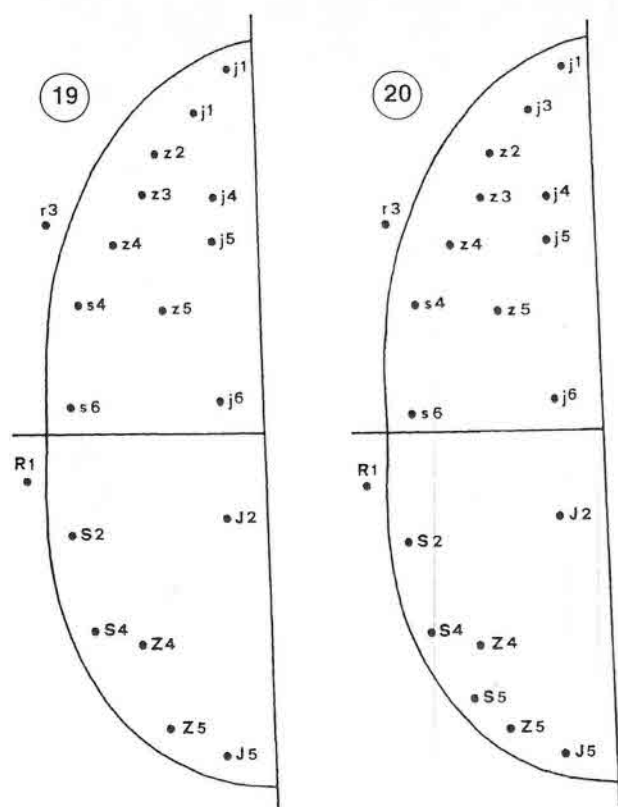
Figs. 7-10 - Diagrammatic demonstration of the dorsal idiosomal setal insertions in adult females for the following genera: 7. *Phytocerus* Amitai and Swirski; 8. *Paragigagnathus* Amitai and Grinberg; 9. *Iphiseius* Berlese; 10. *Typhloseiella* Muma.



Figs. 11-14 - Diagrammatic demonstration of the dorsal idiosomal setal insertions in adult females for the following genera: 11. *Amblyseius* Berlese (se- ta J2 usually present, in some species as *A. messor*, it is missing); 12. *Phytoseiulus* Evans; 13. *Amblyseius* Muma; 14. *Kampimodromus* Nesbitt.



Figs. 15-18 - Diagrammatic demonstration of the dorsal idiosomal setal insertions in adult females for the following genera: 15. *Phytoseius* Ribaga; 16. *Cydnoseius* Muma; 17. *Bauus* van der Merwe; 18. *Typhloseiulus* Chant and McMurtry.



Figs. 19, 20 - Diagrammatic demonstration of the dorsal idiosomal setal insertions in adult females for the following genera: 19. *Typhlodromus* Scheuten; 20. *Amblydromella* Muma.

reaches the bases of setae j1 or lateriad to them. Ventrianal shield (fig. 42) is separated into ventral and anal shields; the ventral shield is elongate transversely, bearing three pairs of preanal setae; the anal shield bears the normal three setae (PST and a pair PA); a pair of large solenostomes posterad to ventral shield. In the insemination apparatus (fig. 68) calyx thin, tube-like; atrium very small; adductor duct cylindrical and long; spermatic channel well prominent. Fixed digit of the chelicera is provided with six teeth (seldom five) and a *pilus dentilis*; the movable digit unidentate. Three knobbed macrosetae on leg IV; stIV short, not reaching the dorsal lyriform fissure, 27-35. On various trees, shrubs and herbs; common on citrus and *Ricinus*. Jordan Valley, Coastal Plain, Judean Foothills and Judean Hills *I. degenerans* (Berlese, 1889)

- Lateral integument not strongly sclerotized 5
- 5. On the opisthonotum (fig. 10) seta Z3 present in median position and seta S5 absent.
Setae r3 and R1 on the lateral integument. Seta J2 present. Two pairs of setae on the sternal shield. Chelicera paucidentate *Typhloseiella* Muma

Dorsal shield (fig. 23) sclerotized, imbricated irregularly; with five pairs of very big crateriform solenostomes (gd1, gd2, gd6, gd8 and gd9); most setae on the shield short, or medium sized, broad and serrated. Apex of peritreme reaches the bases of setae z4-s4, z4, z2-z4 or almost z2. Ventrianal shield (fig. 43) vase-shaped, widest in the anal area and narrowing anteriorly; anterior margin straight, or slightly convex; the shield is sclerotized to a lesser or more degree, usually with few striae, but in some specimens numerous oblique and transverse striae are present; with one pair of preanal setae; with a pair of small far apart solenostomes. Ventral interscutal membrane flanking the ventrianal shield is provided with six pairs of setae. In the insemination apparatus (fig. 69) calyx cup-shaped; neck very small or absent; atrium small and elongate; adductor duct cylindrical and thin; spermatic channel not discernible in most specimens. Fixed digit of the chelicera is provided with 2-3 teeth and a *pilus dentilis*; the movable digit unidentate or edentate. No macrosetae on leg IV. J2 30-42, Z4 33-40, Z5 37-43. Common on *Inula* and *Capparis*, found also on Cistaceae and Labiatae. Upper Galilee, Carmel, Coastal Plain and Judean Hills

- *T. isotricha* (Athias-Henriot, 1958)
- On the opisthonotum (fig. 11) seta Z3 absent and seta S5 present 6
- 6. The three pairs of preanal setae on the ventrianal shield (fig. 45) shifted forward and aligned in one or two transverse rows.
Setae r3 and R1 on the lateral integument. Three pairs of sternal setae. Ventrianal shield (fig. 45) ovate to vase-shaped, with a pair of solenostomes. Leg IV always carries macrosetae. Chelicera relatively small *Euseius* Wainstein
- Preanal setae on the ventrianal shield (figs. 46-49) not shifted forward and not aligned in one or two transverse rows 7
- 7. A pair of sigilla (muscle marks) mostly located on the anterior corners of the ventrianal shield, frequently projecting marginally, or less often minute (fig. 49). In the insemination apparatus (fig. 71) calyx tubular or bell-shaped, 2-6 times longer than wide; atrium quite large; the broad adductor duct about as long as calyx. Solenostomes gd2, gd5 and gd8 absent (fig. 32). Dorsal setae short, simple rather thin. Chelicera paucidentate. Leg IV usually carries one elongate macroseta on the basitarsus; in some species it is not longer than other setae of this segment *Neoseiulus* Hughes
- Anterior corners of the ventrianal shield without the sigilla (muscle marks) (figs. 46-48). Combination of the structure of insemination apparatus, or chelicera, or solenostomes and setae of the dorsal shield, or macrosetae on leg IV not as above.
Seta J2 present or absent. Some of the dorsal setae maybe long and flagelliform, some maybe microchetiae. Setae r3 and R1 on the lateral integument. Sternal shield bears 2-3 pairs of setae. Ventrianal shield (figs. 46-48) with three pairs of preanal setae. Leg IV carries 1-3 macrosetae, which are sometimes developed also on other legs *Amblyseius* Berlese
- 8. Opisthonotum (fig. 12) with four pairs of Z-S setae (Z4, Z5, Z1, S5). Seta J2 absent.
Setae r3 and R1 on the lateral integument. Three pairs of setae on the sternal shield. Ventrianal shield (fig. 50) suboval, with 0-1 pairs of preanal setae. Ventral interscutal membrane flanking the ventrianal shield is provided with 4-5 pairs of setae. Gnathosoma normal. Chelicera small, multidentate. Insemination apparatus (fig. 72) well developed *Phytoseiulus* Evans

- Dorsal shield (fig. 25) lightly, or moderately, sclerotized; podonotum and sometimes also opisthonotum reticulated, with scattered muscle marks; without solenostomes; setae j3, z4, s4, Z1, Z4, Z5, j4, j5 and j6 long, weakly serrated, the rest microchetae, or very short setae. Apex of peritreme reaches the bases of setae j3-z2. Ventrianal shield (fig. 50) oval; sclerotized to a lesser or more degree, with some striae; without preanal setae; with a pair of minute solenostomes. Ventral interscutal membrane flanking the ventrianal shield is provided with five pairs of setae. In the insemination apparatus (fig. 72) calyx vesicular, flaring towards the vesicle, its proximal part swollen; atrium minute; adductor duct cylindrical; spermatic channel discernible. Fixed digit of the chelicera is provided with 6-8 teeth and a *pilus dentilis*; the movable digit tridentate. Three macrosetae on leg IV; stIV pointed, long, passing the dorsal lyriform fissure, 100-129. Seta j6 149-171, S5 30-37, Z4 121-143, Z5 118-136. On various herbs and trees. Hula Valley, Yizre'el Valley, Coastal Plain and Northern Negev. *P. persimilis* was introduced into Israel in 1962 and became established. It is commercially bred in insectaries against *Tetranychus urticae* Koch and *T. cinnabarinus* (Boisduval) (Tetranychidae) ***P. persimilis*** Athias-Henriot, 1957
- Opisthonotum (fig. 13) with five pairs of Z-S setae **9**
9. On the opisthonotum (fig. 13) seta S4 present and seta S5 absent (Z4, Z5, Z1, S2, S4); seta Z4 is transversely mated with S4. Setae r3 and R1 on the lateral integument. Ventrianal shield (fig. 51) reduced. Chelicera normal, paucidentate. Macrosetae on leg IV always present ***Amblyseiella*** Muma
- Dorsal shield slightly sclerotized and smooth, except for lunate scattered ornamentation on the podonotum and opisthonotum; with seven pairs of small crateriform solenostomes (gd1, gd2, gd4, gd5, gd6, gd8 and gd9); setae j3, z4, s4, S2, Z4 and Z5 elongate, setae j1, z2 and S4 of moderate length, the other setae on the shield minute. Apex of peritreme reaches the bases of setae j1, or almost so. Three pairs of setae on the sternal shield. Ventrianal shield (fig. 51) suboval; very slightly sclerotized, smooth; with one pair of preanal setae and a pair of small solenostomes. In the insemination apparatus (fig. 73) calyx bell-shaped, thick-walled; neck absent; atrium minute; adductor duct cylindrical and thin; spermatic channel usually discernible. Fixed digit of the chelicera is provided with three teeth and a *pilus dentilis*; the movable digit unidentate, or edentate. Three macrosetae on leg IV; stIV pointed, long, reaching the dorsal lyriform fissure, 57-70. J2 7-8, Z4 70-87, Z5 88-104. On *Ricinus*, citrus and Gramineae. Jordan Valley, Yizre'el Valley and Coastal Plain ***A. setosa*** Muma, 1955
- On the opisthonotum (fig. 14) seta S5 present and seta S4 absent (Z4, Z5, Z1, S2, S5) **10**
10. Dorsal shield (fig. 26) with deep striae, forming elongate, subparallel cells; with few pairs of solenostomes (gd2 and gd9 in *E. chergui* and *E. hermonensis*). Peritreme very short, its apex reaches the bases of setae s4, or between the bases of setae z4-s4. Leg IV without macrosetae. Sternal shield with 2-3 pairs of setae. Ventrianal shield (figs. 52, 53) with 1-3 pairs of preanal setae, with a pair of solenostomes. Chelicera small and paucidentate ***Eharius*** Tuttle and Muma
- Dorsal shield (figs. 27, 28) without deep striae, coriaceous, slightly ornamented with striae and cells; with 3-6 pairs of solenostomes. Peritreme of normal length, its apex reaches the bases of setae j3-z2, or z2-z4. Leg IV carries a macroseta on the basitarsus.

Sternal shield with 2-3 pairs of setae. Ventrianal shield (figs. 54, 55) subpentagonal, or subrectangular, longer than wide, slightly waisted, with 1-3 pairs of preanal setae and a pair of solenostomes. In the insemination apparatus (fig. 74) calyx hemispherical; atrium globulose, or club-shaped, not inserted in the calyx; adductor duct cylindrical. Chelicera paucidentate. ***Kampimodromus*** Nesbitt

Key to the adult females of the genus *Amblyseius* Berlese

1. Seta J2 absent (fig. 29).
Dorsal shield (fig. 29) sclerotized, not reticulated, slightly ornamented; with seven pairs of small crateriform solenostomes (gd1, gd2, gd4, gd5, gd6, gd8 and gd9); setae s4 (91-105), Z5 (166-191) and Z4 (120-138) very long; seta z2 much shorter (30-37); setae z4, Z1, S2, S4 and S5 very short and subequal in length (9-12); all setae pointed. Apex of peritreme reaches the bases of setae j1. Three pairs of setae on the sternal shield. Ventrianal shield (fig. 47) subtriangular or subpentagonal; strongly sclerotized, ornamented with many striae passing in some locations into cells; with three pairs of preanal setae; with small punctiform solenostomes. In the insemination apparatus (fig. 75) the calyx bell-shaped; neck absent; atrium well developed; adductor duct long and cylindrical; spermatic channel scarcely discernible in some specimens. Leg IV carries three pointed macrosetae; stIV long, reaching the dorsal lyriform fissure, 75-91. Fixed digit of the chelicera is provided with 2-3 teeth and a *pilus dentilis*; the movable digit unidentate or edentate. On various herbs, trees, shrubs and in litter. Upper Galilee, Jordan Valley, Yizre'el Valley, Coastal Plain, Judean Foothills and Northern Negev ***A. messor*** Wainstein, 1960
- Seta J2 present (fig. 30) **2**
2. Ventral interscutal membrane flanking the ventrianal shield is provided with three pairs of setae.
Dorsal shield sclerotized, caudad the bases of setae Z4 usually almost smooth, sometimes slightly reticulated; in some specimens the area between the bases of setae j6-J2 or j4-J2 covered by elongate parallel cells; anterad the base of seta Z4 mainly lateral areas are slightly or strongly reticulated, anterior central area slightly ornamented; with five pairs of quite big crateriform solenostomes (gd1, gd2, gd4, gd6 and gd9); setae j3, z2, z4, s4, Z1, S2, S4 and S5 shorter than the distances between their bases. Peritreme short, its apex reaches the bases of setae z4, between z4-z2, or almost z4. Two pairs of setae on the sternal shield. Ventrianal shield (fig. 46) subpentagonal, much longer than wide, waisted, with anterior margin slightly rounded, ratio of length/width = 1.36 - 1.67; smooth in the preanal area, with few or numerous transverse and oblique striae in the anal area; with three pairs of preanal setae; solenostomes not visible. In the insemination apparatus (fig. 76) the calyx shallowly domed, adjacent to the small atrium; neck absent or minute; adductor duct slender, tube-like; spermatic channel clearly visible. One short pointed macroseta on the basitarsus IV, not reaching the dorsal lyriform fissure, 15-20. Fixed digit of the chelicera is provided with seven teeth and a *pilus dentilis*; the movable digit bidentate. J2 17-18, Z4 31-36, Z5 43-48. On *Thymelaea* and Boraginaceae. Carmel, Coastal Plain and Northern Negev ***A. leucophaeus*** Athias-Henriot, 1959
- Ventral interscutal membrane flanking the ventrianal shield is provided with four pairs of setae **3**
3. In the insemination apparatus (fig. 77) a long neck, atrium oblong and

large, with a crack; calyx conus-shaped; adductor duct cylindrical; spermatic channel prominent.

Dorsal shield sclerotized, strongly reticulated, area between the bases of setae j5-J2, or j5-j6, with elongate parallel cells, in some specimens the cells are pentagonal or square; anterior part of podonotum slightly ornamented or reticulated; with six pairs of small crateriform solenostomes (gd1, gd2, gd4, gd6, gd8 and gd9). Apex of peritreme reaches the bases of setae j1, or almost j1. Three pairs of setae on the sternal shield. Ventrianal shield subpentagonal, its anterior margin almost straight; with rounded or slightly convex anterior lateral corners; with numerous transverse and few longitudinal striae; with three pairs of preanal setae and a pair of small crateriform solenostomes. Leg IV bears three macrosetae; stIV pointed, long, passing the dorsal lyriform fissure, 66-81; genu II carries eight, seldom seven setae. Fixed digit of the chelicera is provided with 3-4 teeth and a *pilus dentilis*; the movable digit edentate, or with a very weakly developed tooth. J2 18-25, Z4 38-56, Z5 47-75. On Gramineae and in litter. Upper Galilee, Jordan Valley and Carmel

..... *A. sp. near zwoelferi* (Dosse, 1957)*

- Insemination apparatus with a short neck, or without a neck; atrium bulbous or elongate (figs. 78-85) 4

4. Leg IV bears three macrosetae 5

- Leg IV bears one macroseta 7

5. Seta S2 short (17-22), seta J2 very short (8-10); seta s4 (68-88), Z4 (75-93) and Z5 (102-138) long.

Dorsal shield (fig. 30) not sclerotized, slightly reticulated or striated antero-laterally; with seven pairs of solenostomes (gd1, gd2, gd4, gd5, gd6, gd8 and gd9), gd1, gd2 and gd5 are small and almost punctiform, others bigger and crateriform. Apex of peritreme reaches the bases of setae j1. Three pairs of setae on the sternal shield. Ventrianal shield (fig. 48) subpentagonal, waisted, anterior margin straight, or rounded to a lesser or more degree, anterior lateral corners rounded; with three pairs of preanal setae and a pair of big crescent and quite close solenostomes. In the insemination apparatus (fig. 78) the calyx cup-shaped, bell-shaped, or hemispherical; neckless; adductor duct cylindrical; spermatic channel usually distinct. Seta stIV pointed, long, passing the dorsal lyriform fissure, 55-81; genu II carries seven (seldom six) setae. Fixed digit of the multidentate chelicera is provided with 8-9 (less often ten) teeth and a *pilus dentilis*; the movable digit has three (seldom two) teeth. On various trees, shrubs and herbs; specimens were collected in litter and in dust (house). Golan Heights, Upper Galilee, Hula Valley, Jordan Valley, Yizre'el Valley, Carmel, Coastal Plain, Judean Foothills, Judean Hills and Northern Negev. On citrus *A. swirskii*

* We checked the drawings of *A. zwoelferi* by Dosse (1957) and of *A. zeitunicus* by Wainstein and Arutunian (1970) - and they look different. The insemination apparatus (fig. 77) of the Israel material resembles the drawings of *A. zeitunicus* and differs from those of *A. zwoelferi*. On the other hand the description of *A. zeitunicus* was based on some characters of a female of *A. marginatus* (Wainstein, 1961) and on other characters of a female and a male belonging, according to Wainstein (1975), to *A. zwoelferi*. It is worthwhile to check the type materials.

is dominant and abundant along the Coastal Plain

..... *A. swirskii* Athias-Henriot, 1962
- Seta S2 long (longer than 51); seta J2 very short (10-20) or long (42-46); setae s4 (longer than 51), Z4 (longer than 61) and Z5 (longer than 71) long 6

6. Genu II carries nine setae. Seta J2 short (10-20). In the insemination apparatus (fig. 79) the calyx digitiform, with a slight constriction; atrium small; adductor duct broad and cylindrical; spermatic channel not discernible, or scarcely so. Fixed digit of the paucidentate chelicera is provided with 2-4 teeth and a *pilus dentilis*; the movable digit unidentate.

Dorsal shield slightly or moderately sclerotized; smooth or podonotum anterolaterally slightly reticulated, in the center of podonotum some light lunatic ornamentations; opisthonotum almost smooth; with seven pairs of prominent crateriform solenostomes (gd1, gd2, gd4, gd5, gd6, gd8 and gd9). Three pairs of setae on the sternal shield. Apex of peritreme reaches the bases of setae j1. Ventrianal shield sclerotized, subpentagonal, slightly waisted, anterior margin slightly rounded, anterior lateral corners rounded; in some specimens the shield is not waisted and the anterior margin almost straight; with numerous transverse and wined (bent) striae; with three pairs of preanal setae and a pair of small slightly crescent solenostomes. Seta stIV pointed, long, passing the dorsal lyriform fissure, 70-93. s4 63-66, S2 56-65, Z4 63-76, Z5 81-100.

..... *A. graminis* Chant, 1956
- Genu II carries seven setae. Seta J2 long (42-46). In the insemination apparatus (fig. 80) the calyx cup-shaped; atrium bulbous; adductor duct cylindrical; spermatic channel distinct. Fixed digit of the multidentate chelicera is provided with ten teeth and a *pilus dentilis*; the movable digit tridentate.

