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New species of feather mites of the subfamily *Avenzoariinae* from waders (*Aves*: *Charadriiformes*) of the New World* (*Acarina*: *Analgoidea*)

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ABSTRACT. Four new species of the genera *Avenzoaria* and *Bychovskiata* are described from some species of waders of the New World: *Avenzoaria bartramica* n.sp. (USA) from the Upland Sandpiper *Bartramia longicauda* (*Scolopacidae*), *A. trifolia* n.sp. (Argentina) from the South American Painted Snipe *Nycticryphes semicollaris* (*Rostratulidae*), *Bychovskiata chilensis* n.sp. (Paraguay) from the Southern Lapwing *Vanellus chilensis* (*Charadriidae*), *B. semipalmati* n.sp. (USA) from the Semipalmated Plover *Charadrius semipalmatus* (*Charadriidae*). Differential diagnoses are provided for all new species.

Key words: Acarology, *Analgoidea*, *Avenzoariinae*, new species, New World.

INTRODUCTION

The feather mite subfamily *Avenzoariinae* (*Analgoidea*: *Avenzoariidae*) includes 8 genera and about 60 species (MIRONOV 1991a). In their host associations the mites of this subfamily are restricted exclusively to the birds of the order *Charadriiformes*. The biodiversity of the *Avenzoariinae* is well explored in Europe, North Asia and Africa (DUBININ 1956; GAUD 1972; VASYUKOVA, MIRONOV 1991),

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while data on mites of this subfamily from North and South America are practically absent, except the record of few species made by OUDEMANS (1910).

During the taxonomic studies of this subfamily, carried out in recent years (MIRONOV 1992, 1994a, 1994b; MIRONOV, DABERT 1992; MIRONOV et al., 1993) four new species of the genera *Avenzoaria* and *Bychovskiata* have been discovered on some waders living in New World.

MATERIAL AND METHODS

The materials used in the present study were collected from dry bird skins and from alcohol-preserved bird specimens at the Zoological Museum of the University of Michigan (Ann Arbour, Michigan). In the descriptions of new species the chaetotaxy nomenclature follows GRIFFITHS et al. (1990). All measurements are given in micrometers. The full set of measurements is provided for the holotype (male) and one paratype (female), while the range of idiosomal size is given for all other paratypes of each type series. Holotypes and paratypes are deposited in the following institutions: ZMUM - Zoological Museum of the University of Michigan (Ann Arbor, Michigan, USA), ZIN - Zoological Institute, Russian Academy of Sciences (Saint-Petersburg, Russia).

DESCRIPTION OF NEW TAXA

Genus *Avenzoaria* OUDEMANS, 1905

The genus *Avenzoaria* includes 18 species (DUBININ 1956; GAUD 1972; VASYUKOVA, MIRONOV 1991), but the systematic status of four species and their host association must be verified. Thus, for example *Avenzoaria dubinini* ČERNY, 1969 (= *A. squatarolae* DUBININ, 1951) is most probably a synonym of *A. calidris* (OUDEMANS, 1904) and its host Black-bellied Plover *Pluvialis squatarola* is accidental. The mites of this genus are widely distributed on various taxa of wader families *Scolopacidae* and *Rostratulidae* (suborder *Scolopaci*). Birds of the tribes *Calidridini*, *Arenariini*, *Phalaropodini* are exclusively hosts of different species of the genus *Avenzoaria*, while on some taxa of *Tringini*, *Limosini*, *Numeniini* and *Gallinagonini* this mite genus is substituted by more evolved genera, like *Pomeranzevia*, *Pseudavenzoaria*, *Capelloptes*.

Avenzoaria trifolia n. sp.

(Figs. 1-3, 14)

Male (holotype). Length of idiosoma excluding terminal lamellae 352, width of idiosoma 172 (male paratype 366 x 172). Prodorsal shield: length along medial line

82, width 79, lateral margins entire, posterior angles rounded, posterior margin slightly convex, distance between external scapular setae se 60. Distance between prodorsal and hysteronotal shields about 15. Length of hysteronotal shield from anterior margin to bases of setae h3 254, width of anterior part 146, width at the level of setae e2 134; anterior angles of the shield widely rounded. Opisthosomal lobes slightly enlarged apically, this part 1.5 times wider than medial parts of lobes. Terminal cleft widely transverse oval, with nearly straight bottom, length of cleft 62, maximal width 77, distance between setae ps1 53; interlobal membrane weakly developed only along the bottom of the cleft. Postlobar membrane with 3 rounded teeth, medial one twice bigger than the other two (Fig. 1). Setae e2 setiform, not extending to the tip of lobes. Setae ps1 narrow lanceolate, length 24 .

Epimeres I with parallel posterior parts. Subhumeral setae c3 set on striated tegument outside the humeral shield. Genital organ set between levels of trochanters III and IV; genital arc length 24, width 29. Anterior genital acetabulae set at the level of apex of genital arc. Diameter of adanal discs 20, corollas with 18-19 teeth. Distance between setae: 3a-4a 44, 4a-g 17, g-ps3 49.

Female (paratype). Length of idiosoma 366, width of idiosoma 182. Prodorsal shield as in male, length 87, width 86, distance between setae se 62. Distance between prodorsal and hysteronotal shields 15. Length of hysteronotal shield 264, width of anterior part 156, width at level of setae e2 144; anterior margin of shield slightly convex, anterior angles widely rounded, posterior margin between setae h3 with small semicircular incision (Fig. 3). Distance between setae: h3-h3 46, e1-e1 66, h1-h1 51, e2-e1 35, e2-h1 22.

Epigynium semicircular, length 38, width 55. Setae ps2 and ps3 long hair-like, 2-2.5 times longer than anal slit. Spermatheca as in Fig. 14. Legs IV extending to posterior margin of the body.

DIFFERENTIAL DIAGNOSIS

This species is very closely related to *Avenzoaria setifera* GAUD, 1972 described from Painted Sandpiper *Rostratula bengalensis* (*Rostratulidae*). Male of *A. trifolia* differs from that species in smaller idiosoma, relatively enlarged apical parts of opisthosomal lobes, which are approximately 1.5 times wider at the level of setae ps1 than in medial part. In males of *A. setifera* the length of idiosoma varies from 395 to 400, width from 205 to 225, and width of opisthosomal lobes is approximately equal in apical and medial parts. Female of *A. trifolia* differs clearly from *A. setifera* only in metric characters of idiosoma and hysteronotal shield. In females of *A. setifera* the length of idiosoma varies from 390 to 420, length of hysteronotal shield from 283 to 295.

MATERIAL

Holotype male (#64069), paratypes: 1 male, 1 female from the South American Painted Snipe *Nycticryphes semicollaris* (*Rostratulidae*), Argentina, Mardel Plata, 12 November 1914, R. HOSECK. Holotype and paratypes are deposited at ZMUM.

Avenzoaria bartramica n. sp.
(Figs. 4, 5)

Male (holotype). Length of idiosoma excluding terminal lamellae 425, width of idiosoma 215. Prodorsal shield: length along medial line 96, width 96, lateral margins entire, posterior angles rounded, posterior margin slightly convex in medial part, distance between external scapular setae se 77. Distance between prodorsal and hysteronotal shield about 25. Length of hysteronotal shield 298, width of anterior part 146, width at level of setae e2 180; anterior margin trapezoid. Opisthosomal lobes slightly curved by apical parts to middline. Terminal cleft transverse oval, length of cleft 103, maximal width excluding interlobar membrane 127, distance between setae ps1 105. Interlobar membrane wide along all margins of terminal cleft, as wide as or slightly wider than opisthosomal lobes. Incision in interlobar membrane (formed by free margin of membrane) transverse oval. Postlobar membranes with 4 acute teeth (Fig. 4). Setae e2 formed as macrochaetae, length 96. Setae ps1 narrow lanceolate, length 22.

Epimeres I with slightly divergent posterior ends. Subhumeral setae c3 set on ventral margin of humeral shield. Genital organ set at the level of trochanter IV, length of genital arc 24, width 26. Posterior genital acetabulae set at the level of apex of genital arc (Fig. 5). Distance between setae: 3a-4a 46, 4a-g 31, g-ps3 65. Diameter of adanal discs 24, corollas with 19-20 teeth. Cupules ih distinct.

Female unknown.

DIFFERENTIAL DIAGNOSIS

This species resembles *Avenzoaria rackae* GAUD, 1972 described from the Jack Snipe *Lymnocryptes minima* (*Scolopacidae*), in terminal membranes with 4 acute teeth. However *A. bartramica* is easily distinguished from that species due to the following characters: setae e2 long (96) and extending behind the apices of opisthosomal lobes, incision in interlobar membrane transverse oval, relatively shorter distance between prodorsal and hysteronotal shields and absence of lacunae in the hysteronotal shield. In male of *A. rackae* setae e2 are shorter (50) and not extending to the apex of the lobes, the incision in interlobar membrane is longitudinal oval or egg-shaped, distance between prodorsal and hysteronotal shield is 40-50, the surface of hysteronotal shield has small pit-like lacunae.