Dorsal shield strongly reticulated except for the striated areas around the bases of setae Z4, and slightly ornamented area between the bases of setae j4-J2; with five pairs of solenostomes (gd1, gd2, gd4, gd8 and gd9), gd9 the biggest, others are small and crateriform. Three pairs of setae on the sternal shield. Apex of peritreme reaches the bases of setae j1 or between j1-j3. Ventrianal shield subtriangular; striated, the striae passing around the anus into reticulation; with three pairs of preanal setae and a pair of big crescent solenostomes. Seta stIV pointed, long, passing the dorsal lyriform fissure, 71. s4 51-53, S2 51-58, Z4 61-66, Z5 71-78. On *Epilobium*. Coastal Plain

..... *A. sharonensis* Rivnay and Swirski, 1980
7. In the insemination apparatus (fig. 81) a slightly elongate neck; calyx cup-shaped; atrium bulbous; adductor duct cylindrical; spermatic channel discernible.

Dorsal shield slightly or moderately sclerotized; usually on the opisthonotum the reticulation is stronger than on podonotum; in some specimens the shield is reticulated all over, except for smooth areas around the bases of setae Z4; with seven pairs of prominent crateriform solenostomes (gd1, gd2, gd4, gd5, gd6, gd8 and gd9). Three pairs of setae on the sternal shield. Apex of peritreme reaches the bases of setae j1, between j1-j3 or j3. Ventrianal shield subtriangular, or subpentagonal, slightly or scarcely waisted, anterior margin straight or almost so,

or slightly convex, anterior lateral corners rounded, or not rounded; sclerotized to a lesser or more degree; with numerous transverse and oblique striae forming in some locations cells, sometimes the striae are weakly pronounced, in some specimens the shield is smooth, or reticulated allover; with three pairs of preanal setae and a pair of small slightly crescent solenostomes. Seta stIV pointed, long, passing the dorsal lyriform fissure, 66-75. Fixed digit of the chelicera is provided with 5-8 teeth and a *pilus dentilis*; the movable digit unidentate. J2 18-20, s4 28-33, S2 33-40, Z4 35-50 (usually 35-38), Z5 75-100 (usually 88-100). On shrubs and herbs. Upper Galilee, Jordan Valley, Coastal Plain, Northern and Central Negev and Dead Sea **A. bicaudus** Wainstein, 1962

- In the insemination apparatus (figs. 82-85) neck absent, or minute, almost indiscernible 8
- 8. In the insemination apparatus (fig. 82) calyx cup-shaped; atrium bulbous; adductor duct cylindrical; spermathecal channel discernible. Movable digit of the chelicera bidentate; fixed digit is provided with 5-6 (seldom 7) teeth and a *pilus dentilis*.

Dorsal shield slightly sclerotized, reticulated except for the faintly ornamented areas around the bases of setae Z4 and anterior part of the shield; with six pairs of small crateriform solenostomes (gd1, gd2, gd4, gd6, gd8 and gd9). Three pairs of setae on the sternal shield. Apex of peritreme reaches the bases of setae j1-j3. Ventrianal shield subtriangular, with rounded antero-lateral corners; striated and reticulated; with three pairs of preanal setae and a pair of minute slightly crescent solenostomes. Seta stIV pointed, long, passing the dorsal lyriform fissure, 63-73. J2, s4 17-20, S2 27-37, Z4 30-35, Z5 75-83. On *Ficus*. Jordan Valley **A. rambami** Swirski and Amitai, 1990

- In the insemination apparatus (figs. 83-85) calyx conus-shaped, or bell-shaped, or elongated narrow. Movable digit of the chelicera unidentate; fixed digit is provided with 3-8 teeth and a *pilus dentilis* 9
- 9. Five pairs of prominent crateriform solenostomes on the dorsal shield (gd1, gd2, gd6, gd8 and gd9). Fixed digit of the chelicera is provided with 3-4 (usually 3) teeth and a *pilus dentilis*. Seta J2 23-27, setae s4 and S2 33-42.

Dorsal shield sclerotized; area between the bases of setae j5-J2 covered with elongate parallel cells, opisthonotum reticulated to a lesser or more degree, podonotum smooth, or very slightly reticulated, or ornamented with few cells. Apex of peritreme reaches the bases of setae j3 or between j3-j1. Three pairs of setae on the sternal shield. Ventrianal shield subpentagonal, very slightly waisted, anterior margin straight, antero-lateral corners rounded; sclerotized to a lesser or more degree, with numerous transverse and few oblique striae, forming few cells; in some specimens the reticulation weakly pronounced; with three pairs of preanal setae; with a pair of small crateriform solenostomes. Primary inguinal sigillum subtriangular, 25-32. Seta stIV pointed, long, passing the dorsal lyriform fissure, 57-60; genu II carries seven (less often six or eight) setae. In the insemination apparatus (fig. 83) the calyx elongated narrow, bell-shaped, neck absent or minute; atrium small and bulbous; adductor duct long and slender; spermathecal channel thin, often indiscernible, or scarcely so. Z4 35-42, Z5 66-78, JV5 42-53. On herbs, rarely on shrubs, often recorded from hydrophytic vegetation on banks of rivers and lakes. Carmel, Coastal Plain,

Judean Hills, Northern and Central Negev and Dead Sea **A. cucumeris** (Oudemans, 1930)

- Six pairs of small crateriform solenostomes on the dorsal shield (gd1, gd2, gd4, gd6, gd8 and gd9). Fixed digit of the chelicera is provided with 5-8 teeth and a *pilus dentilis*. Seta J2 13-17, seta s4 and S2 15-23.

Dorsal shield sclerotized; area between the bases of setae j5-J2 covered by elongate parallel cells, podonotum slightly reticulated than opisthonotum. Three pairs of setae on the sternal shield. Ventrianal shield subtriangular, anterior margin straight, antero-lateral corners rounded; with numerous transverse and few oblique striae, forming in the anal (sometimes also in the preanal) area cells; with three pairs of preanal setae and a pair of small punctiform solenostomes (in some specimens scarcely seen). Primary inguinal sigillum 29-35. Seta stIV pointed, long, passing the dorsal lyriform fissure, 42-55; genu II carries seven setae. In the insemination apparatus (figs. 84, 85) calyx conus-shaped, or bell-shaped; neck absent; atrium well developed; adductor duct cylindrical; spermathecal channel distinct. J2 13-17, s4 15-23, S2 17-23, Z4 23-35, Z5 51-71. On Gramineae and *Moringa*. Carmel, Judean Hills, Dead Sea.

..... **A. longilaterus** (Athias-Henriot, 1957)*

Key to the adult females of the genus *Eharius* Tuttle and Muma

1. In the chelicera (fig. 113) the *pilus dentilis* large, robust. Six pairs of JV-ZV setae.

Dorsal shield reticulated allover, besides the area caudad to the bases of setae Z4, which is smooth, or slightly ornamented; with two pairs of small punctiform solenostomes (gd2 and gd9). Apex of peritreme between the bases of setae s4-Z1. Three pairs of setae on the sternal shield. Ventrianal shield (fig. 53) vase-shaped, broad at the anal level; striated; with three pairs of preanal setae. In the insemination apparatus calyx cup-shaped, neck absent; adductor duct cylindrical and elongate; spermathecal channel discernible. Fixed digit of the chelicera is provided with two teeth and a *pilus dentilis*; the movable digit with a bifid apex and a small protuberance (no teeth). J2 10-13, Z4 15-22, Z5 33-45. On *Marrubium* (Labiatae). Mount Hermon. **E. hermonensis** Amitai and Swirski, 1980

- In the chelicera (fig. 114) the *pilus dentilis* normal. Five pairs of JV-ZV setae.

Dorsal shield (fig. 26) reticulated allover, besides the area caudad to the bases of setae Z4, which is smooth, or slightly ornamented; with two pairs of small punctiform solenostomes (gd2 and gd9). Apex of peritreme reaches the bases of setae s4. Three pairs of setae on the sternal shield. Ventrianal shield (fig. 52) vase-shaped, waisted, with a convex anterior margin; with transverse and oblique striae; with a pair of far apart solenostomes; the shield carries usually two pairs of preanal setae, but less often setting of 2-3 or 2-1. In the insemination apparatus (fig. 86) calyx cup-shaped, shallow, neck absent; adductor duct cylindrical; spermathecal channel discernible. Fixed digit of the chelicera is provided with 4-5

* Examination of the type material of *A. engaddensis* Amitai and Swirski (from the Dead Sea region) and specimens of *A. longilaterus* (Athias-Henriot) (from Mt. Carmel and Judean Hills) shows that they are apparently conspecific.

teeth spread along few levels and with a *pilus dentilis*; the movable digit edentate. J2 12-13, Z4 13-17, Z5 33-43. On Labiatae and Cistaceae. Judean Foothills and Judean Hills. *E. chergui* (Athias-Henriot, 1960)

Key to the adult females of the genus *Euseius* Wainstein

1. Seta J2 short (12-18); $J2/j1 = 0.44-0.59$; $J2/Z5 = 0.24-0.34$. Seta Z4 short (15-20). Seta stIV pointed, of medium size, usually passing, sometimes not reaching the dorsal lyriform fissure, 48-66 (usually 50-58). In the insemination apparatus (fig. 87) calyx bottle-like, dilated at its base and flared towards the vesicle; atrium incorporated in the calyx; adductor duct cylindrical; spermatic channel discernible.
Dorsal shield slightly, or moderately sclerotized, podonotum and opisthonotum slightly reticulated, in some specimens podonotum very weakly ornamented; with six pairs of small crateriform solenostomes (gd2, gd4, gd5, gd6, gd8 and gd9). Apex of peritreme reaches the bases of setae z2-z4 or z4. Sternal shield carries three pairs of setae. Ventrianal shield elongated, subpentagonal, widest at the anal area; slightly sclerotized, smooth, or with few striae; with a pair of big crescent solenostomes. Three macrosetae on leg IV. Fixed digit of the chelicera bears 4-6 teeth and a *pilus dentilis*; the movable digit unidentate. Z5 45-56. On *Acer*, *Platanus* and *Juglans*. Upper Galilee. *E. sp. near finlandicus* (Oudemans, 1915)*
- Seta J2 of medium size, or long (longer than 37); $J2/j1 > 1$; $J2/Z5 > 0.57$. Seta Z4 of medium size, or long (longer than 30). St IV slightly knobbed, tapered, or pointed, long (longer than 70), passing the dorsal lyriform fissure. In the insemination apparatus the calyx is different in shape, either funnel-shaped (fig. 88), or narrow and very elongate (fig. 89) 2
2. In the insemination apparatus (fig. 88) the calyx funnel-shaped; atrium incorporated in the calyx; adductor duct cylindrical; spermatic channel distinct. Apex of peritreme reaches the bases of setae j1-j3, or between j3-z2. The three macrosetae on the leg IV are slightly knobbed, or tapered. Seta J2 very long (58-73); $J2/J1 = 1.75-2.53$; $J2/Z5 = 0.76-0.98$. Seta Z4 long (58-71).
Dorsal shield smooth, or slightly striated (mostly at the anterior part); with five pairs of prominent crateriform solenostomes (gd2, gd4, gd6, gd8 and gd9), gd4 duplicate. Ventrianal shield slightly waisted anteriorly; smooth, or very slightly striated; with a pair of big crateriform solenostomes. Fixed digit of the chelicera bears three teeth and a *pilus dentilis*; the movable digit unidentate. stIV 70-83, Z5 71-86. On trees, shrubs and herbs. Dead Sea. *E. eitanae* (Swirski and Amitai, 1965)
- In the insemination apparatus (fig. 89) the calyx is narrow and very elongate, flaring towards the vesicle; atrium small; adductor duct ap-

* Prominent difference between the structure of the insemination apparatus of Israel material and the type material of *E. finlandicus* checked by Ragusa di Chiara and Tsolakis. The mites also differ in the size of setae (Z4, s4 etc.).

parently short; spermatic channel distinct. Apex of peritreme reaches the bases of setae z2, between z2-z4, or z4. Macrosetae on the leg IV pointed, or slightly tapered. Seta J2 shorter (37-50); $J2/j1 = 1.15-1.50$; $J2/Z5 = 0.57-0.70$. Seta Z4 shorter (30-46).

Dorsal shield (fig. 31) moderately sclerotized, area between the bases of setae j5-J2 covered with elongate parallel cells, podonotum and opisthonotum reticulated; in some specimens the shield slightly sclerotized, smooth, or opisthonotum reticulated and podonotum smooth and the cells on the area between the bases of setae j5-J2 are weakly pronounced, or absent; with five pairs of crateriform solenostomes (gd2, gd4, gd6, gd8 and gd9), gd9 the biggest, gd4 duplicate. Ventrianal shield (fig. 45) suboval, slightly waisted anteriorly; slightly or moderately sclerotized, smooth, or with few striae; with a pair of big crateriform solenostomes. Fixed digit of the chelicera bears 2-3 teeth and a *pilus dentilis*; the movable digit unidentate or edentate. stIV 73-81, Z5 56-81. On various trees, shrubs and herbs. Allover the country *E. scutalis* (Athias-Henriot, 1958)

Key to the adult females of the genus *Kampimodromus* Nesbitt

1. Three pairs of solenostomes (gd2, gd6 and gd9) on the dorsal shield (fig. 28). Ratio $S5/Z5 = 0.94-1.0$. Two pairs of setae on the sternal shield.
In the dorsal shield the opisthonotum more ornamented with striae and cells than the podonotum. Ventrianal shield subpentagonal, very slightly waisted; with few (less often numerous) striae; with a pair of small solenostomes. Apex of peritreme reaches the bases of setae z2. Seta stIV pointed, short, not reaching the dorsal lyriform fissure, 19. Fixed digit of the chelicera is provided with three teeth and a *pilus dentilis*; the movable digit with small protuberances and edentate. J2 42-48, S5 50-54, Z4 52-56, Z5 50-56. On Labiatae. Golan Heights, Judean Foothills and Judean Hills *K. judaicus* (Swirski and Amitai, 1961)
- Four or five pairs of solenostomes on the dorsal shield (fig. 27). Ratio $S5/Z5 = 0.29-0.48$. Three pairs of setae on the sternal shield (fig. 66) 2
2. Five pairs of solenostomes on the dorsal shield (gd1, gd2, gd6, gd8 and gd9) (fig. 27). Movable digit of the chelicera edentate. Ratio $S5/Z5 = 0.47-0.48$, J2 32-38, S5 22-26.
Podonotum and opisthonotum of the dorsal shield slightly ornamented (fig. 27). Ventrianal shield (fig. 54) subrectangular in the anal area, slightly waisted; striated; with a pair of small solenostomes. Apex of peritreme reaches the bases of setae j3-z2. Seta stIV pointed, short, not reaching the dorsal lyriform fissure, 22-31. Fixed digit of the chelicera bidentate and with a *pilus dentilis*. Z4 39-46, Z5 46-54. On trees and shrubs of the families Fagaceae, Labiatae and Cistaceae. Lower Galilee, Yizre'el Valley, Carmel, Coastal Plain, Judean Foothills and Judean Hills *K. ericinus* Ragusa di Chiara and Tsolakis, 1994
- Four pairs of solenostomes on the dorsal shield (gd1, gd2, gd6 and gd9); gd1 is not discernible in some specimens. Movable digit of the chelicera unidentate. Ratio $S5/Z5 = 0.29-0.36$. J2 13-18, S5 12-15.
Dorsal shield weakly reticulated on its mid and/or posterior parts, while in some specimens the reticulation is scarcely pronounced. Ventrianal shield (fig. 55) longer than wide, waisted; striated; with minute pores in some specimens. Apex

of peritreme reaches the bases of setae z2-z4. Seta stIV pointed, short, not reaching the dorsal lyriform fissure, 17-22. Fixed digit of the chelicera is provided with two teeth and a *pilus dentilis*. Z4 25-35, Z5 33-42. On *Quercus* and apple. Golan Heights, Jordan Valley, Carmel and Coastal Plain **K. ragusai** Swirski and Amitai, 1997

Key to the adult females of the genus *Neoseiulus* Hughes

1. Calyx truncated-cone-shaped, with one side straight and the other curved; atrium narrow, as wide as calyx base (fig. 71).
Dorsal shield (fig. 32) sclerotized, mostly smooth throughout, anterolaterally with few striae, in some specimens also hexagonal area with lunatic ornamentations; in fewer specimens the shield is sclerotized, but smooth throughout; with four pairs of crescent solenostomes (gd1, gd4, gd6 and gd9), gd9 large, others small. Apex of peritreme reaches the bases of setae j1. Three pairs of setae on the sternal shield. Ventrianal shield (fig. 49) elongate, subpentagonal, subquadrate in the preanal area; sclerotized, usually with numerous transverse and oblique striae, passing in some places into reticulations, in some specimens with few striae; with three pairs of preanal setae; with a pair of small solenostomes. Seta stIV pointed, long, passing the dorsal lyriform fissure, 55-68. In the chelicera the fixed digit has 3-5 (usually 4) teeth and a *pilus dentilis*, the movable digit unidentate. J2 18-20, Z4 30-40, Z5 46-56. In litter of various trees; on trees, shrubs and herbs; in house dust. Upper and Lower Galilee, Hula Valley, Jordan Valley, Yizre'el Valley, Carmel, Coastal Plain, Judean Foothills, Judean Hills, Northern and Central Negev, Dead Sea **N. barkeri** Hughes, 1948
- Calyx bell-shaped, 2.6-3.4 times longer than wide, about 3.8 times longer than atrium, with straight axis.
Dorsal shield with only a few ridgelets on its antero lateral region; with four pairs of solenostomes (gd1, gd4, gd6 and gd9). Apex of peritreme reaches the bases of setae j1. In the genital shield lateral margins posterior to the setae ST5 straight and posterior corners acute. Ventrianal shield subpentagonal, slightly attenuated posteriorly with numerous transverse and oblique striae; with three pairs of pre-anal setae; with a pair of solenostomes. Seta stIV 72-73. Z4 39-40, Z5 55. In litter. Coastal Plain **N. aleurites** Ragusa and Athias-Henriot, 1983

Subfamily Phytoseiinae

Genus *Phytoseius* Ribaga

Six pairs of z-s setae on the podonotum (z2, z3, z4, z5, s4 and s6) (fig. 15). Dorsal setae not paddle-shaped. Genu II carries seven setae.
Dorsal shield (fig. 33) slightly sclerotized, smooth, or both podonotum and opisthonotum are very slightly ornamented with striae and few cells; seta r3 on the dorsal shield, seta R1 on the lateral integument; with four pairs of crateriform solenostomes (gd2, gd6, gd8 and gd9), gd8 far from seta Z4; setae z2, z4, z5, R1, j4, j5, j6 and J5 smooth, or very slightly serrate, seta J2 usually slightly serrate, sometimes smooth, all the other setae on the dorsal shield are serrate. Apex of peritreme reaches the bases of setae j1-j3, j3 or z2. Three pairs of setae on the sternal shield. Ventrianal shield (fig. 56) vase-shaped, waisted; smooth,

or with few transverse striae; with a pair of small solenostomes. In the insemination apparatus (fig. 90) calyx narrow elongate, flared towards the vesicle; atrium knobbed; adductor duct broad; spermatic channel thin, usually indistinct. Three macrosetae on leg IV; those on genu and tibia are pointed, short, scarcely discernible; stIV blunt, sometimes pointed, short, not reaching the dorsal lyriform fissure, 32-38. Fixed digit of the paucidentate chelicera is provided with 1-2 teeth and a *pilus dentilis*; the movable digit usually unidentate, or with an additional minute tooth. J2 17-25, Z4 47-76, Z5 65-109. **Ph. plumifer** (Canestrini and Fanzago, 1876)

Key to the adult females of the genera in the subfamily Typhlodrominae

1. Five pairs of z-s setae on the podonotum (z2, z4, z5, s4, s6; z3 absent) (fig. 16). Six pairs of Z-S setae on the opisthonotum (Z1 present) (fig. 16). Hypostome and palp of normal size, about half the length of leg I. Setae on the dorsal shield setiform, not inserted on tubercles. Leg IV bears a macroseta. Ventrianal shield (fig. 57) subtriangular, with three pairs of preanal setae. Four pairs of setae on the ventral interscutal membrane flanking the ventrianal shield (ZV1, ZV3, JV4, JV5). **Cydnoseius** Muma
Dorsal shield (fig. 34) sclerotized, reticulated allover; with seven pairs of solenostomes (gd1, gd2, gd4, gd5, gd6, gd8 and gd9); all setae pointed, setae Z4 and Z5 slightly serrate. Apex of peritreme reaches the bases of setae j1. Three pairs of setae on the sternal shield. Ventrianal shield (fig. 57) lightly reticulated and striated throughout; with a pair of closely placed solenostomes. Calyx of insemination apparatus (fig. 91) small, cup-shaped and sclerotized; atrium short and bifid; adductor duct elongated and cylindrical; spermatic channel clearly discernible in most specimens. Seta stIV pointed, long, reaching the dorsal lyriform fissure, 43-56. Hypostome and palp 159-171, 0.54-0.57 of leg I length. Fixed digit of the chelicera is provided with four teeth and a *pilus dentilis*; the movable digit unidentate. J2 18-22, Z4 30-34, Z5 51-60. On Gramineae and date palms. Northern Negev, Dead Sea and Arava Valley. **C. negevi** (Swirski and Amitai, 1961)
- Six or seven pairs of z-s setae on the podonotum (z2, z4, z5, s4, z3, s6; z6 absent or present) (figs. 17-20) 2
2. Seven pairs of z-s setae on the podonotum (z6 present, as well as z2, z3, z4, z5, s4, s6). Six pairs of Z-S setae on the opisthonotum (Z3 present, as well as Z4, Z5, S2, S4, S5) (fig. 17). The caudoventral seta JV2 absent **Bawus** van der Merwe
Dorsal shield (fig. 35) sclerotized and reticulated allover; lateral areas of the shield partly covered by elongate cells; opisthonotum stronger reticulated than podonotum; with three pairs of big crateriform solenostomes (gd2, gd6 and gd9); all dorsal setae tapering and pointed; seta Z5 slightly serrated, setae r3 and R1 situated on the lateral integument. Apex of peritreme between the bases of setae j1-j3. Ventrianal shield (fig. 58) vase-shaped, waisted, widest at the anal level; with few striae; with two pairs of preanal setae; without solenostomes. Ventral interscutal membrane flanking the ventrianal shield is provided with four pairs of setae. In the insemination apparatus (fig. 92) calyx bell-shaped, thick-walled before the vesicle; neck absent; adductor duct cylindrical, short and

broad; spermathecal channel prominent. Leg IV carries one macroseta; stIV pointed, short, not reaching the dorsal lyriform fissure, 22-32. Fixed digit of the paucidentate chelicera is provided with 2-3 teeth and a *pilus dentilis*; the movable digit unidentate (sometimes additional minute tooth is present). J2 28-43, Z3 23-35, Z4 37-50, Z5 42-50. On trees, shrubs and herbs. Golan Heights, Jordan Valley, Yizre'el Valley, Carmel, Coastal Plain and Judean Hills.