MATERIAL

Holotype male (# 225406) from the upland sandpiper *Bartramia longicauda* (*Scolopacidae*: *Limosinae*), Michigan, Cheboygan Co, 5 Mi E Pellstone, 16. Juni 1953, P.S. HEMPHREY. Holotype deposited at ZMUM.

REMARK

It is interesting to note, that *Avenzoaria bartramica*, in having such characters as long setae e2, acute teeth on terminal membranes, prodorsal shield with rounded

angles, and well developed cupules ih shows a similarity to the genus *Pomeranzevia* DUBININ, 1951, which is closely related to *Avenzoaria*. The genus *Avenzoaria* is rather diversiform and its various members are distributed on many tribes of *Scolopaci* (*Tringini*, *Calidridini*, *Limosini* a. o.), while the genus Pomeranzevia is specific to curlews of the genus *Numenius* (*Scolopaci*: *Numeniini*). The Upland Sandpiper *B. longicauda* is considered as a member of the tribe *Numeniini* (JOHNSGRAD 1981; JEHL 1968; STRAUCH 1978; CHU 1993). *Bartramia longicauda* is a very distinctive curlew that shows some characters (external) similar to those of tattlers (HAYMAN et al. 1991). But this is not an evidence of common ancestry of *Bartramia* and *Tringini*. Its specific parasite *A. bartramica* also shows some features of the genus *Pomeranzevia*, and is not closer related to *Avenzoaria* species from tattlers. The fact may confirm the earlier proposed hypothesis on the coevolution of the *Avenzoariinae* and *Charadriiformes* (MIRONOV 1990).

Genus *Bychovskiata* DUBININ, 1951

The genus includes 12 species (VASYUKOVA, MIRONOV 1991; MIRONOV, 1994 a, 1994 b). Mites of this species are associated mainly with plovers and related taxa of the suborder *Charadriomorpha* (*Charadriidae*, *Haematopodidae*, *Ibidorhynchidae*, *Recurvirostridae*).

Bychovskiata semipalmati n. sp.

(Figs. 6-8, 15)

Male (holotype). Length of idiosoma 352, width of idiosoma 200 (idiosomal size of paratype males 345-355 x 194-205). Prodorsal shield: length 92, width 113, with posterior angles acute, posterior margin slightly convex as wide blunt angle, distance between setae se 82 (Fig. 6). Hysteronotal shield: anterior margin straight, anterior angles rounded, lateral margins nearly straight, length 250, width in anterior part 177, width at level of setae ps2 127; surface of shield uniformly dotted. Opisthosomal lobes greatly shortened, triangular with widely rounded ends. Terminal cleft small U-like or rounded V-like, with strongly sclerotized interlobar membrane occupying near all cleft; length of cleft 29. Setae ps1 set on the apex of lobes; distance between setae ps1 39. Length of semicircular incision in interlobar membrane 14. Distance between setae: c1-c1 74, h3-h3 70.

Genital organ set at the level of trochanters IV, genital arc like on inverted Y, length 24, width 22 (Fig. 7). Posterior pair of genital acetabulae set at the level of apex of genital arc or slightly anteriorly to the arc. Setae 4a set at the level of midlength of genital arc. Adanal shields represented by pair of weakly sclerotized transversal sclerites anterior to adanal discs. Setae ps3 set posterior to adanal shields. Setae ps2 narrow lanceolate, not extending beyond the margin of apices of

opisthosomal lobes. Distance between setae: 3a-4a 48, 4a-g 29, g-ps3 55. Setae d and e of tarsus IV like small buttons ringed by soft cuticle.

Female (paratype). Length of idiosoma 415, width of idiosoma 225 (idiosomal size of other paratype females 365-415 x 190-225). Prodorsal shield as in male, length 100, width 132, distance between setae se 84. Hysteronotal shield: anterior margin straight, anterior angles rounded, lateral margins almost straight, length 312, width in anterior part 194, width at the level of setae e2 180. Uniformly dotted shield without lacunae. Posterior margin of opisthosoma with convex blunt extension between setae h2 (Fig. 8). Setae ps1 set at the level of setae h3, setae e1 set at the level of setae e2 or slightly anteriorly. Distance between dorsal setae c1-c1 86, e1-e1 47, h1-h1 44, e2-h1 29-30.

Epigynium semicircular, length 43, width 70. Setae ps3 two times longer than anal slit, extending beyond posterior margin of opisthosoma by 1/4 length. Spermatheca long, tube-like, with thin primary spermaduct and thin, weakly sclerotized internal duct (Fig. 15). Legs IV slightly extending beyond posterior margin of opisthosoma.

DIFFERENTIAL DIAGNOSIS

This species belongs to the "charadrii" species group (*B. charadrii*, *B. subcharadrii*), which is generally characterized by greatly shortened opisthosomal lobes with rounded apices and small genital apparatus in males, and rather long setae ps3 extending beyond the posterior margin of the body in females. *Bychovskiata semipalmati* is most similar to *B. charadrii* (CANESTRINI, 1878) described originally from *Charadrius hiaticula* and also recorded from several plover species of the genus *Charadrius* living in northern Palearctic. The male of *B. semipalmati* differs from ones of *B. charadrii* in more pronounced opisthosomal lobes, in deeper incision in interlobar membrane, and in the presence of weakly sclerotized adanal sclerites. Female of *B. semipalmati* is distinguished by the form of hysteronotal shield (straight anterior margin, straight or slightly convex lateral margins, Fig. 8) and by the structure of spermatheca (Figs. 15). In male of *B. charadrii* the interlobar membrane has very shallow incision and adanal sclerites are absent (Fig. 9), in female of that species the hysteronotal shield is egg-shaped, the spermatheca broad, with rather thin primary spermaduct and with well sclerotized internal duct (Figs 10, 16).

MATERIAL

Holotype male (BMOC #82-0806-1), paratypes 13 males, 14 females from the Semi-palmated Plover *Charadrius semipalmatus* (*Charadriidae*: *Charadriinae*), Michigan, Monroe Co., Point Mouillee State, Game Area, 6 August 1982, leg S. GOODMAN.

Holotype is deposited at ZMUM, paratypes at ZMUM and ZIN.

REMARK

Existence of a separate species *Bychovskiata semipalmati* on *Charadrius semipalmatus* confirms the specific status of the host, which is not always recognized (i.e. WOLTERS 1982).

Bychovskiata chilensis n. sp.

(Figs. 11-13, 14, 17)

Male (holotype). Length of idiosoma 405, width of idiosoma 255 (idiosomal size of paratype males 385-420 x 230-264). Prodorsal shield: length 89, width 132, lateral margins entire, posterior angles bluntly rounded on apex, posterior margin slightly convex with small medial projection, distance between setae se 79 (Fig.11). Hysteronotal shield: anterior margin slightly convex, anterior angles widely rounded, lateral margins slightly convex, length 273, width at the level of trochanters IV 225, width at the level of setae ps2 206. Uniformly dotted shield with small indistinct circular lacunae in opisthosomal part. Opisthosomal lobes big triangular, with rounded apices, separated by wide semicircular terminal cleft. Supraanal concavity longitudinal, fused with terminal cleft. Length of terminal cleft from bottom to membrane margin on apices of lobes 84, maximal width (distance between setae ps1) 122. Interlobar membrane developed along all margin of terminal cleft and spreading on apices of opisthosomal lobes up to the base of setae h3. Length of incision in interlobar membrane (formed by free margin of membrane) 55. Membrane margin with one acute lateral tooth on apices of opisthosomal lobes (Fig. 12) Distance between setae: c1-c1 58, h3-h3 170.

Genital organ set at the level of trochanters IV, genital arc like an inverted Y, 24 x 27. Anterior genital acetabulae set at the level of apex of genital arc. Setae g and 4a arranged in transversal row slightly posterior to the base of genital arc. Adanal shields represented by pair of small sclerites (Fig. 12). Setae ps3 set posteriorly to this shields. Distance between setae: 3a-g 48, g-ps3 84. Setae ps2 thick setiform, extending slightly posterior to the bases of setae h2. Tarsus IV with setae d and e button-like.

Female (paratype). Length of idiosoma 400, width of idiosoma 244 (idiosomal size of other paratype females 395-415 x 240-260). Prodorsal shield as in male, length 94, width 122, distance between setae se 84. Hysteronotal shield with anterior margin slightly concave or straight, anterior angles widely rounded, lateral margins slightly convex, length 264, width at the level of trochanters IV 204, width at the level of setae f2 190. The whole surface of this shield uniformly dotted with big U-like lacuna in posterior half (Fig. 13). Posterior margin of opisthosoma widely rounded, with weakly sclerotized tegument along the border. Setae ps1 set at the level of setae h3, setae e1 set in anterior ends of U-like lacuna, setae h1 - in its posterior part. Distance between dorsal setae c1-c1 62, e1-e1 53, h1-h1 36, e2-h1 53.