B. talbii (Athias-Henriot, 1960)

- Six pairs of z-s setae on the podonotum (z6 absent; z2, z3, z4, z5, s4, s6 present). Four, five, or six pairs of Z-S setae on the opisthonotum (Z3 absent) (figs. 18-20). The caudoventral seta JV2 present 3
- 3. Six pairs of Z-S setae on the opisthonotum (Z1 present, as well as Z4, Z5, S2, S4, S5) (fig. 18) 4
- Five or four pairs of Z-S setae on the opisthonotum (Z1 absent; present - Z4, Z5, S2, S4, S5 present or absent) (figs. 19, 20) 5
- 4. Setae on the dorsal shield (fig. 36) for the most part strong, thickened, thorn-like and set on tubercles, some are elongate. Ventrianal shield (fig. 59) diminished in size, square, with one pair of preanal setae. The caudo-ventral seta JV3 absent. Peritreme striated. Calyx of the insemination apparatus (fig. 93) elongate-tubular and flares towards the vesicle. Chelicera paucidentate. Leg IV with at most one macroseta **Typhloseiulus** Chant and McMurtry
- Dorsal shield (fig. 36) strongly sclerotized, ornamented with reticulated and tuberculate sculpture; with five pairs of small and punctiform solenostomes (gd1, gd2, gd6, gd8 and gd9); setae j4, j5, z5, S5, J5 and R1 short, other setae on the dorsal shield thorn-like, thicker, and longer, inserted on tubercles, most setae serrated. Apex of peritreme reaches the bases of setae j1 or between j1-j3. Two pairs of setae on the sternal shield. Ventrianal shield (fig. 59) sclerotized, with oblique, transverse and vertical striae; solenostomes not visible. In the insemination apparatus (fig. 93) neck absent; adductor duct cylindrical and long; spermathecal channel discernible in some specimens. Seta stIV weakly prominent; pointed, or slightly tapered, short, not reaching the dorsal lyriform fissure, 22-27; genu II carries seven (seldom six, or eight) setae. In the chelicera the fixed digit bears 1-2 teeth and a *pilus dentilis*; the movable digit unidentate (seldom bidentate). J2 38-66, Z4 63-86, Z5 66-85. On trees and shrubs in forests. Upper and Lower Galilee, Carmel and Judean Hills **T. simplex** (Chant, 1956)
- Setae on the dorsal shield (fig. 37) setaceous. Ventrianal shield (fig. 60) normal in size, with three or four pairs of preanal setae. The caudo-ventral seta JV3 present/absent. Calyx of the insemination apparatus (fig. 94) bowl-shaped, cup-shaped or goblet **Neoseiulella** Muma
- 5. Four pairs of Z-S setae on the opisthonotum (seta S5 absent) (fig. 19). Dorsal shield usually with reticulate ornamentation to a lesser or more degree. Leg IV carries 1-3 macrosetae **Typhlodromus** Scheuten
- Five pairs of Z-S setae on the opisthonotum (seta S5 present) (fig. 20) 6
- 6. Most of the z-s, Z-S setae plumose (fig. 38). Setae r3 and R1 on the lateral integument. Sternal shield bears 2-3 pairs of setae. Leg IV carries macrosetae **Clavidromus** Muma
- Dorsal shield (fig. 38) sclerotized to a lesser or more degree, ornamented with

reticulate sculpture, which in some specimens is weakly pronounced in various locations; with four pairs of solenostomes (gd2, gd6, gd8 and gd9), gd9 small punctiform, others big crateriform; setae J5 and S5 very short and pointed, other setae medium-sized and most of them blunt, slightly knobbed or knobbed and serrate to a lesser or more degree. Apex of peritreme reaches the bases of setae j3 or between j3-z2. Two pairs of setae on the sternal shield. Ventrianal shield (fig. 61) vase-shaped, or subpentagonal; its anterior margin convex, or straight; anterior lateral corners rounded; sclerotized to a lesser or more degree, with few or numerous striae; with three pairs of preanal setae; solenostomes not visible. Ventral interscutal membrane flanking the ventrianal shield provided with four pairs of setae. In the insemination apparatus (fig. 95) the calyx elongate, conus-shaped, thick-walled towards the vesicle; adductor duct cylindrical, spermathecal channel not visible. In the paucidentate chelicera the fixed digit is provided with two teeth (seldom one) and a *pilus dentilis*; the movable digit unidentate. Three macrosetae on the hind leg; those on genu and tibia scarcely discernible; stIV slightly knobbed, not reaching the dorsal lyriform fissure, 40-46. J2 42-60, Z4 50-61, Z5 61-70. On various shrubs, herbs and trees, in litter and in manure heap (donkey). Lower Galilee, Yizre'el Valley, Coastal Plain and Dead Sea **C. jackmickleyi** (De Leon, 1958)*

- Most of the z-s, Z-S setae not plumose, only a few may be serrated (fig. 39). Dorsal shield strongly, or moderately, sclerotized, tuberculate, or with a reticulate ornamentation. Leg IV carries 1-3 macrosetae **Amblydromella** Muma

Key to the adult females of the genus *Amblydromella* Muma

1. Three (or two) pairs of preanal setae on the ventrianal shield (fig. 62). Peritreme short, its apex reaching the bases of setae z4-s4, or s4-s6. Dorsal shield slightly reticulated caudad to J2, or smooth, hexagonal area weakly ornamented or smooth; in some specimens few elongate parallel cells on the area between the bases of setae j6-J2; with three pairs of prominent crateriform solenostomes (gd2, gd6 and gd9). Two pairs of setae on the sternal shield. Ventrianal shield (fig. 62) of varying shape, longer than wide, with lateral margins usually constricted, anterior margin more or less rounded; one to few transverse striae in the preanal area, or smooth; with small punctiform solenostomes. In the insemination apparatus (fig. 96) the calyx bell-shaped or conus-shaped; the neck very short and in some specimens scarcely discernible; adductor duct cylindrical, thin; spermathecal channel short. One macroseta on leg IV; stIV scarcely differentiated, pointed, short, not reaching the dorsal lyriform fissure, 32-38. In the paucidentate chelicera the fixed digit is provided with 3-4 teeth and a *pilus dentilis*; the movable digit unidentate. J2 26-34, Z4 39-55, Z5 62-78. On trees, shrubs and herbs. Golan Heights, Upper and Lower Galilee and Hula Valley **A. invecta** (Chant, 1959)

* According to Muma and Denmark (1968) *C. jackmickleyi* (De Leon) is a junior synonym of *C. transvaalensis* (Nesbitt, 1951). But according to Van der Merwe (1968) they are separate species (macrosetae on leg IV, number of setae on the sternal shield, size of seta s6). The type material should be checked before final conclusion. In Israel mites, as in *C. jackmickleyi*, macrosetae are present on leg IV, three pairs of setae on the sternal shield and the seta s6 shorter than the distance between its base and the base of seta S2.

- Four pairs of preanal setae on the ventrianal shield (fig. 63). Peritreme long, its apex reaching the bases of setae z2, j3 or j1 2
- 2. In the insemination apparatus (fig. 97) the basal part of calyx swollen like the head of a snake; adductor duct thick; spermathecal channel distinct. Dorsal shield strongly ornamented with cells; with five pairs of medium-sized crateriform solenostomes (gd2, gd4, gd6, gd8 and gd9). Apex of peritreme reaches the bases of setae j1. Three pairs of setae on the sternal shield. Ventrianal shield subpentagonal, slightly waisted, with convex anterior margin; smooth; with a pair of small solenostomes. One macroseta on leg IV; stIV short, blunt, not reaching the dorsal lyriform fissure, 33-38. Fixed digit of the chelicera is provided with 2-3 teeth and a *pilus dentilis*; the movable digit has 2-3 teeth. J2 20-25, Z4 25-28, Z5 42-50. On trees and shrubs. Carmel and Coastal Plain **A. thesbites** Swirski and Amitai, 1997
- In the insemination apparatus (figs. 98-104) basal part of calyx not as above 3
- 3. Three macrosetae on leg IV 4
- One macroseta on leg IV 6
- 4. In the insemination apparatus (fig. 98) the narrow calyx has a wide cylindrical stalk with bead-like transverse thickenings; without a neck; atrium small; adductor duct cylindrical and thin; spermathecal channel discernible.
Dorsal shield usually strongly sclerotized and reticulated all over; area between the bases of setae j5-J2 with elongate parallel cells; in some specimens the shield is weakly sclerotized and reticulated all over; with four pairs of small crateriform solenostomes (gd2, gd4, gd6, and gd8); seta Z5 serrated with a bulbous tip. Apex of peritreme reaches the bases of setae j3-j1. Three pairs of setae on the sternal shield. Ventrianal shield much longer than wide, waisted, with anterior margin rounded; usually smooth, or with one to few striae; with a pair of small crescent solenostomes. Seta stIV knobbed, not reaching the dorsal lyriform fissure, 26-34. Fixed digit of the chelicera is provided with five teeth and a *pilus dentilis*; the movable digit has 2-3 teeth. J2 23-26, Z4 32-36, Z5 47-55. On trees and shrubs, less often on herbs. Mount Hermon, Golan Heights, Upper and Lower Galilee, Yizre'el Valley, Carmel, Shomron, Coastal Plain and Judean Hills **A. porathi** (Swirski and Amitai, 1967)
- In the insemination apparatus (figs. 99-104) the calyx bell-shaped, or tubiform, but without the bead-like thickenings 5
- 5. In the insemination apparatus (fig. 99) calyx tubular, the typically bulbous atrium slightly bulges with prominent darkish clips; flaring distally; adductor duct cylindrical; spermathecal channel well visible. Apex of peritreme reaches the bases of setae j3 or j3-z2.
Dorsal shield sclerotized; the area between the bases of setae j5-J2 with elongate parallel cells; opisthonotum strongly reticulated, podonotum slightly reticulated, its anterior part ornamented; in some specimens the elongate cells between j5-J2 are not expressed; with five pairs of prominent crateriform solenostomes (gd2, gd4, gd6, gd8 and gd9); setae Z4 and Z5 serrated. Two pairs of setae on the sternal shield. Ventrianal shield subpentagonal, waisted, with anterior margin rounded; smooth, or with few striae; solenostomes not visible. Seta stIV knobbed, long, reaching the dorsal lyriform fissure, 46-51. Fixed digit of the chelicera is provided

- with four teeth and a *pilus dentilis*; the movable digit unidentate. J2 20-25; Z4 32-42; Z5 45-55. On *Tamarix*, *Acacia* and *Atriplex*. Jordan Valley, Dead Sea and Arava Valley **A. drori** (Grinberg and Amitai, 1970)
- In the insemination apparatus (fig. 100) calyx bell-shaped, adductor duct cylindrical. Apex of peritreme reaches the bases of setae j1 or between j1-j3.
Dorsal shield sclerotized; area between the bases of setae j3-J2 with elongate parallel cells; the shield is reticulated and part of podonotum slightly ornamented; in some specimens the shield is strongly reticulated all over and some of the cells between j3-J2 are not expressed; with five pairs of prominent crateriform solenostomes (gd2, gd4, gd6, gd8 and gd9), gd9 the biggest. Two pairs of setae on the sternal shield. Ventrianal shield subpentagonal, with round anterior margin, in some specimens waisted or slightly waisted; smooth, or with few striae or cells; solenostomes not visible. Seta stIV knobbed and long, reaching or passing the dorsal lyriform fissure, 40-51. Fixed digit of the chelicera is provided with three teeth and a *pilus dentilis*; the movable digit bidentate. J2 22-27, Z4 42-46, Z5 51-60. On trees, shrubs and herbs, found in litter. Upper Galilee, Carmel, Jordan Valley, Judean Hills, Coastal Plain and Northern Negev **A. crypta** (Athias-Henriot, 1960)
- 6. In the insemination apparatus (fig. 101) a long neck is present; the calyx cone-shaped; adductor duct broad.
Dorsal shield sclerotized, strongly reticulated, except for the faintly ornamented areas around the bases of setae Z4; area between the bases of setae j5-J2 is covered by elongate parallel cells; with five pairs of small crateriform solenostomes (gd2, gd4, gd6, gd8 and gd9). Apex of peritreme reaches the bases of setae z2 or between j3-z2. Two pairs of setae on the sternal shield. Ventrianal shield subtriangular, waisted; with few transverse striae; solenostomes not visible. Seta stIV clavate, long, passing the dorsal lyriform fissure, 48-50. Fixed digit of the chelicera is provided with two teeth and a *pilus dentilis*; the movable digit edentate. J2 20-23, Z4 55-56, Z5 63-70. On trees and shrubs. Jordan Valley and Dead Sea **A. jordanis** (Rivnay and Swirski, 1980)
- In the insemination apparatus (figs. 102-104) a neck absent; calyx bell-shaped or flask-shaped 7
- 7. Seta S5 very short, 9-10, S5/Z5 = 0.12-0.18. Setae j3, z2, z3, z4, s4, S2 and S4 longer than, or equal to the distances between their bases. Ventrianal shield longer than wide, ratio of length/width = 1.74-1.83; waisted; with small crateriform solenostomes (in some specimens scarcely visible).
Dorsal shield sclerotized, reticulated, posterior part of the opisthonotum slightly ornamented, in some specimens all the shield is reticulated besides smooth areas around setae Z4; with four pairs of prominent crateriform solenostomes (gd2, gd4, gd8 and gd9). Apex of peritreme reaches the bases of setae j1, or almost so. Two pairs of setae on the sternal shield. In the insemination apparatus (fig. 102) calyx flute-shaped; adductor duct broad; spermathecal channel discernible. Seta stIV pointed, short, not reaching the dorsal lyriform fissure, 29-30. Fixed digit of the chelicera is provided with four teeth and a *pilus dentilis*; the movable digit tridentate. J2 42-49, Z4 60-70, Z5 55-71. On trees and shrubs. Dead Sea, Judean Desert and Jordan Valley. **A. hierochuntica** (Amitai and Swirski, 1968)

- Seta S5 much longer, longer than 20, $S5/Z5 = 0.36-0.55$. Setae j3, z2, z3 longer, equal to, or shorter, than the distances between their bases; setae z4, s4, s6, S2 shorter than the distances between their bases. Ventrianal shield subpentagonal, ratio of length/width = 1.21-1.37 8
- 8. Three pairs of solenostomes on the dorsal shield (gd2, gd6 and gd9) (fig. 39). Seta stIV pointed, short, not reaching the dorsal lyriform fissure, 28-37.

Dorsal shield (fig. 39) sclerotized, strongly reticulated all over, except for the faintly ornamented areas around the bases of setae Z4; area between the bases of setae j5-J2, or j5-j6, covered by elongate parallel cells; seta Z5 serrated. Apex of peritreme reaches the bases of setae j3, between j3-z2 or z2. Two pairs of setae on the sternal shield. Ventrianal shield (fig. 63) subpentagonal, waisted to a lesser or more degree, anterior margin straight, anterior lateral corners rounded; ratio of length/width = 1.21-1.32; striated; with a pair of small punctiform solenostomes (in some specimens scarcely visible). In the insemination apparatus (fig. 103) the calyx bell-shaped, sometimes cone-shaped, slightly flaring towards the vesicle, thin-walled in its proximal half and slightly thick-walled near the vesicle; adductor duct cylindrical. Fixed digit of the chelicera is provided with three teeth and a *pilus dentilis*; the movable digit unidentate. J2 22-30, S5 23-35, Z4 32-38, Z5 50-63. On various trees, shrubs and herbs. Common. Golan Heights, Upper and Lower Galilee, Hula Valley, Jordan Valley, Yizre'el Valley, Carmel, Shomron, Coastal Plain, Judean Foothills, Judean Hills, Northern and Central Negev *A. recki* (Wainstein, 1958)

- Five pairs of prominent crateriform solenostomes on the dorsal shield (gd2, gd4, gd6, gd8 and gd9). Seta stIV knobbed, long, reaching the dorsal lyriform fissure, 46-50.

Dorsal shield strongly reticulated; setae Z4 slightly serrated, setae Z5 slightly serrated, some blunt. Apex of peritreme reaches the bases of setae j3 or between j3-z2. Two pairs of setae on the sternal shield. Ventrianal shield subpentagonal, its anterior margin convex, with rounded lateral corners; ratio of length/width = 1.24-1.31; with one or few striae; solenostomes not visible. In the insemination apparatus (fig. 104) the calyx bell-shaped, thick-walled; adductor duct cylindrical; spermathecal channel distinct. Fixed digit of the chelicera is provided with three teeth and a *pilus dentilis*; the movable digit unidentate. J2 22-23, S5 20-22, Z4 35-38, Z5 51-55. On *Pinus*. Jordan Valley *A. athenas* (Swirski and Ragusa, 1976)

Key to adult females of the genus *Neoseiulella* Muma

1. Primary inguinal sigillum (fig. 117) subtriangular, 23. Seta stIV knobbed, reaching the dorsal lyriform fissure, 58-66. Three pairs of setae on the sternal shield. Dorsal shield (fig. 37) not reticulated, but ornamented anteriorly and striated posteriorly.
Six pairs of small crateriform solenostomes on the dorsal shield (gd1, gd2, gd4, gd6, gd8 and gd9). Apex of peritreme reaches the bases of setae j1 or between j1-j3. Ventrianal shield (fig. 60) subtriangular; slightly striated; with four pairs of preanal setae; solenostomes not visible. In the insemination apparatus (fig. 94) calyx bell-shaped; the small atrium adjacent to the calyx; adductor duct cylindric;

drical; spermathecal channel distinct. Genu II carries six setae. Fixed digit of the chelicera is provided with 3-4 teeth and a *pilus dentilis*; the movable digit unidentate. J2 25-28, Z4 38-43, Z5 51-56, JV5 53-58. On trees and shrubs. Carmel *N. carmeli* (Rivnay and Swirski, 1980)

- Primary inguinal sigillum (fig. 118) narrow, elongated, 30-43. Seta stIV pointed, shorter, not reaching the dorsal lyriform fissure, 32-40. Two pairs of setae on the sternal shield. Dorsal shield reticulated at least at certain locations 2
- 2. Dorsal shield reticulated all over. In the chelicerae the fixed digit is provided with 3-4 teeth and a *pilus dentilis*; the movable digit bidentate. Seta J2 33-35.