Epigynium semicircular, length 41, width 84. Setae ps3 two times shorter than anal slit, not extending to posterior margin of opisthosoma. Spermatheca as in Fig. 17. Legs IV slightly extending beyond posterior margin of opisthosoma.

DIFFERENTIAL DIAGNOSIS

Among members of the genus *Bychovskiata* this species has a rather unusual appearance and is closely related to *Bychovskiata nudidorsa* GAUD & MOUCHET, 1959 described from *Vanellus albiceps* (*Charadriidae*: *Vanellinae*). The male of *B. chilensis* is distinguished from that species by the presence of adanal shields and shorter setae ps2. In the examined type material of *B. nudidorsa* the adanal shields of males are absent, setae ps2 is longer and extends to the acute membranous tooth on the lateral side of opisthosomal lobes. The female of *B. chilensis* differs from *B. nudidorsa* in big U-shaped lacunae in posterior part of hysteronotal shield. In the female of the latter species the lacuna is rectangular, its length is about a half of the length of hysteronotal shield and its width is about one third of the width of this shield (GAUD & MOUCHET 1959).

Material

Holotype male, paratypes 16 males, 20 females from *Vanellus chilensis* (*Charadriidae*: *Vanellinae*) - 1.5 Km S Puerto Risso, E Bank Rio Paraguay, Paraguay, 18 September 1988 (SMG 2459, UMMZ 226451) S.M. GOODMAN.

Holotype is deposited at ZMUM, paratypes at ZMUM and ZIN.

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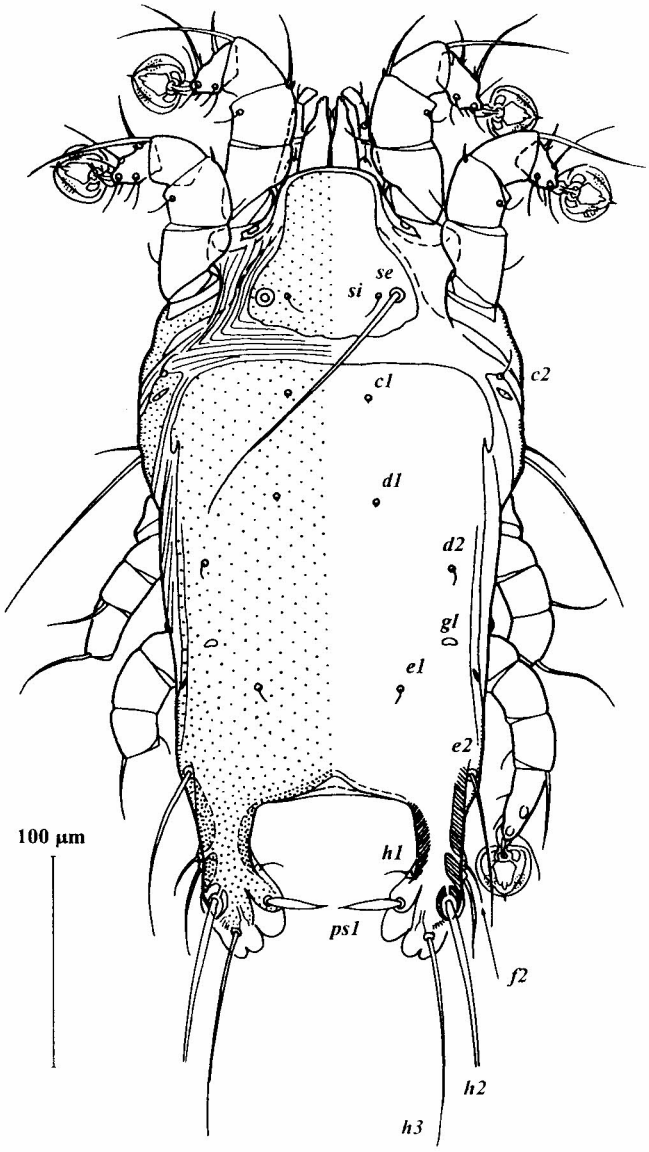
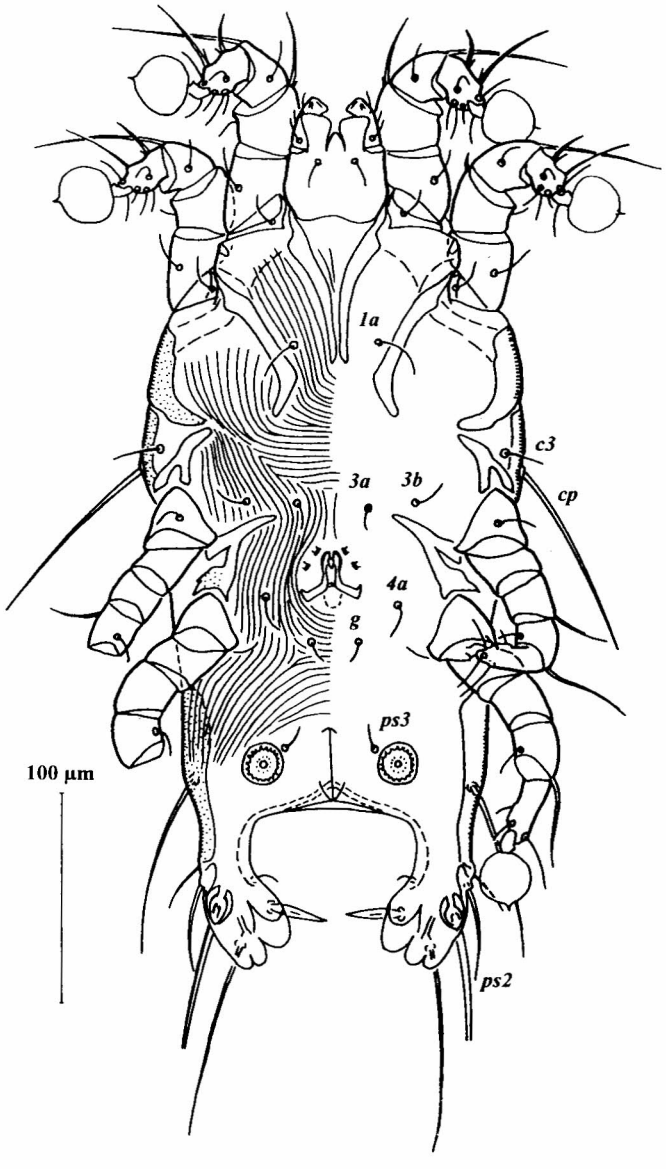
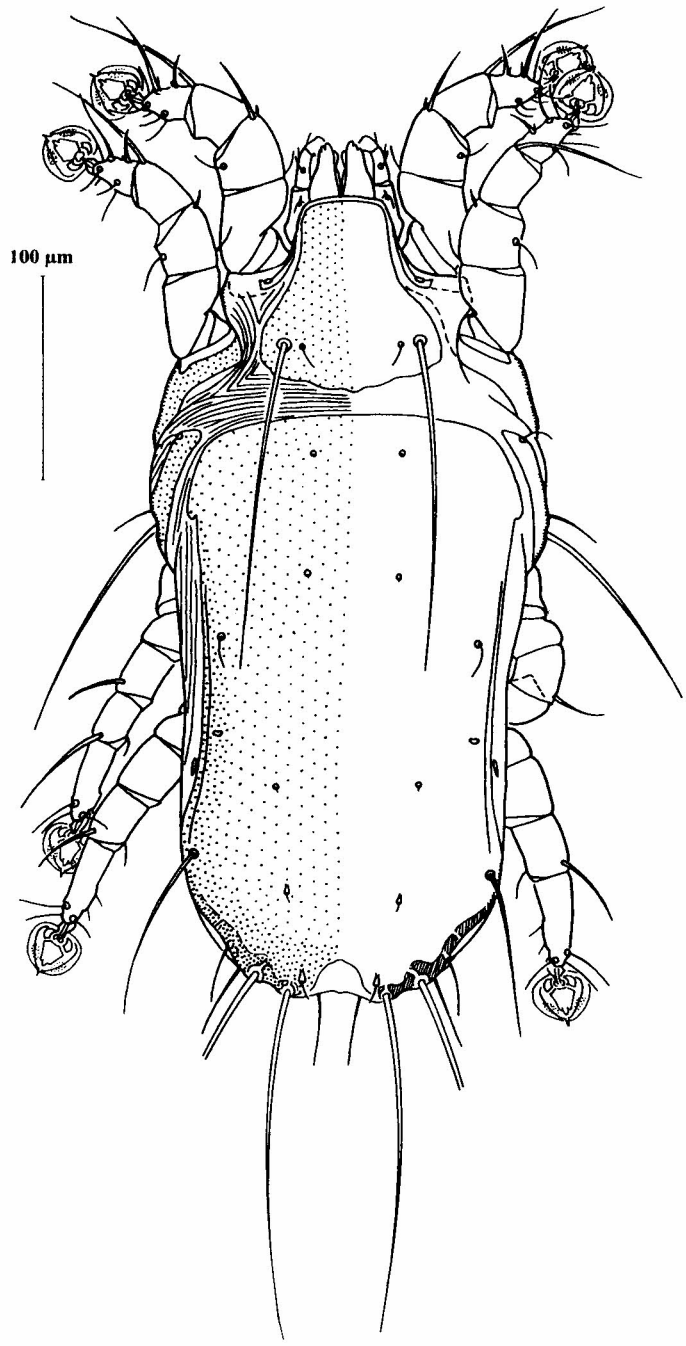