Primary inguinal sigillum 32-34. Six pairs of small crateriform solenostomes on the dorsal shield (gd1, gd2, gd4, gd6, gd8 and gd9). Ventrianal shield with posterior half reticulated; with a pair of small crateriform solenostomes. Apex of peritreme reaches the bases of setae j3 or between j3-j1. In the insemination apparatus calyx bell-shaped; the small atrium adjacent to the calyx; adductor duct cylindrical; spermathecal channel distinct. Genu II carries seven setae. Z4 45-50, Z5 55-58, JV5 46-51. On trees and shrubs. Upper Galilee, Carmel and Coastal Plain. *N. montforti* (Rivnay and Swirski, 1980)

- Dorsal shield striated, passing at certain locations into reticulation; area between the bases of setae j5-J2 covered by elongated cells. In the chelicerae the fixed digit is provided with 2-3 teeth and a *pilus dentilis*; the movable digit edentate or unidentate. Seta J2 14-18.

Primary inguinal sigillum 30-43. Six pairs of big crateriform solenostomes on the dorsal shield (gd1, gd2, gd5, gd6, gd8 and gd9 - gd4 absent !). Ventrianal shield slightly striated, in some places the striation passes into reticulation; solenostomes not visible. Apex of peritreme reaches the bases of setae j3 or between j3-z2. In the insemination apparatus calyx bell-shaped; the small atrium adjacent to the calyx; adductor duct cylindrical. Genu II carries seven setae. Z4 32-55, Z5 48-70, JV5 35-56. On shrubs and herbs. Coastal Plain and Northern Negev. *N. litoralis* (Swirski and Amitai, 1984)

Key to the adult females of the genus *Typhlodromus* Scheuten

1. Ventrianal shield (fig. 64) carries three pairs of preanal setae. Palp longer than 200. Setae on dorsal shield short, Z5 the longest, other setae subequal in length, all setae setaceous and smooth. J2 12-15, Z4 17-18, Z5 23-27.
Dorsal shield sclerotized, its hexagonal area not ornamented, anteriorly median and lateral regions are covered with oblique striae, passing at certain locations into elongate cells, the reticulations around the bases of setae Z4 faint, the remaining parts of the shield strongly reticulated; with four pairs of prominent crateriform solenostomes (gd2, gd6, gd8 and gd9). Two pairs of setae on the sternal shield. Apex of peritreme reaches the bases of setae j3 or z2; its surface uniformly stipulated. The anterior margin of the waisted ventrianal shield convex, form of the shield is sometimes irregular; smooth; or striated; solenostomes not visible. Four pairs of setae on the ventral interscutal membrane flanking the ventrianal shield. In the insemination apparatus (fig. 105) the calyx cup-shaped, thick-walled almost all over; neck absent; adductor duct thick; spermathecal channel slightly visible. Hind leg carries three macrosetae; stIV

- knobbed, long, reaching the dorsal lyriform fissure, 43-45; genu II carries seven setae. Fixed digit of the chelicera is provided with four subapical teeth and a *pilus dentilis*; the movable digit unidentate. On *Cupressus* and *Widelia*. Jordan Valley *T. longipalpus* Swirski and Ragusa, 1976*
- Ventrianal shield carries four pairs of preanal setae (fig. 65). Palp shorter than 185. Setae on the dorsal shield longer - J2 longer than 19, Z4 longer than 33, Z5 longer than 50 2
 - 2. Surface of peritreme unevenly stippled, with central core (fig. 115); peritreme short, its apex reaches the bases of setae z3-z4, or z4.
Dorsal shield moderately sclerotized, opisthonotum reticulated, area between the bases of setae z5-J2 covered with elongate parallel cells, lateral areas of the podonotum slightly reticulated, the central area of the podonotum almost smooth; with four pairs of big crateriform solenostomes (gd2, gd6, gd8 and gd9). Two pairs of setae on the sternal shield. Ventrianal shield subpentagonal, its anterior margin slightly convex and anterior lateral corners rounded; moderately sclerotized, almost smooth or faintly reticulated, with prominent muscle marks; solenostomes not visible. In the insemination apparatus (fig. 106) calyx "U-shaped"; neck absent; adductor duct cylindrical and short. Leg IV carries one macroseta; stIV slightly blunt, 50; genu II carries seven setae. Fixed digit of the chelicera is provided with three teeth and a *pilus dentilis*; the movable digit unidentate. J2 25, Z4 35, Z5 51. On *Asparagus*. Carmel *T. klimenkoi* Kolodochka, 1980
 - Surface of peritreme evenly stippled, without a central core (fig. 116); peritreme longer, its apex at least reaches the bases of setae z2-z3 3
 - 3. Genu II carries six setae.
Dorsal shield moderately sclerotized; opisthonotum strongly reticulated, podonotum reticulated except on central area between the bases of setae j1-j4, area between the bases of setae j6-J2 with some elongate cells; with four pairs of prominent crateriform solenostomes (gd2, gd6, gd8 and gd9). Apex of peritreme reaches the bases of setae z2, or between j3-z2. Two pairs of setae on the sternal shield. Ventrianal shield subtriangular, slightly waisted, its anterior margin convex; with few striae; solenostomes not visible. Four pairs of setae on the ventral interscutal membrane flanking the ventrianal shield. In the insemination apparatus (fig. 107) calyx bell-shaped, thick-walled towards the vesicle; adductor duct cylindrical; spermatic channel discernible. One macroseta on leg IV; stIV slightly knobbed, or tapered, long, passing the dorsal lyriform fissure, 48-56. Fixed digit of the chelicera is provided with three teeth and a *pilus dentilis*; the movable digit unidentate. J2 20-23, Z4 38-43, Z5 59-65. On *Quercus*. Carmel *T. setubali* Dosse, 1961
 - Genu II carries seven setae 4
 - 4. Leg IV bears three macrosetae.
Dorsal shield slightly to moderately sclerotized; usually reticulated except for faint ornamentation of the hexagonal area and around the bases of setae Z4,

* *T. longipalpus* was considered to be by Abbasova (1980) and Chant and Yoshida-Shaul (1987) a junior synonym of *T. leptodactylus* Wainstein (1961). Denmark (1992) regards *T. longipalpus* as a valid species, easily separated from the latter. At this stage of knowledge and prior to comparison of the type materials - we adopt Denmark's opinion.

- cells between the bases of setae j5-j6 irregular from elongate to quadrangular; with four pairs of prominent crateriform solenostomes (gd2, gd6, gd8 and gd9). Apex of peritreme between j1-j3 or between j3-z2. Two pairs of setae on the sternal shield. Ventrianal shield subpentagonal, slightly waisted, its anterior margin almost straight, with rounded anterior lateral corners; with few striae; solenostomes not visible or scarcely so. Four pairs of setae on the ventral interscutal membrane flanking the ventrianal shield. In the insemination apparatus (fig. 108) calyx bell-shaped, uniformly thick; neck absent; adductor duct cylindrical; spermatic channel discernible. Seta stIV blunt, long, reaching the dorsal lyriform fissure, 45-48. Fixed digit of the chelicera is provided with 3-4 teeth and a *pilus dentilis*; the movable digit unidentate. J2 19-23, Z4 33-36, Z5 50-54. On trees, shrubs and herbs. Upper Galilee, Hula Valley, Carmel and Coastal Plain *T. ernesti* Ragusa and Swirski, 1978
- Leg IV bears one macroseta 5
 - 5. In the insemination apparatus (fig. 109) a short neck present; calyx bell-shaped, thick-walled allover; adductor duct cylindrical; spermatic channel discernible.
Dorsal shield (fig. 40) sclerotized and reticulated, a number of elongate cells on the area between the bases of setae j5-j6; with four pairs of big crateriform solenostomes (gd2, gd6, gd8 and gd9). Apex of peritreme usually reaches the bases of setae j3, sometimes j1-j3 or between j3-z2. Two pairs of setae on the sternal shield. Ventrianal shield (fig. 65) subpentagonal, slightly waisted, with convex anterior margin; slightly striated, with few cells; with small punctiform solenostomes, which are not discernible in some specimens. Seta stIV slightly knobbed, not reaching the dorsal lyriform fissure, 36-42. Fixed digit of the chelicera is provided with 2-3 teeth and a *pilus dentilis*; the movable digit unidentate. J2 20-23, Z4 33-40, Z5 58-65. On trees and shrubs. Carmel, Coastal Plain and Judean Hills *T. exhilaratus* Ragusa, 1977
 - Insemination apparatus (figs. 110-112) without a neck 6
 - 6. Seta stIV with a weakly bulbous tip, or pointed, short, not reaching, scarcely reaching, or passing the dorsal lyriform fissure, 32-42 (usually 33-35). Calyx of insemination apparatus (fig. 110) U-shaped, short, 12-18 (usually 15-17); atrium small; adductor duct cylindrical.
Dorsal shield with elongate parallel cells on the area between the bases of setae j5-J2, or j4-J2, podonotum and opisthonotum strongly reticulated, in some specimens the area around the bases of setae Z4 smooth and/or podonotum slightly reticulated; with four pairs of prominent solenostomes (gd2, gd6, gd8 and gd9). Apex of peritreme reaches the bases of setae j3-j1, or j3. Two pairs of setae on the sternal shield. Ventrianal shield subpentagonal, waisted, with a convex anterior margin; preanal area smooth, or with few striae, anal area with few cells; solenostomes not visible. Fixed digit of the chelicera is provided with 2-3 teeth and a *pilus dentilis*; the movable digit unidentate. J2 17-18, Z4 27-32, Z5 42-48. On trees, shrubs and herbs. Jordan Valley, Coastal Plain and Judean Foothills *T. phialatus* Athias-Henriot, 1960
 - Seta stIV long, passing the dorsal lyriform fissure, 44-60. Calyx of insemination apparatus (figs. 111, 112) elongate, tube-like, longer than 20 7
 - 7. Apex of peritreme reaches the bases of setae j3-z2, less often j3 or z2. Se-

ta Z4 long (47-55), longer than the distance between its base and the base of the seta Z5. Seta Z5 long (70-83).

On the slightly sclerotized dorsal shield the opisthonotum usually lightly reticulated (sometimes moderately) almost allover; the podonotum lightly ornamented with striae and cells, mainly in lateral areas (in some specimens also in the central area); with four pairs of prominent crateriform solenostomes (gd2, gd6, gd8 and gd9). Two pairs of setae on the sternal shield. Ventrianal shield subpentagonal, slightly or moderately waisted, its anterior margin convex (seldom concave); preanal area with few, or numerous, transverse striae, anal area with few scarcely prominent striae; solenostomes not visible. Calyx of the insemination apparatus (fig. 111) tubuliform, elongate, 23-30 (usually 25-28); atrium small and incorporated in the calyx; adductor duct cylindrical. Seta stIV with tapered tip, 44-60. Fixed digit of the chelicera is provided with three teeth and a *pilus dentilis*; the movable digit unidentate. J2 23-26. On trees, shrubs and herbs. Found in litter and dust (house). Common. Allover the country. On citrus *T. athiasae* is prevalent in the Yizre'el Valley, Jordan Valley and Galilee. Widespread on apple trees.

..... *T. athiasae* Porath and Swirski, 1965
Apex of peritreme reaches the bases of setae j1-j3. Seta Z4 shorter, 37-43, shorter than the distance between its base and the base of seta Z5. Seta Z5 shorter (53-60).

Dorsal shield slightly sclerotized, its opisthonotum reticulated, podonotum slightly ornamented; with four pairs of prominent solenostomes (gd2, gd6, gd8 and gd9). Two pairs of setae on the sternal shield. Ventrianal shield subtriangular, slightly waisted, its anterior margin convex; with few striae; solenostomes not visible. In the insemination apparatus (fig. 112) calyx elongate and narrow. Seta stIV slightly knobbed, 50-52. Fixed digit of the chelicera is provided with 2-3 teeth and a *pilus dentilis*; the movable digit unidentate. J2 18-23. On *Asparagus*. Lower Galilee

..... *T. athiasae perbibus* Wainstein and Arutunian

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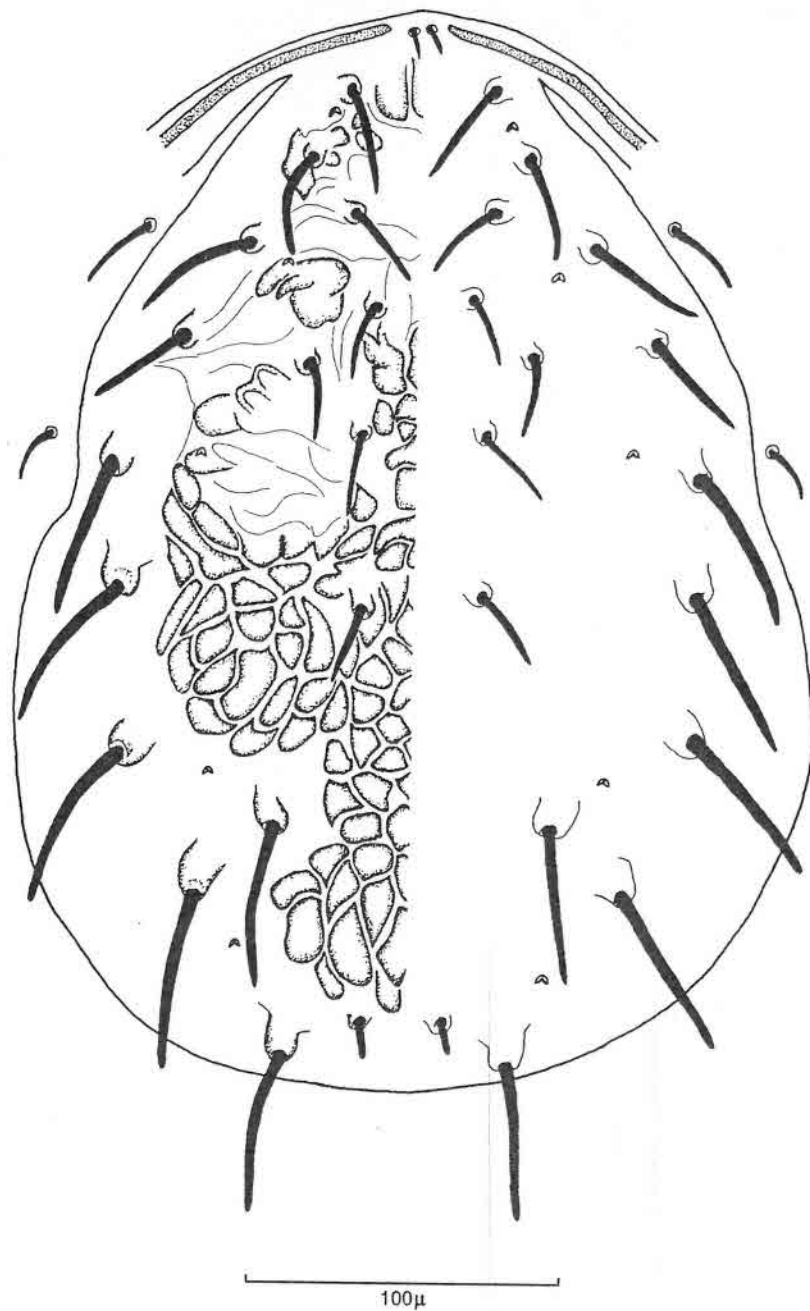
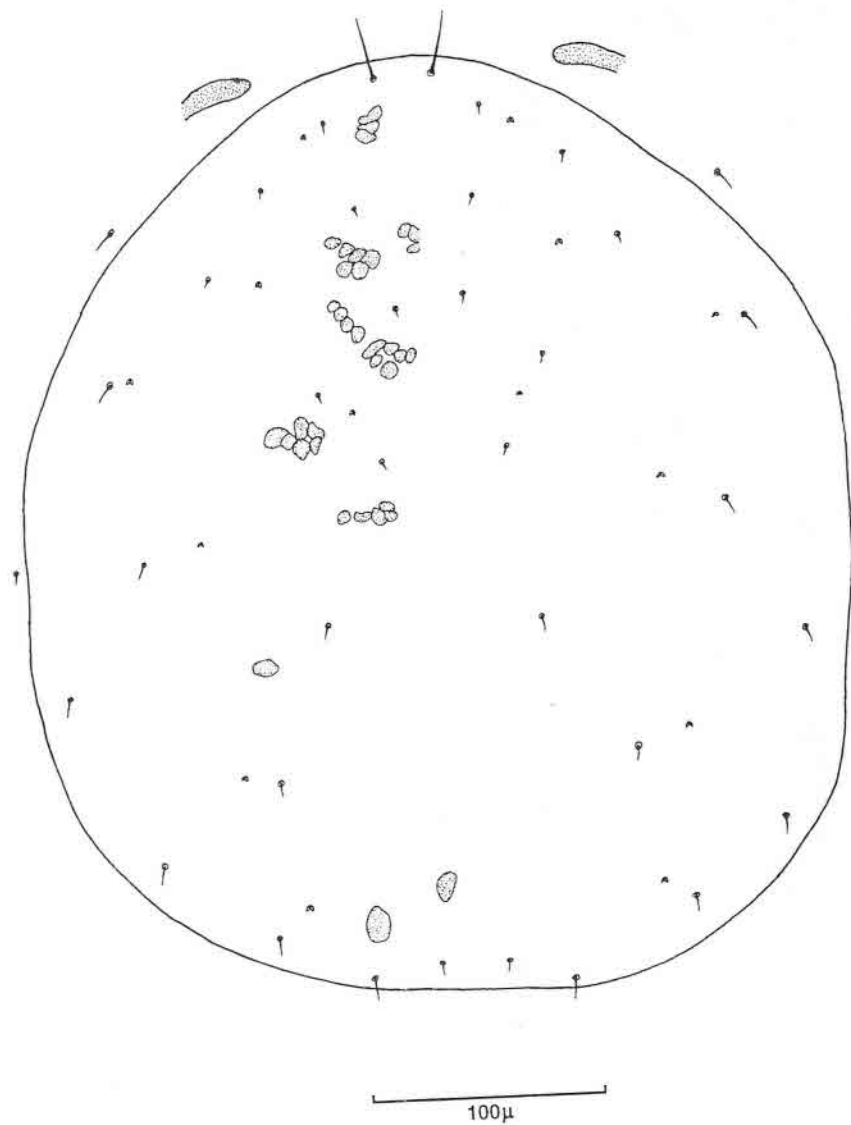
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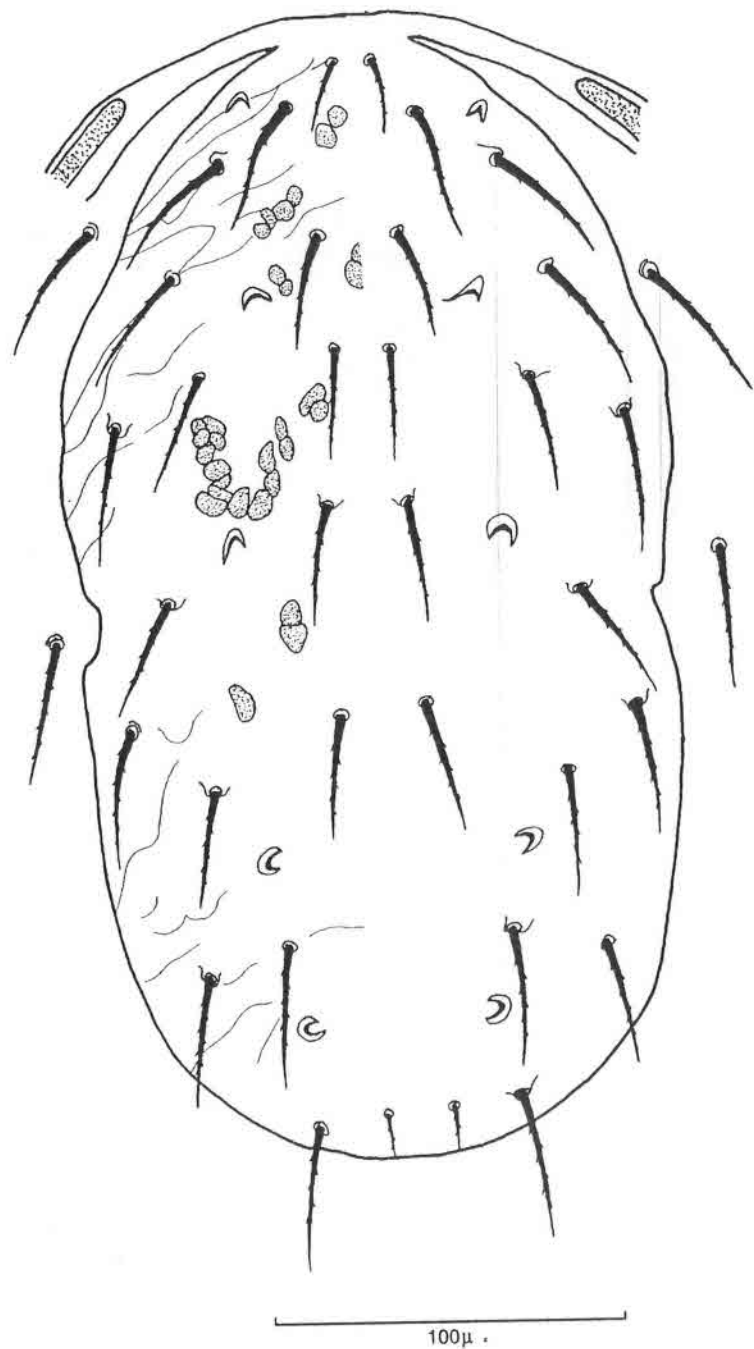
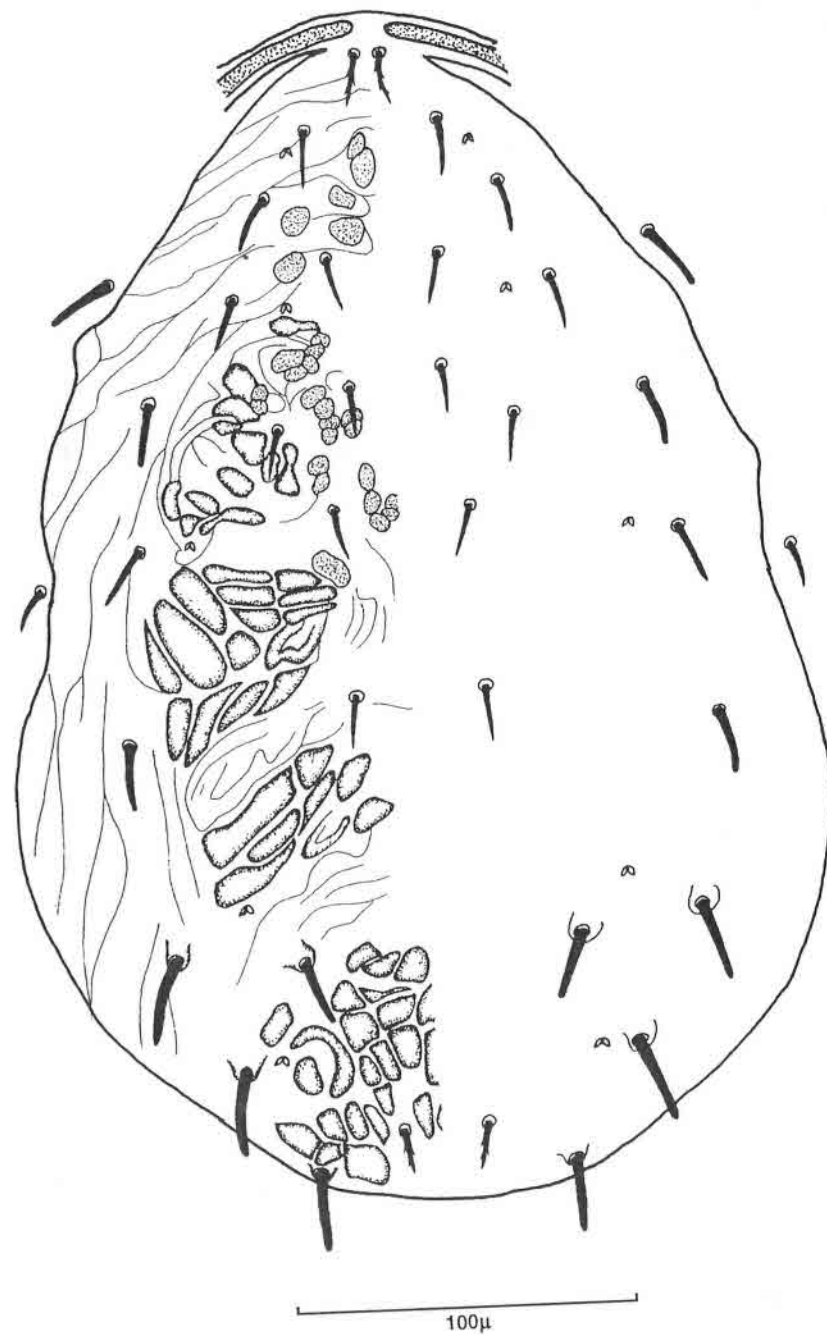
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Fig. 21 - Dorsal shield of *Phytocerus desertorum*.Fig. 22 - Dorsal shield of *Iphiseius degenerans*.

Fig. 23 - Dorsal shield of *Typhloseiella isotricha*.Fig. 24 - Dorsal shield of *Paragigagnathus tamaricis*.

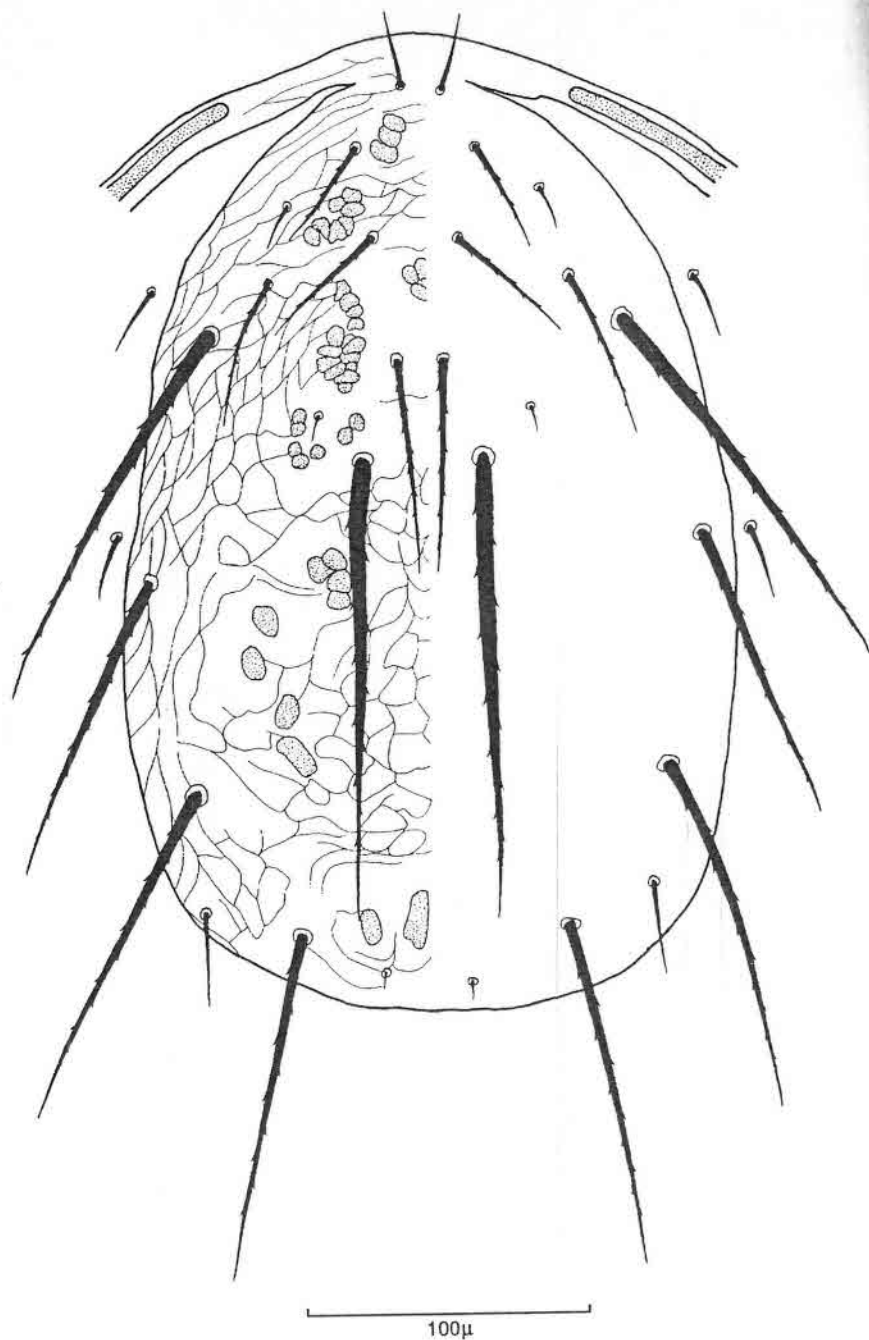


Fig. 25 - Dorsal shield of *Phytoseiulus persimilis*.

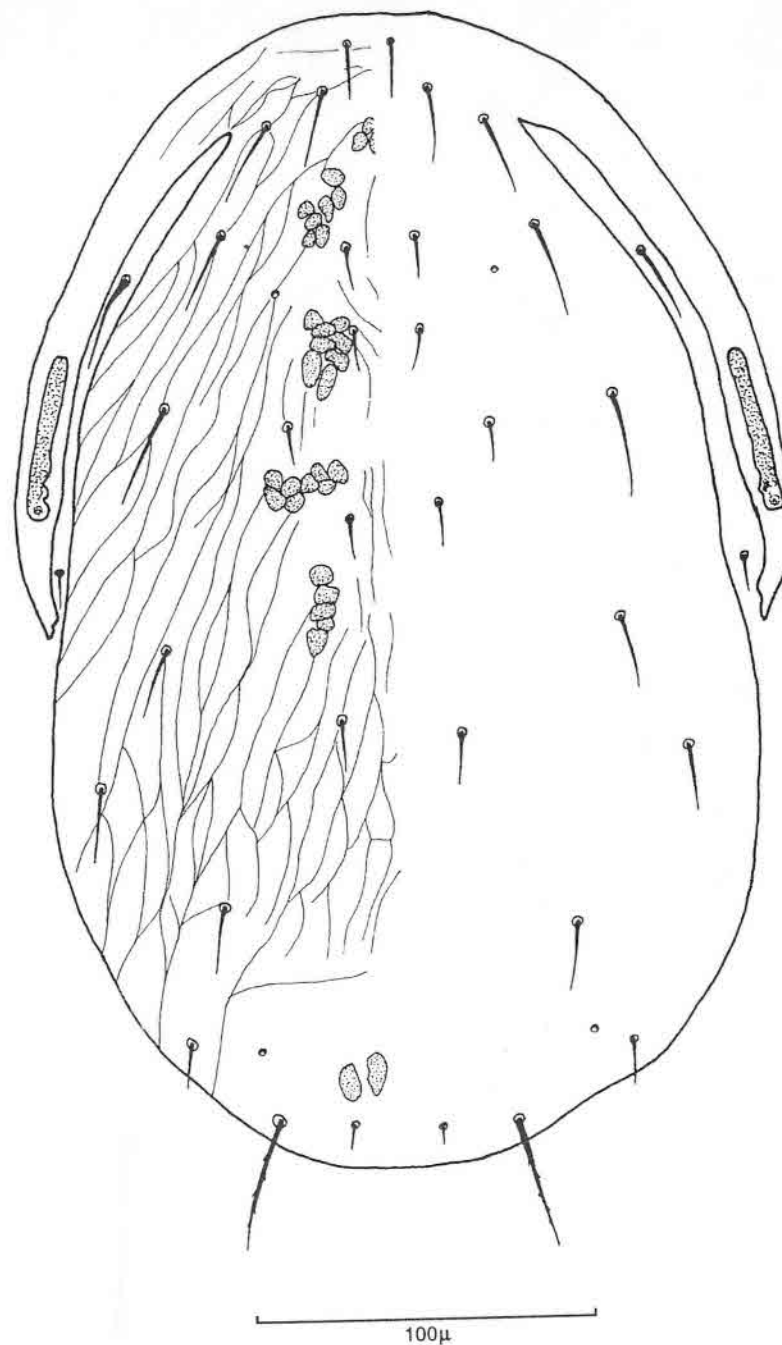


Fig. 26 - Dorsal shield of *Eharius chergui*.

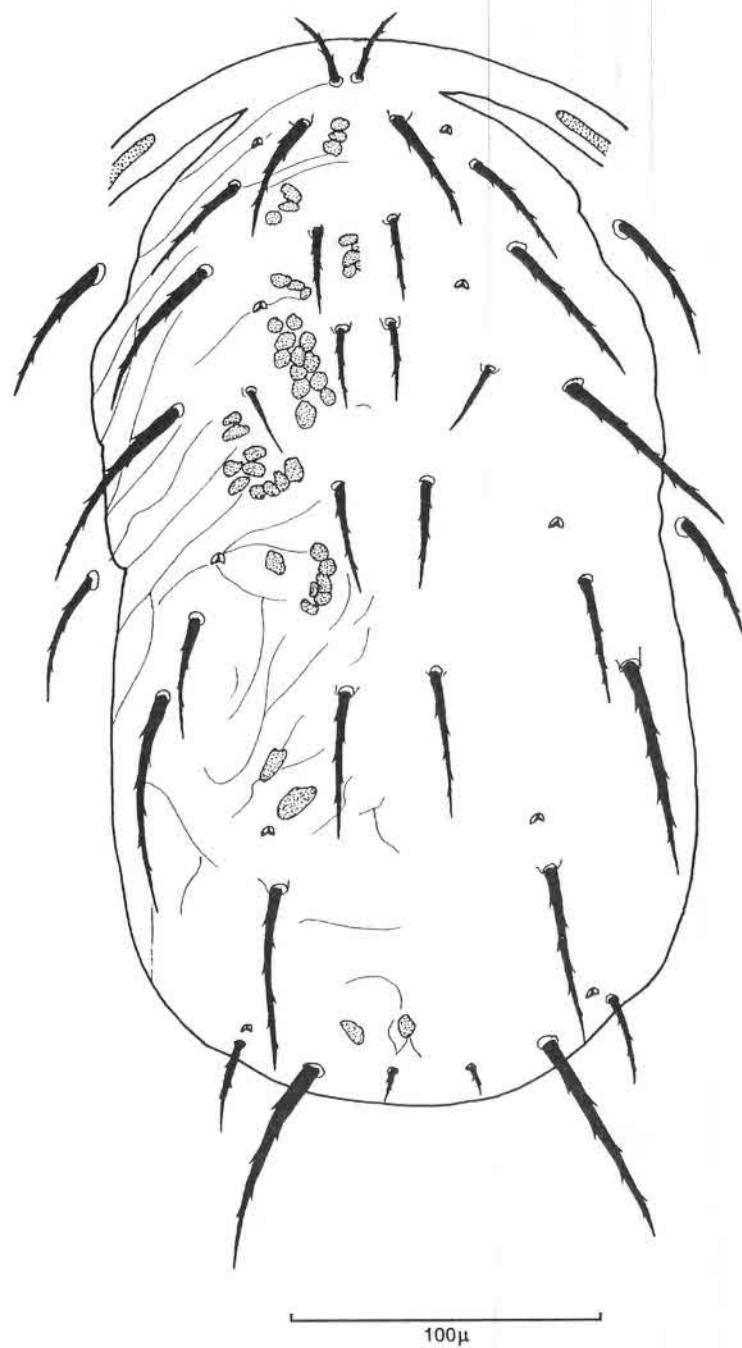


Fig. 27 - Dorsal shield of *Kampimodromus ericinus*.

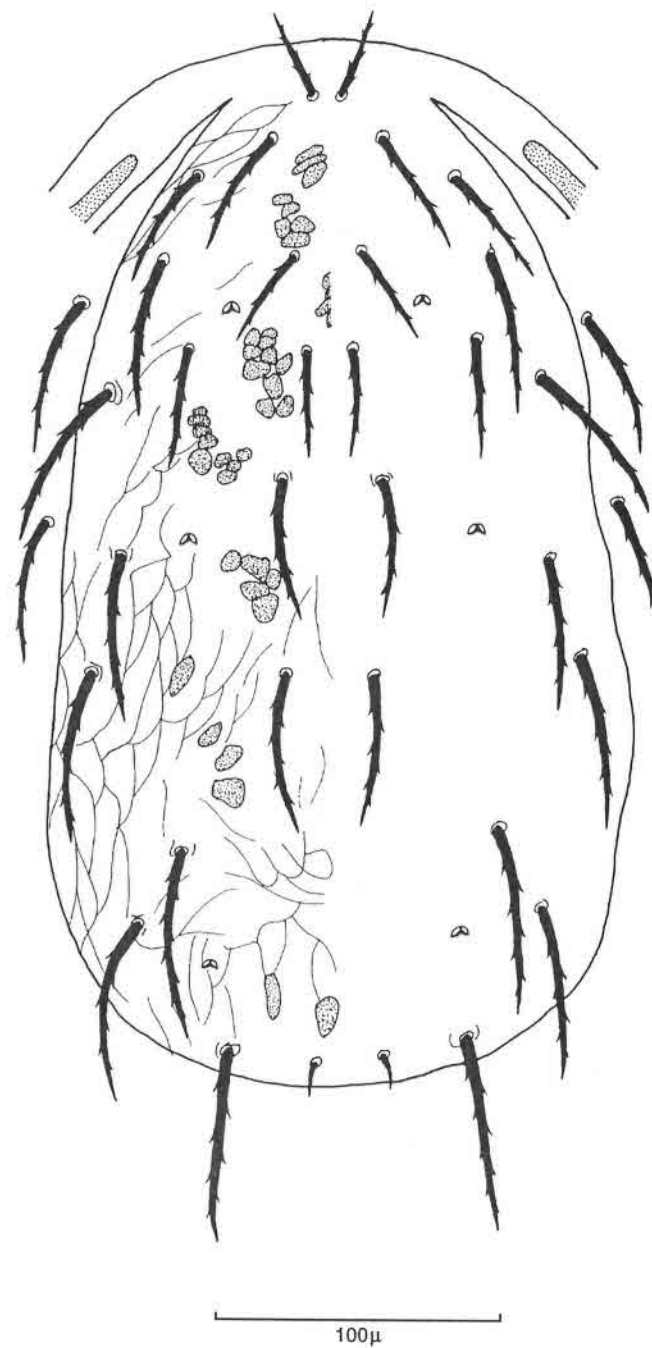


Fig. 28 - Dorsal shield of *Kampimodromus judaicus*.