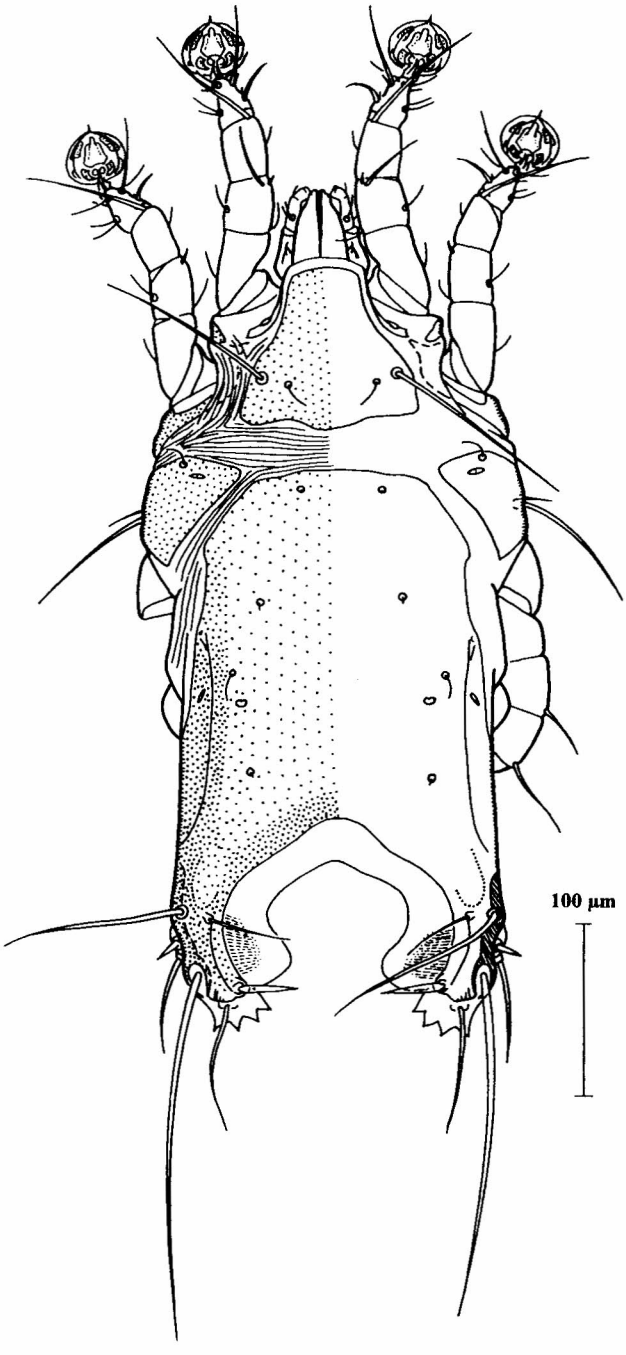
1 - *Avenzoaria trifolia*, male dorsal view