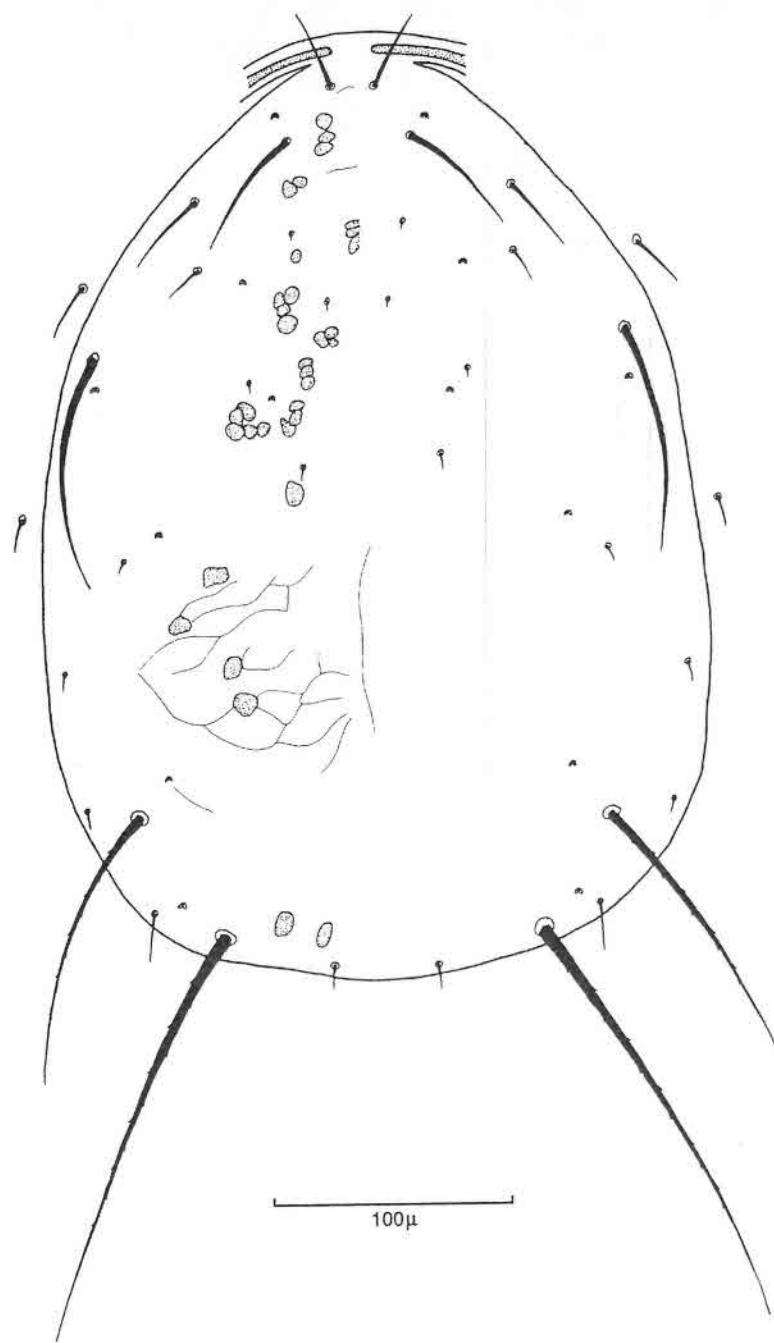
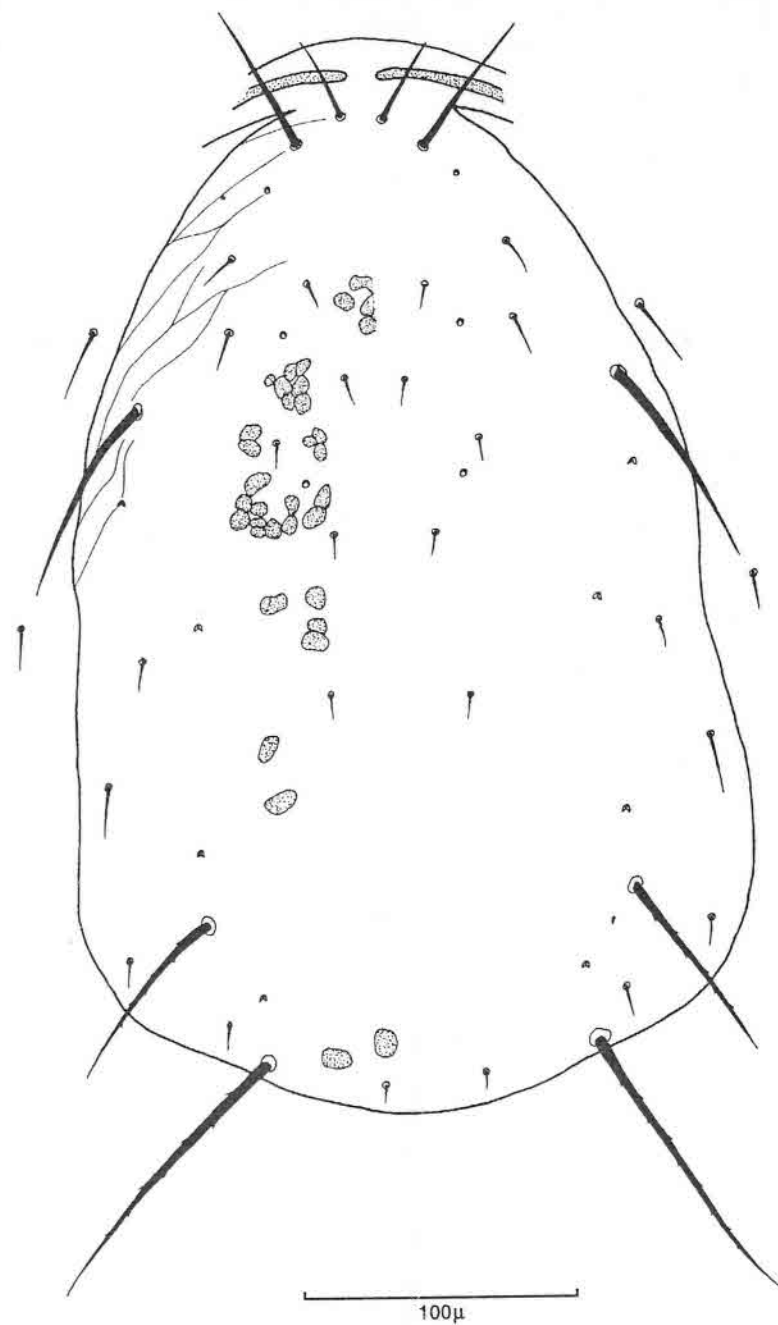
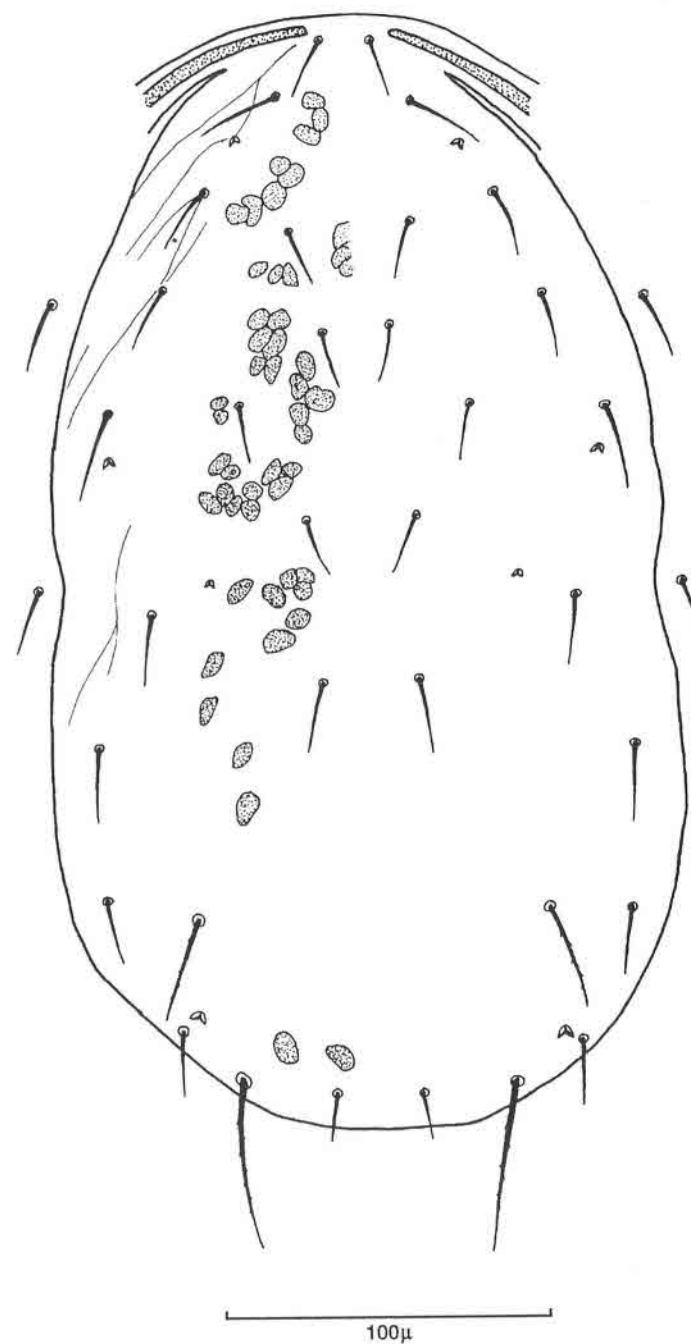
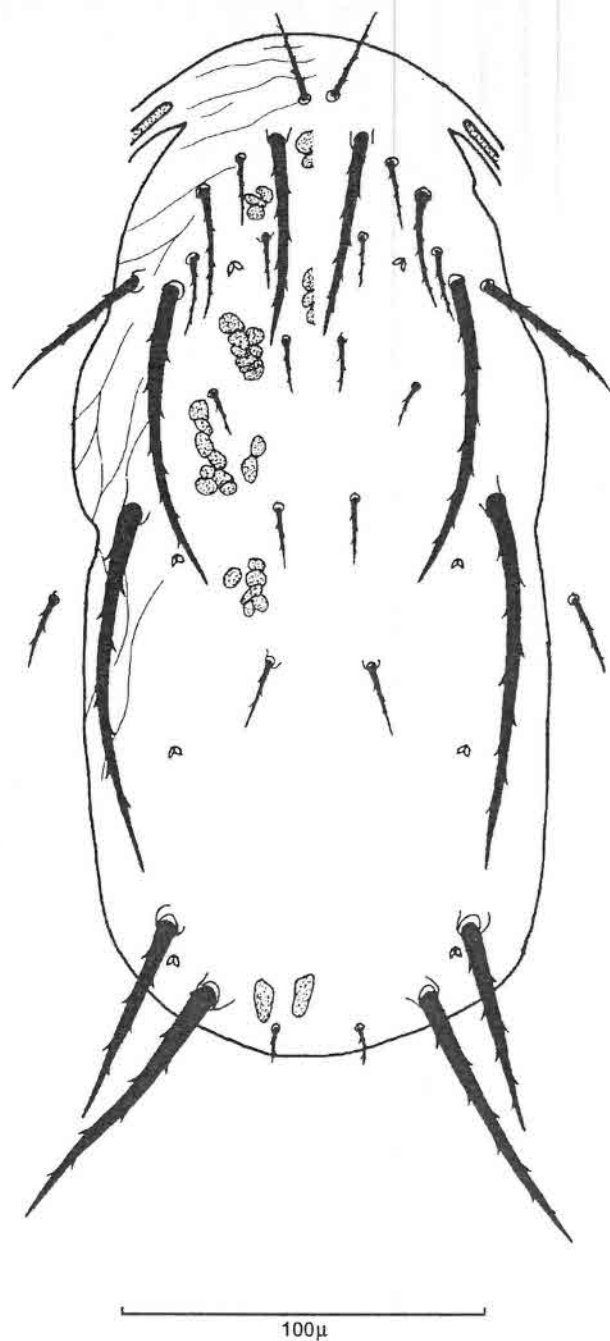
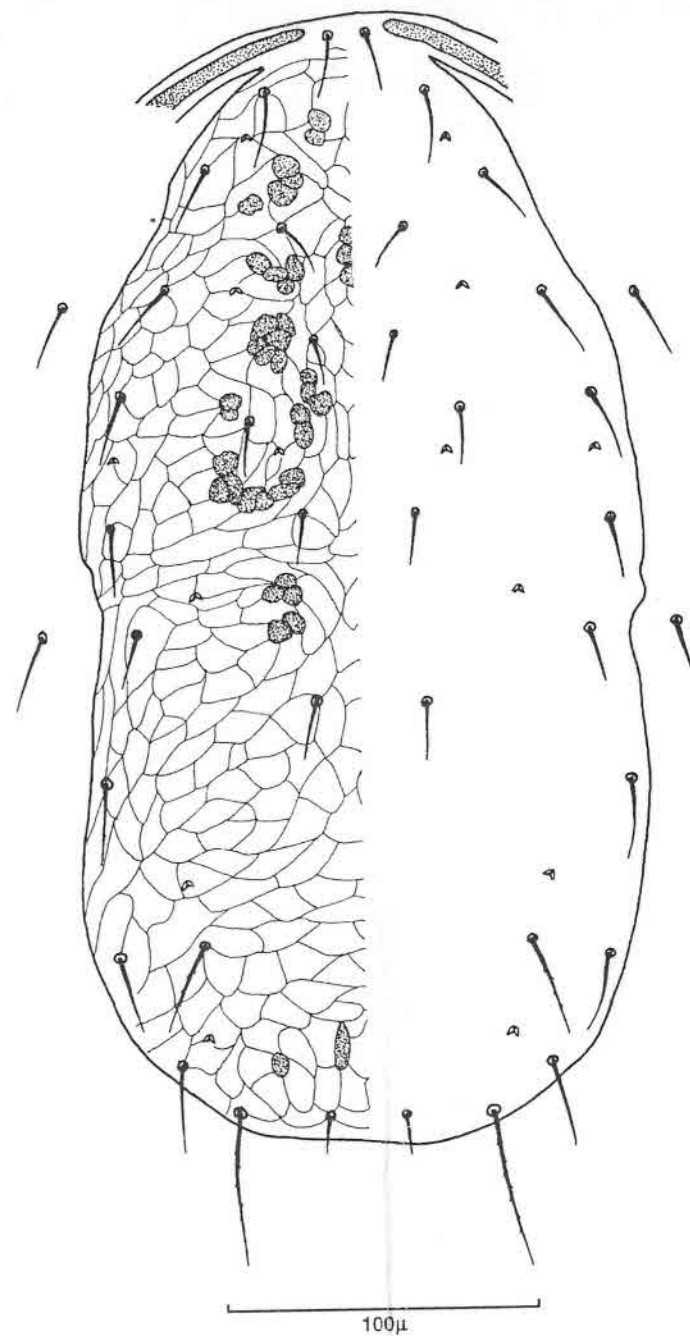
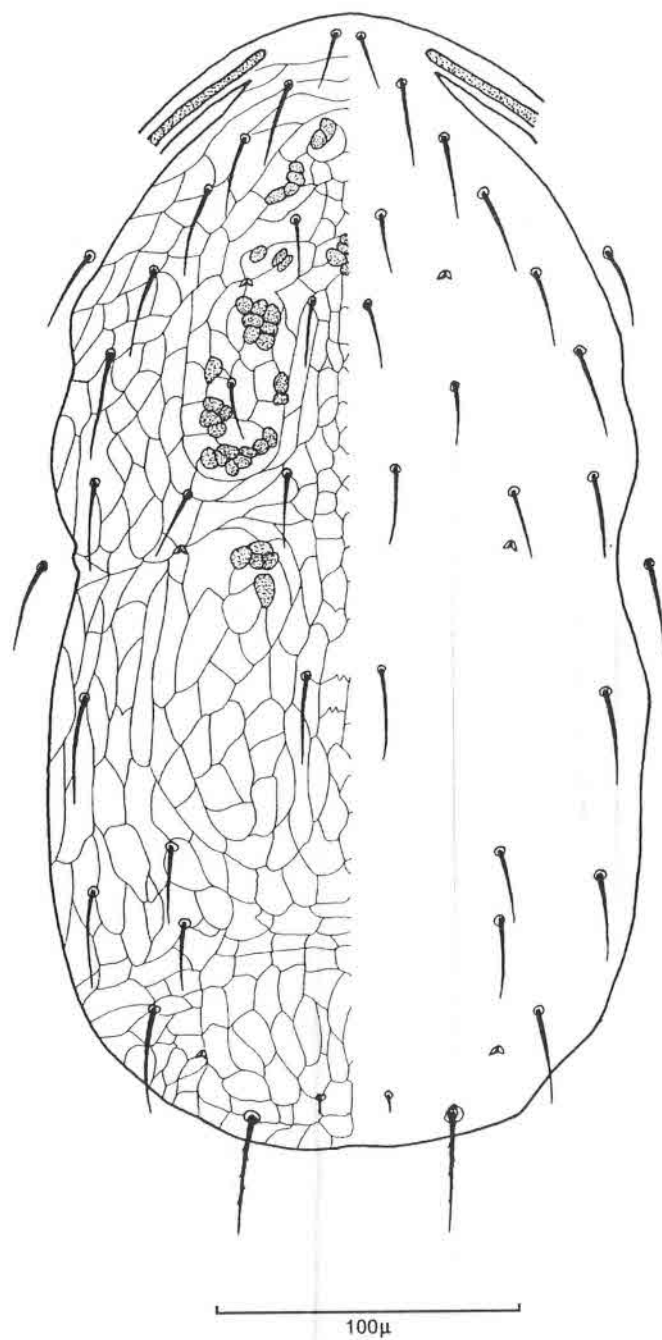
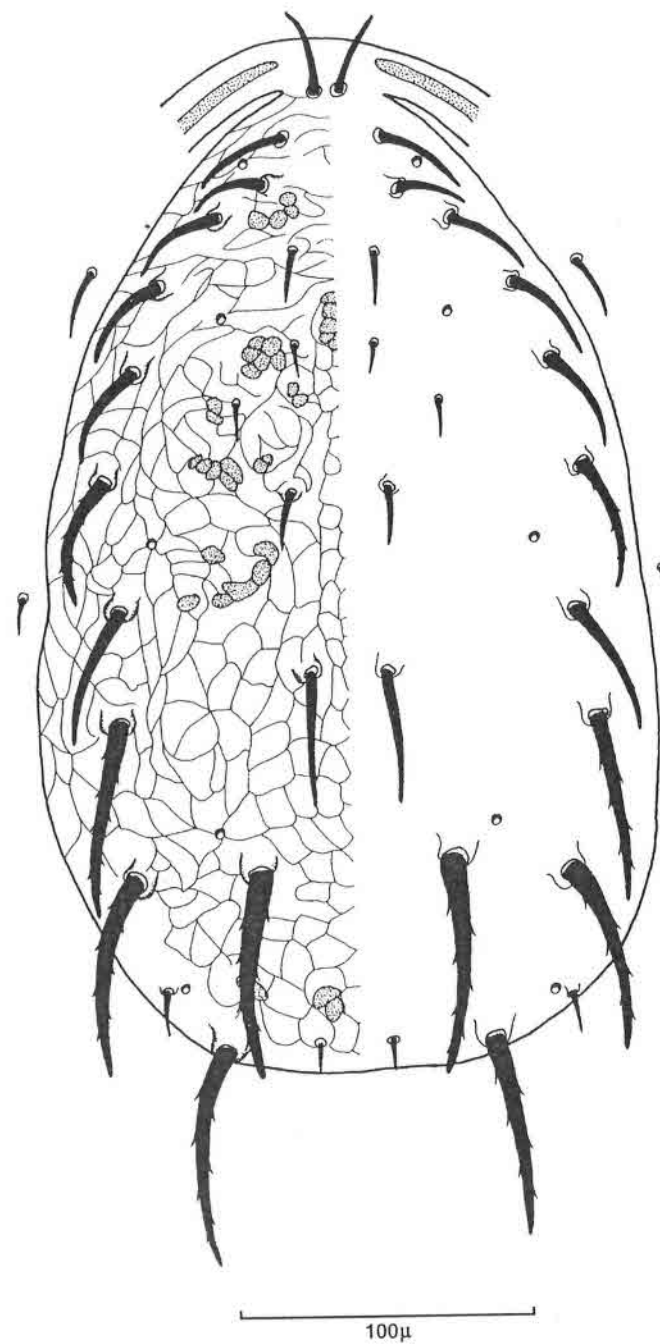
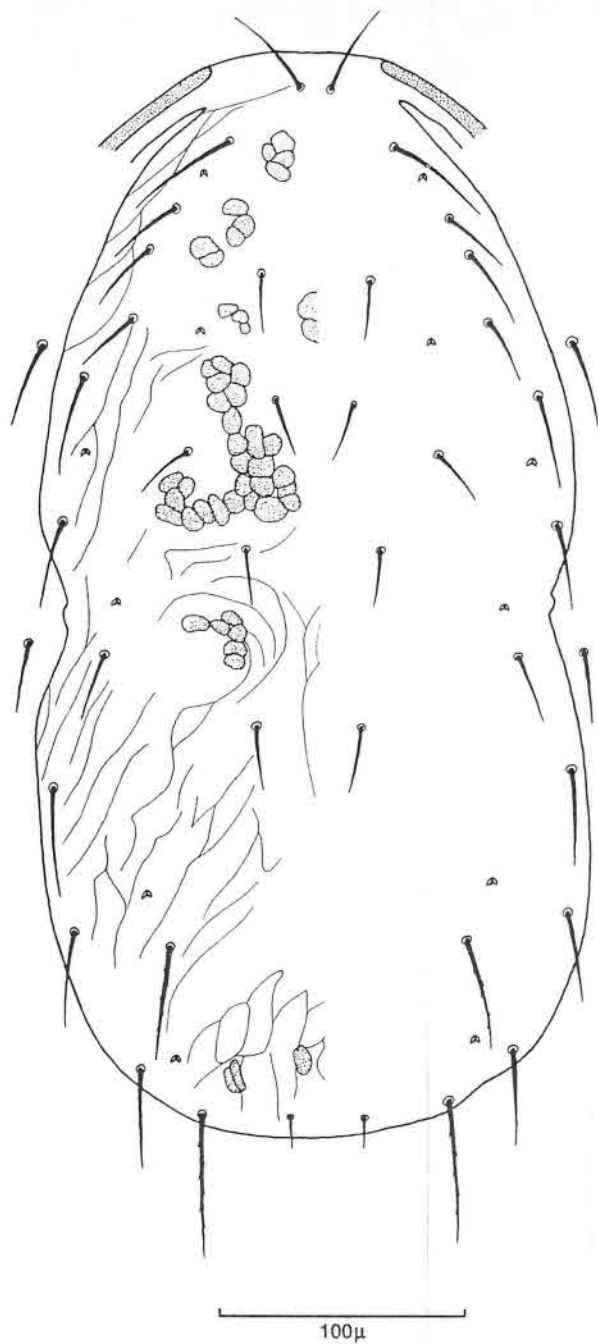
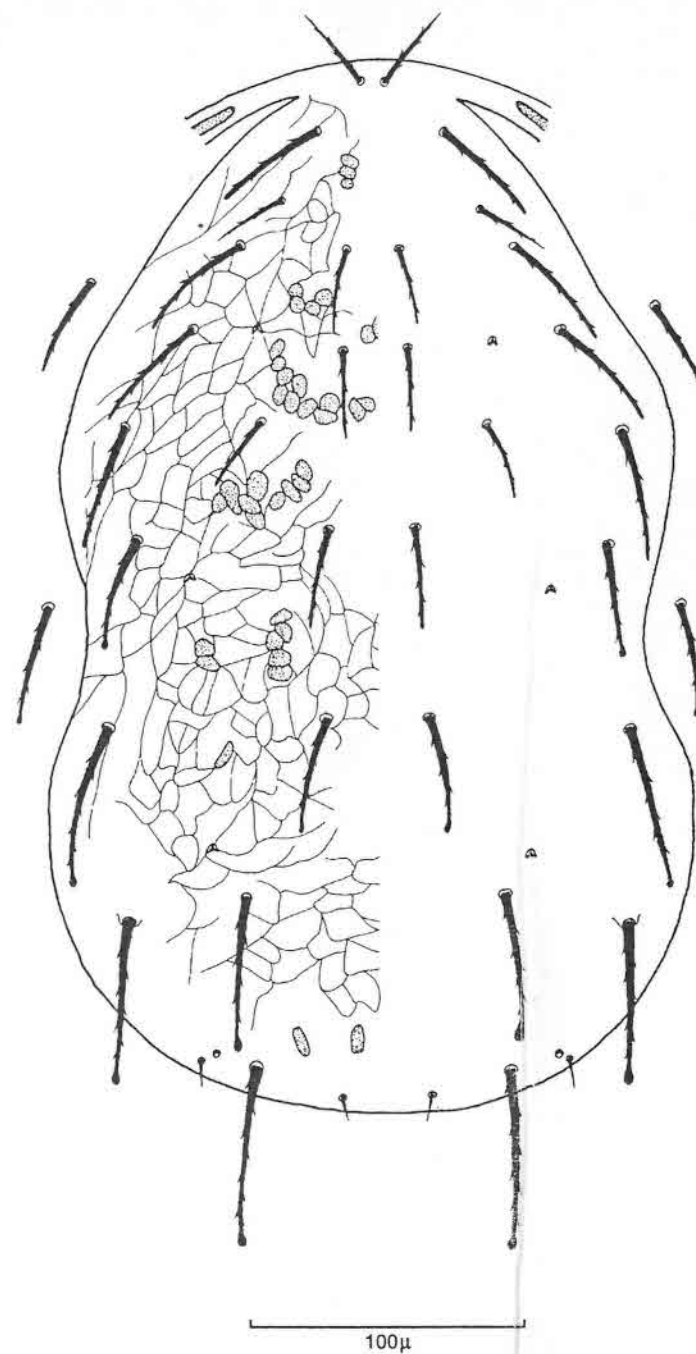
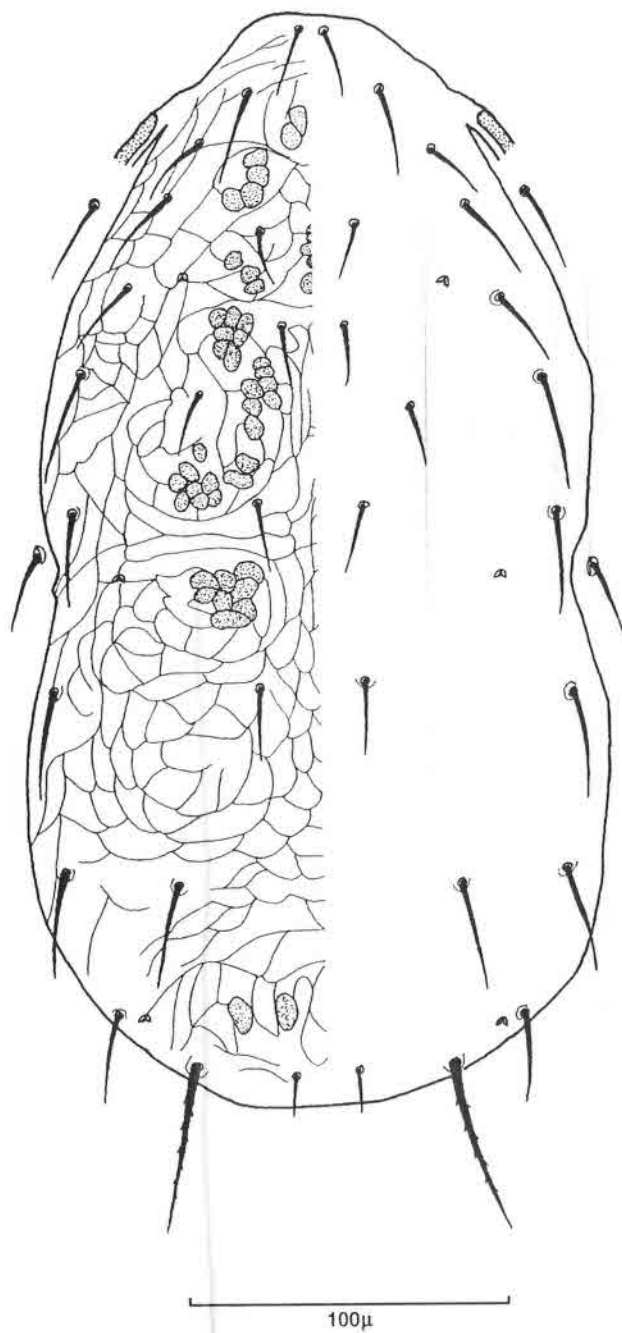
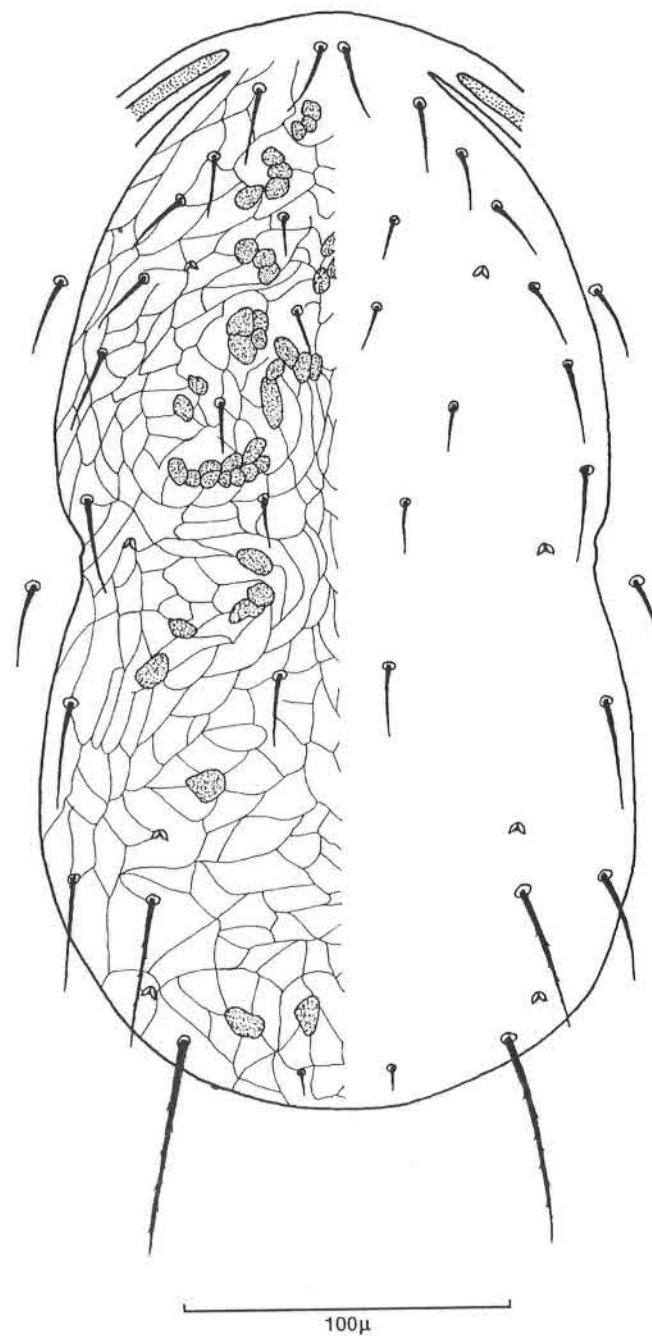
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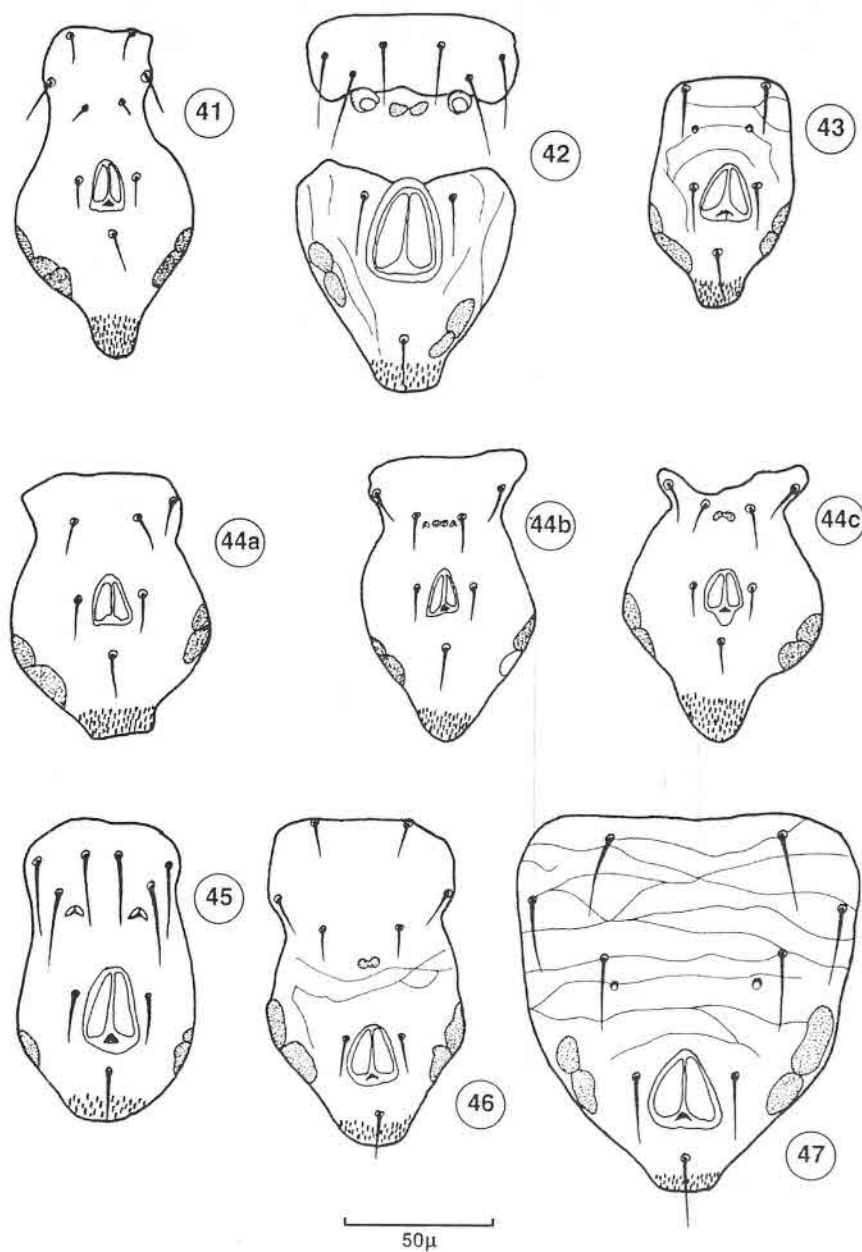


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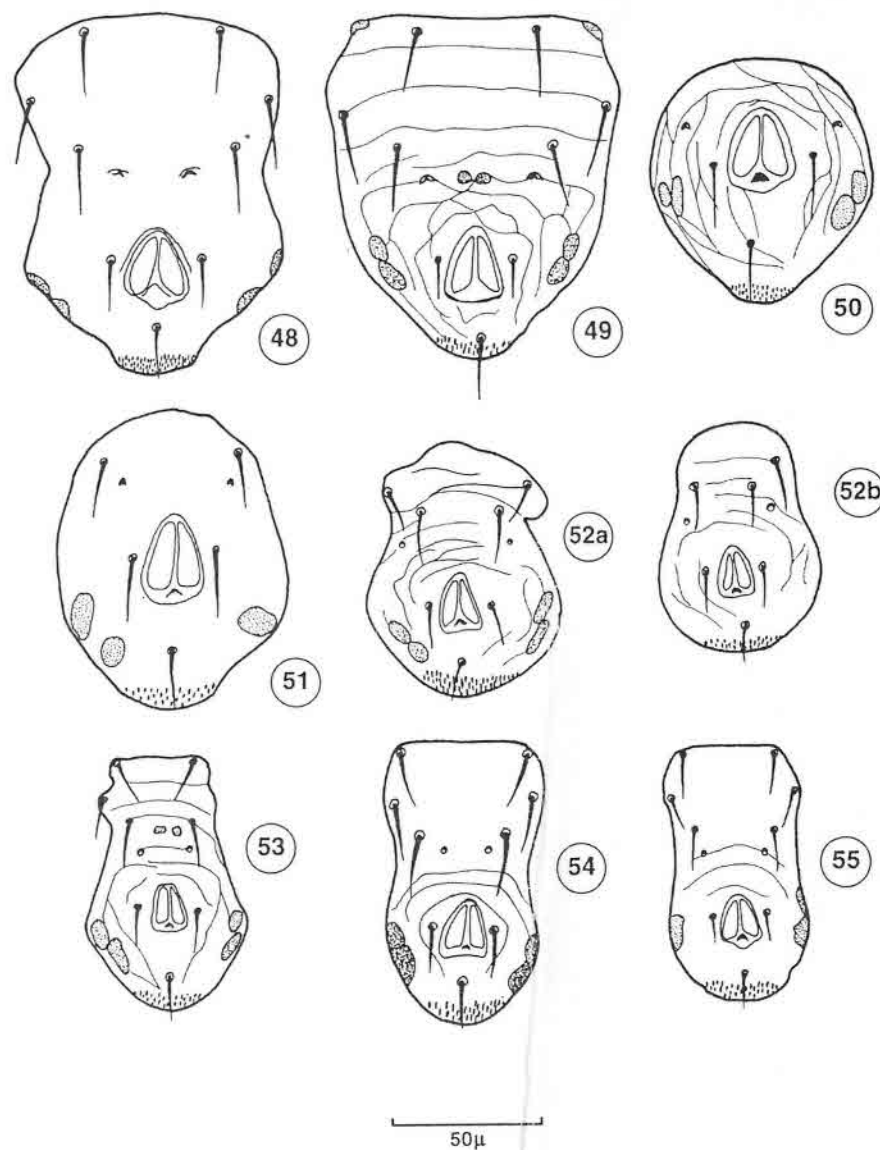


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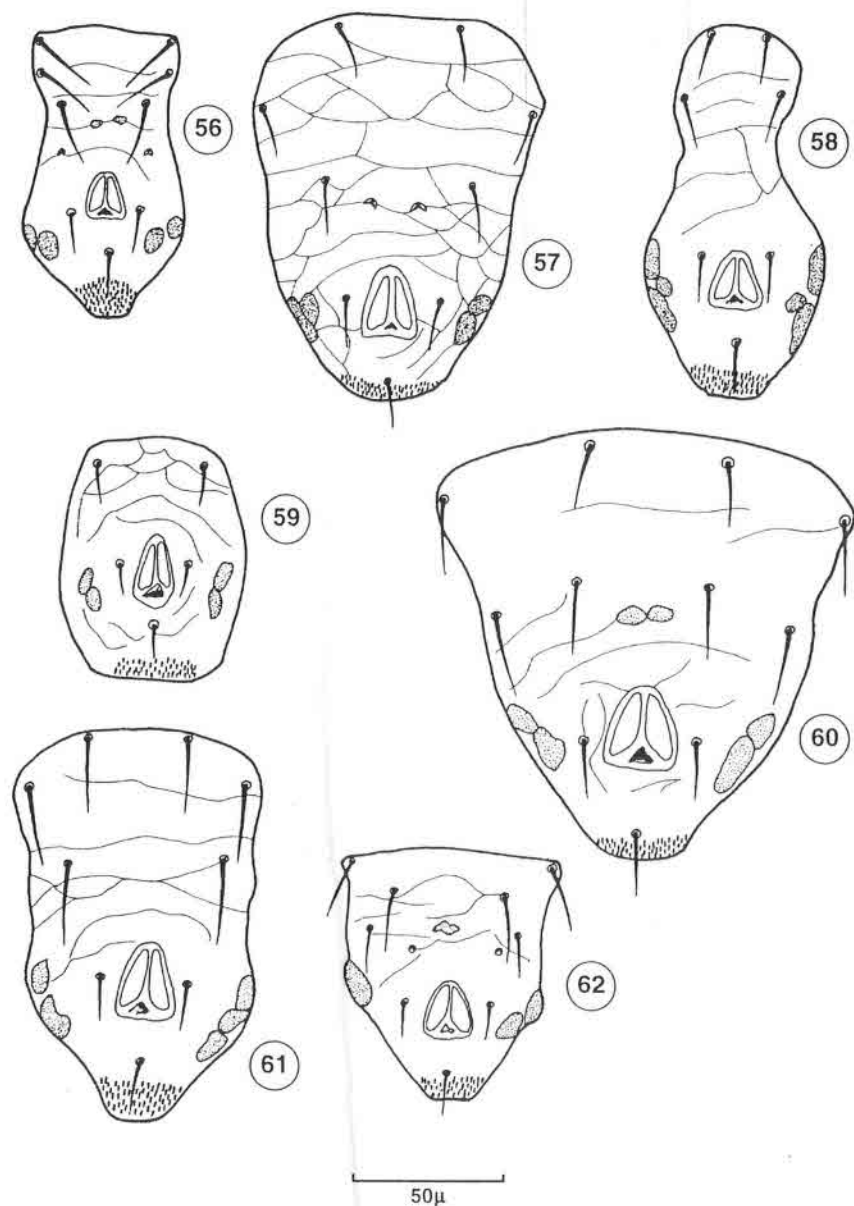


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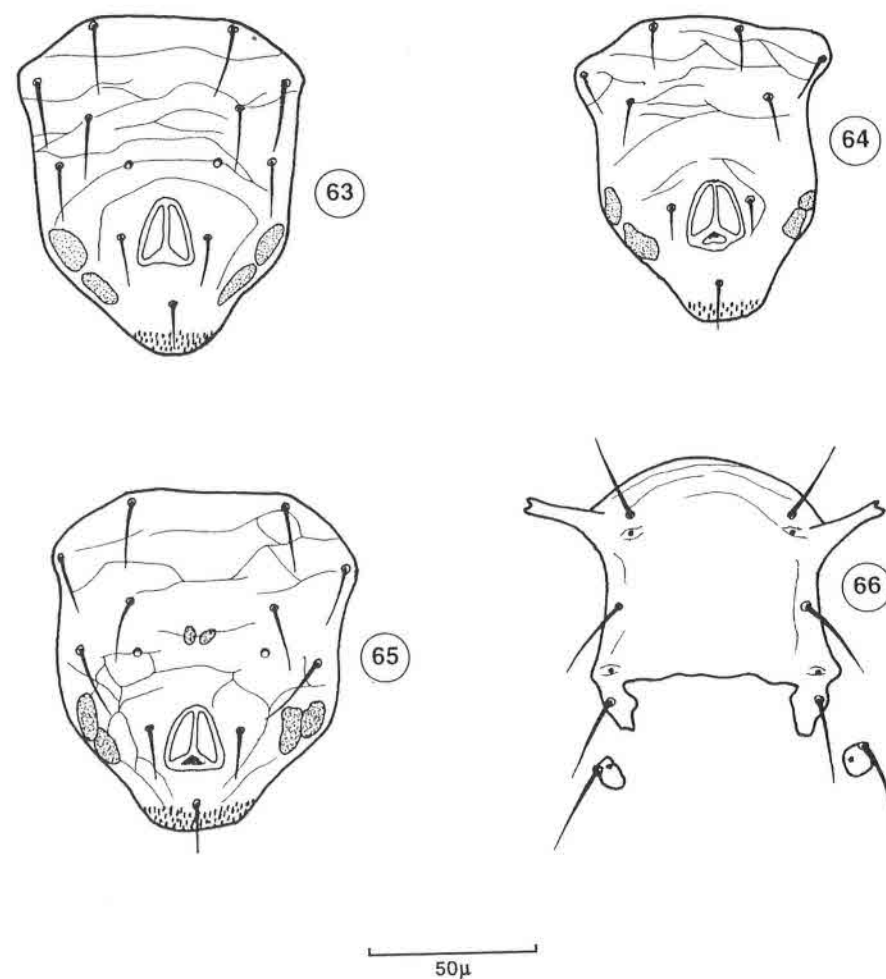
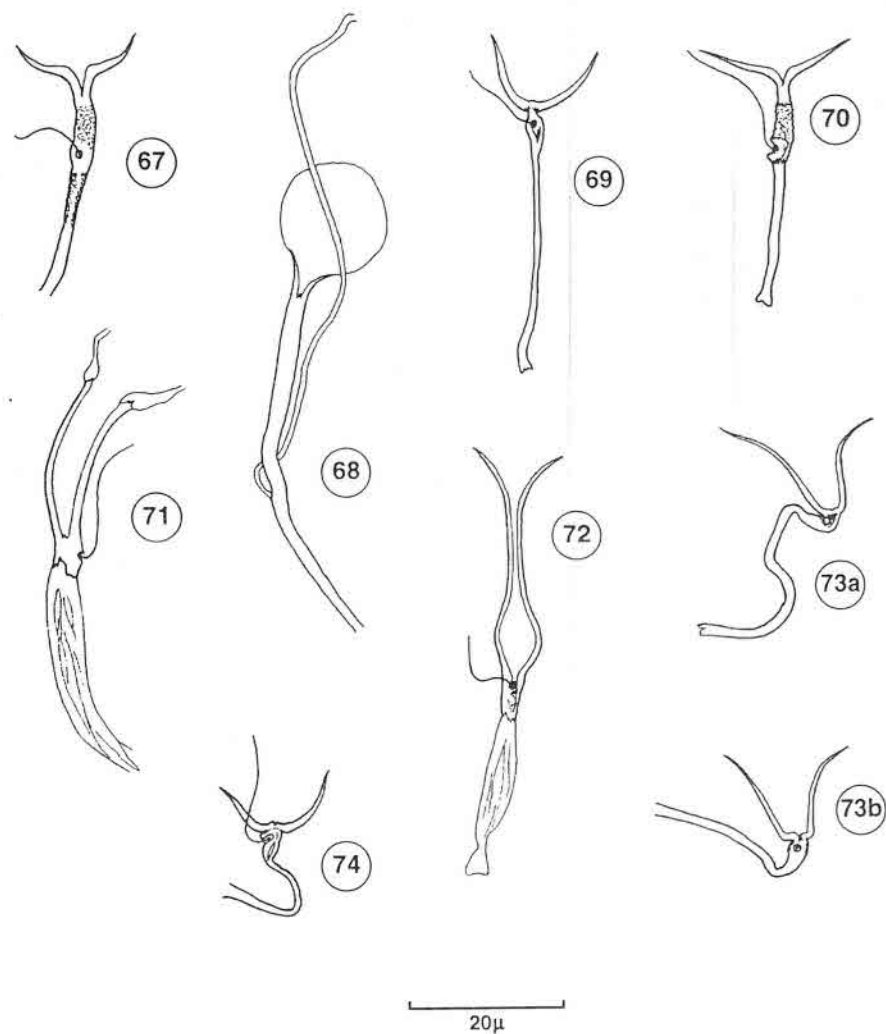
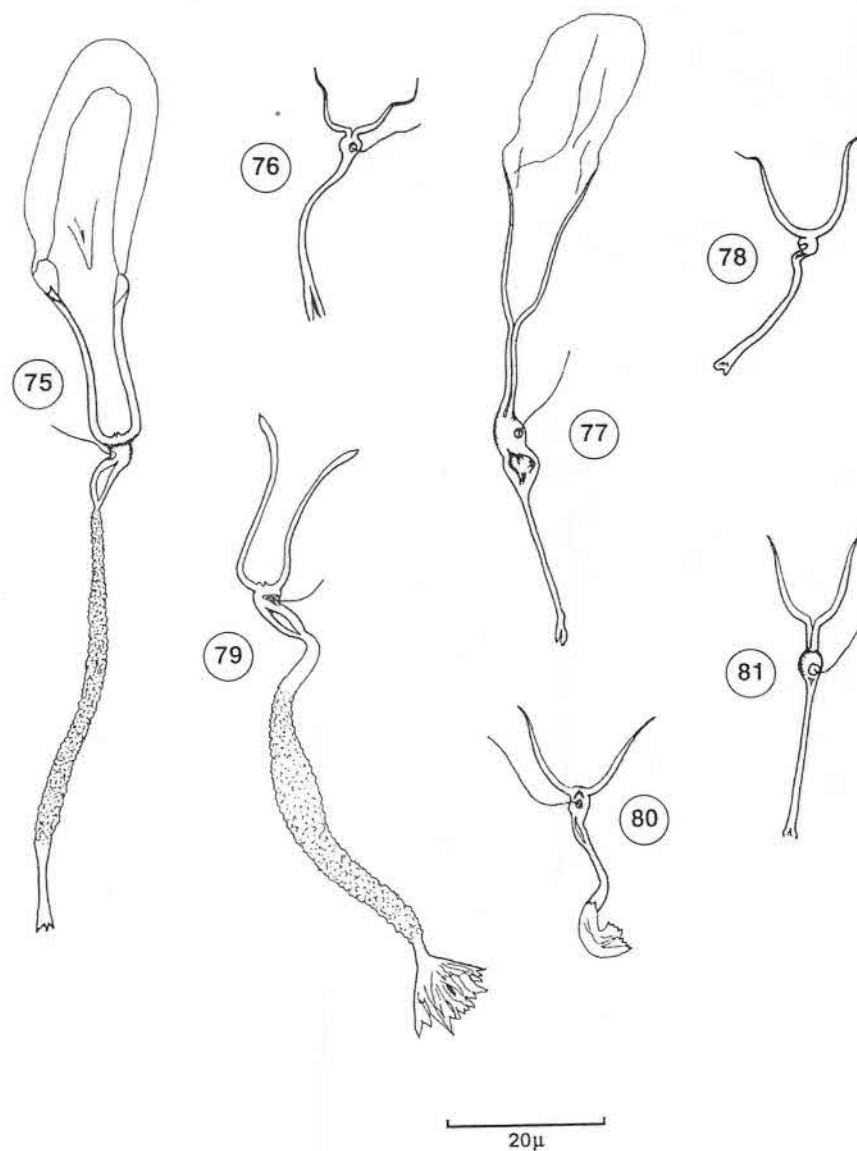


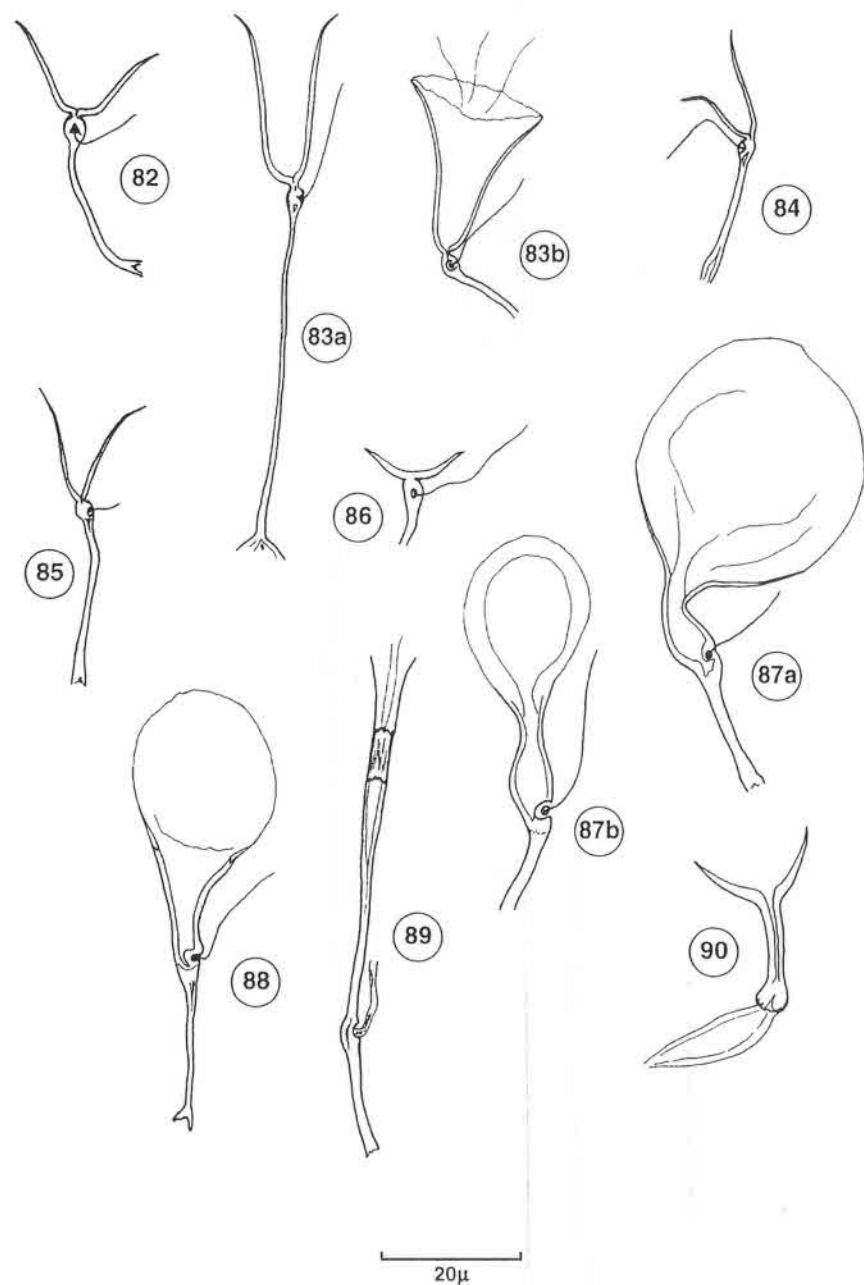
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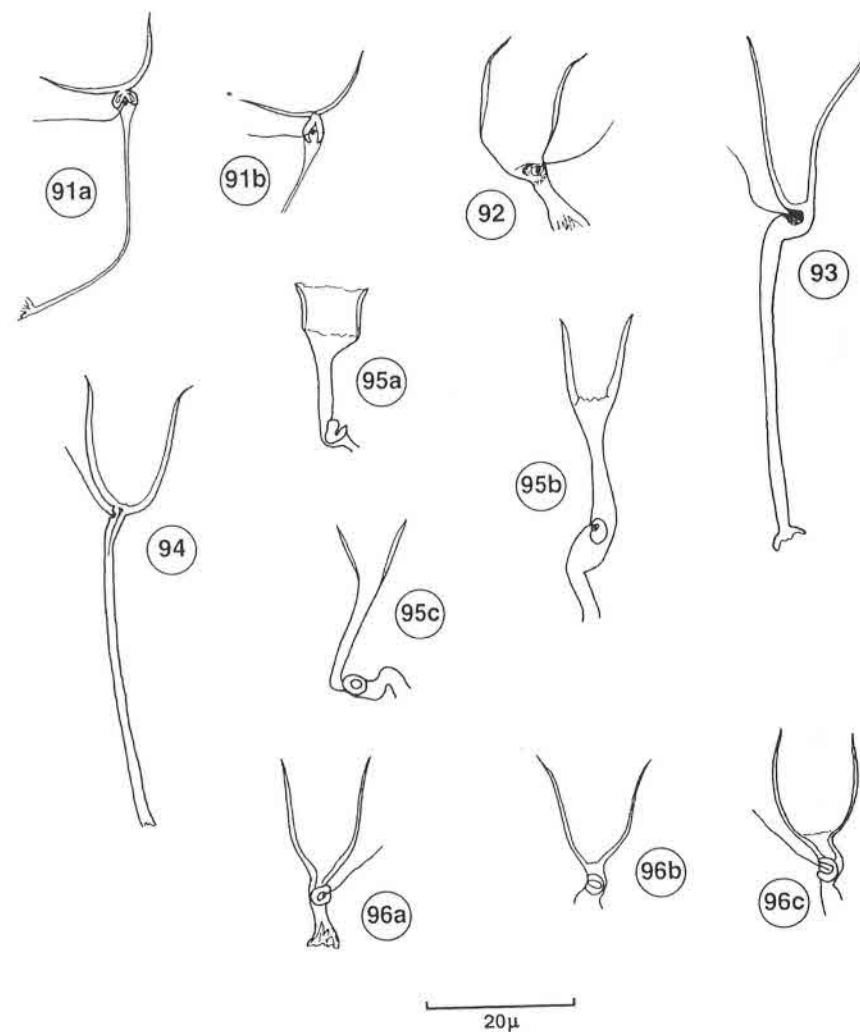
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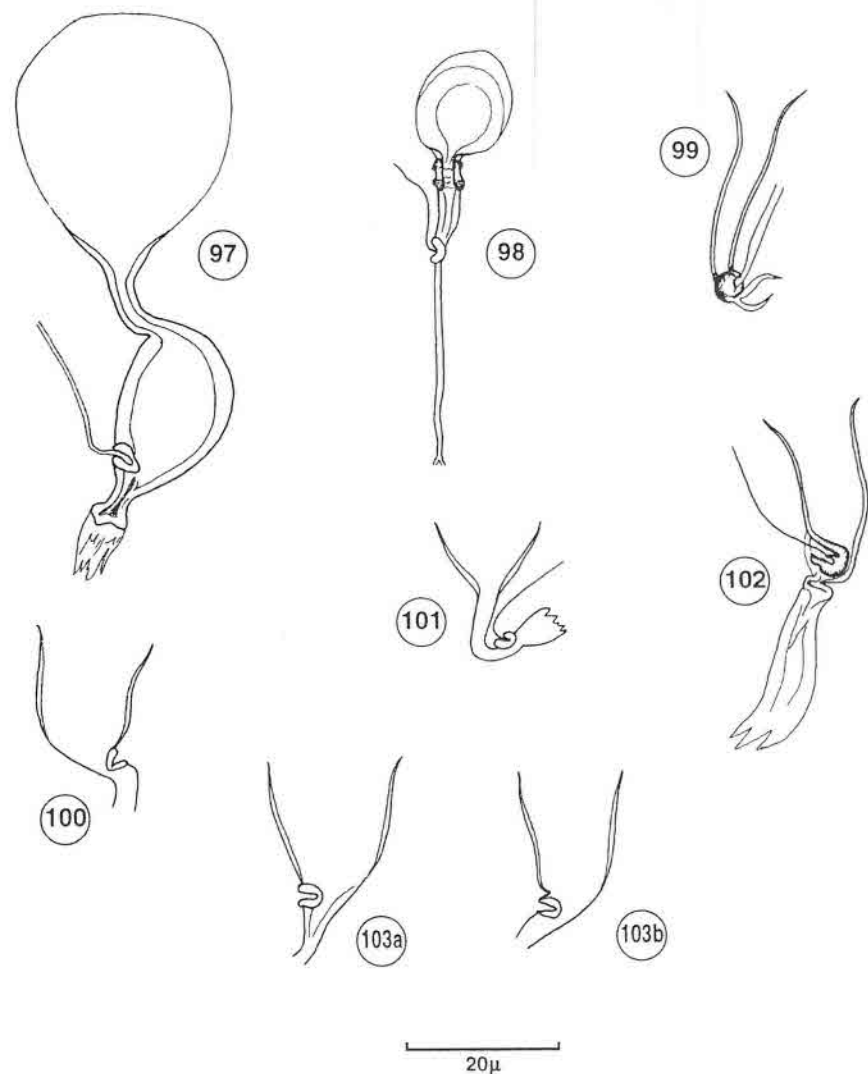
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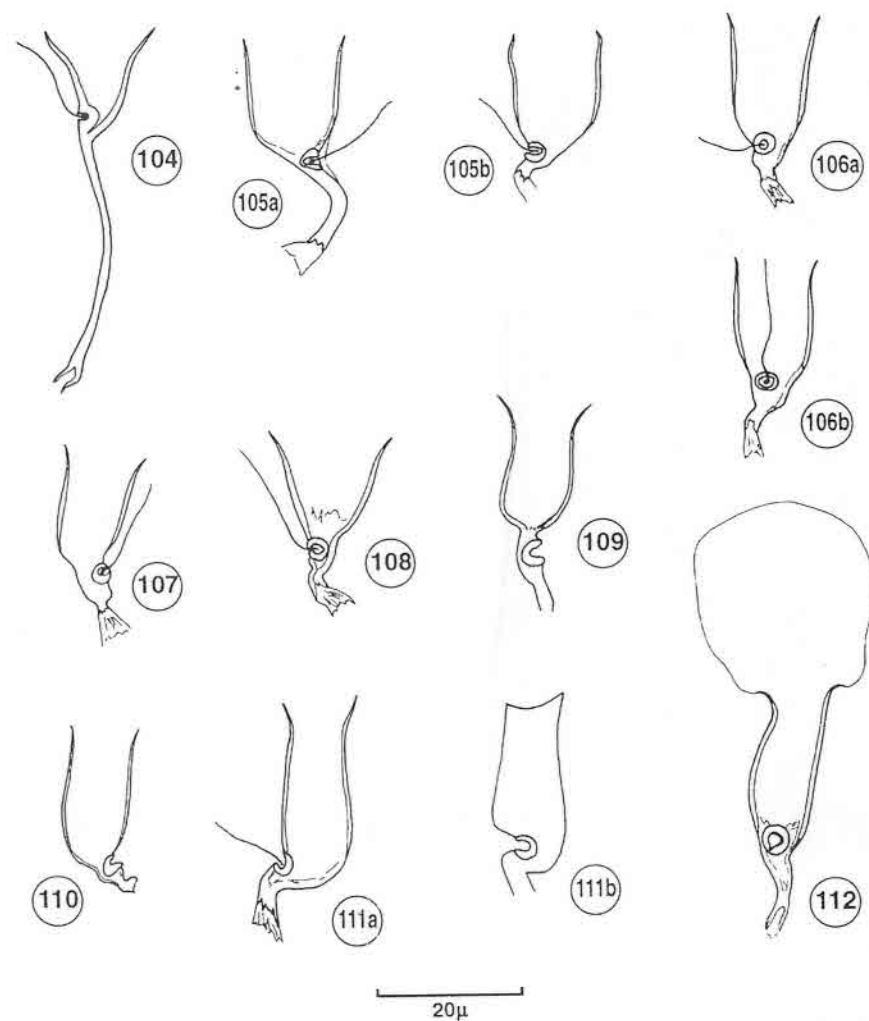
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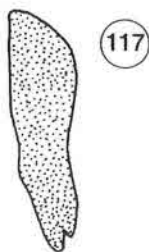
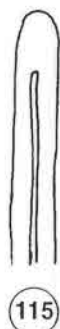
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