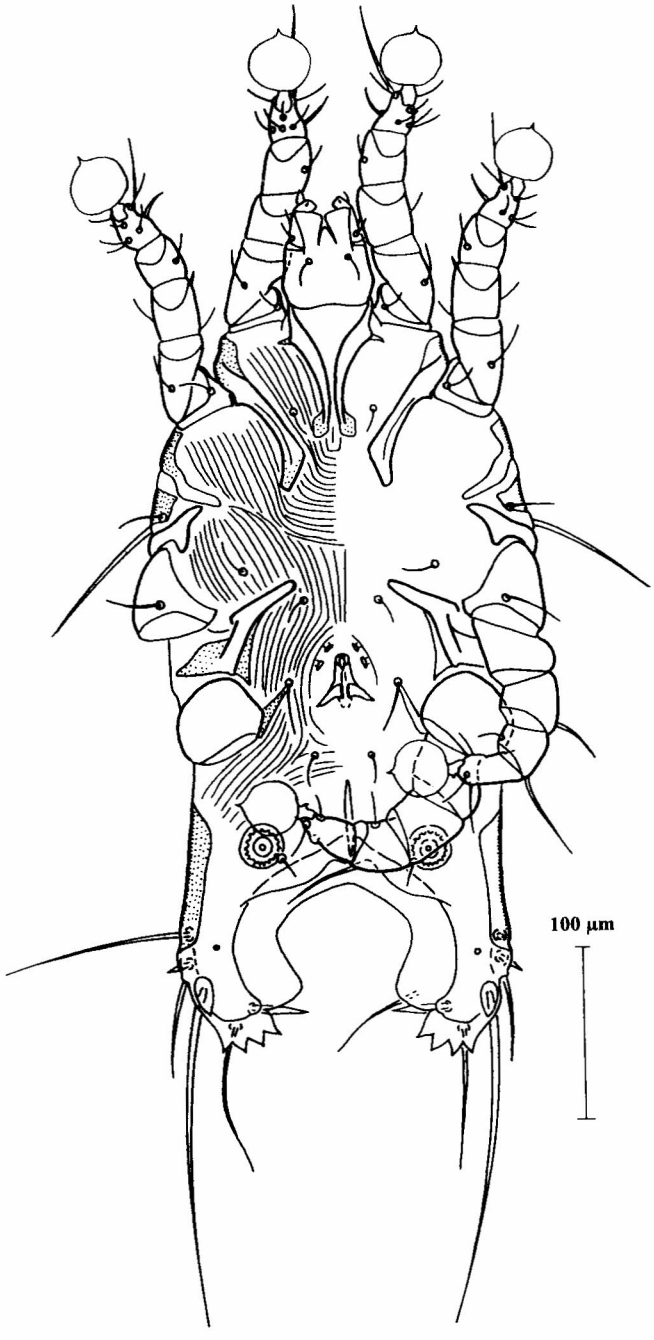
2 - *Avenzoaria trifolia*, male ventral view



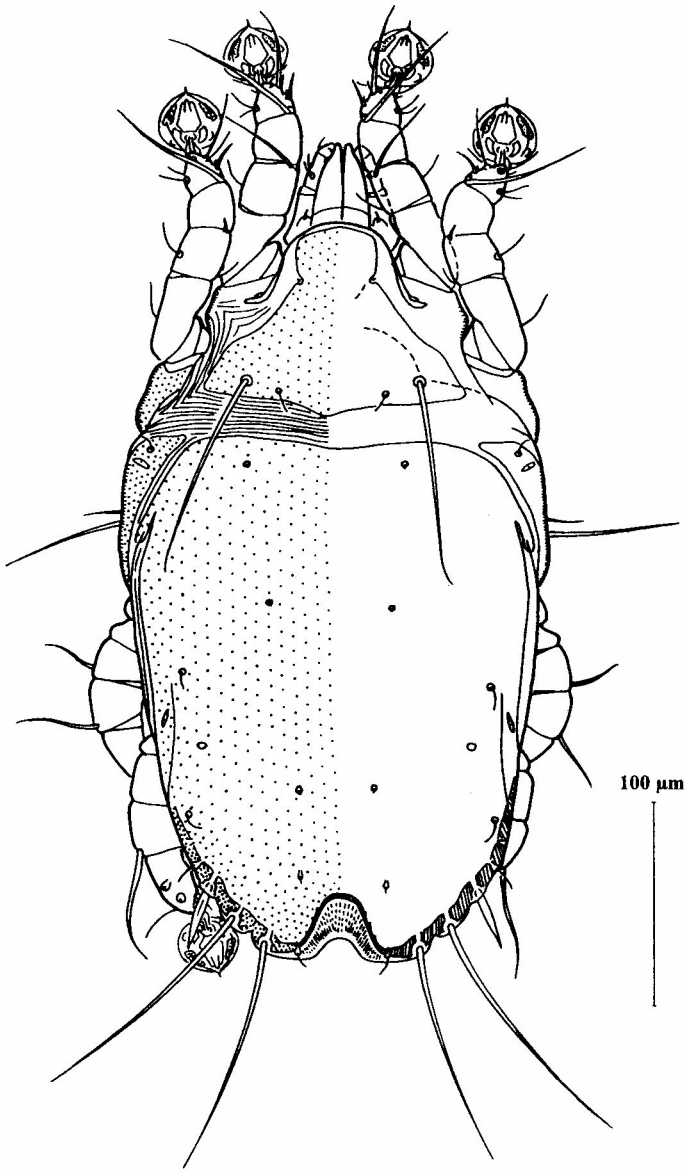
3 - *Avenzoaria trifolia*, female dorsal view



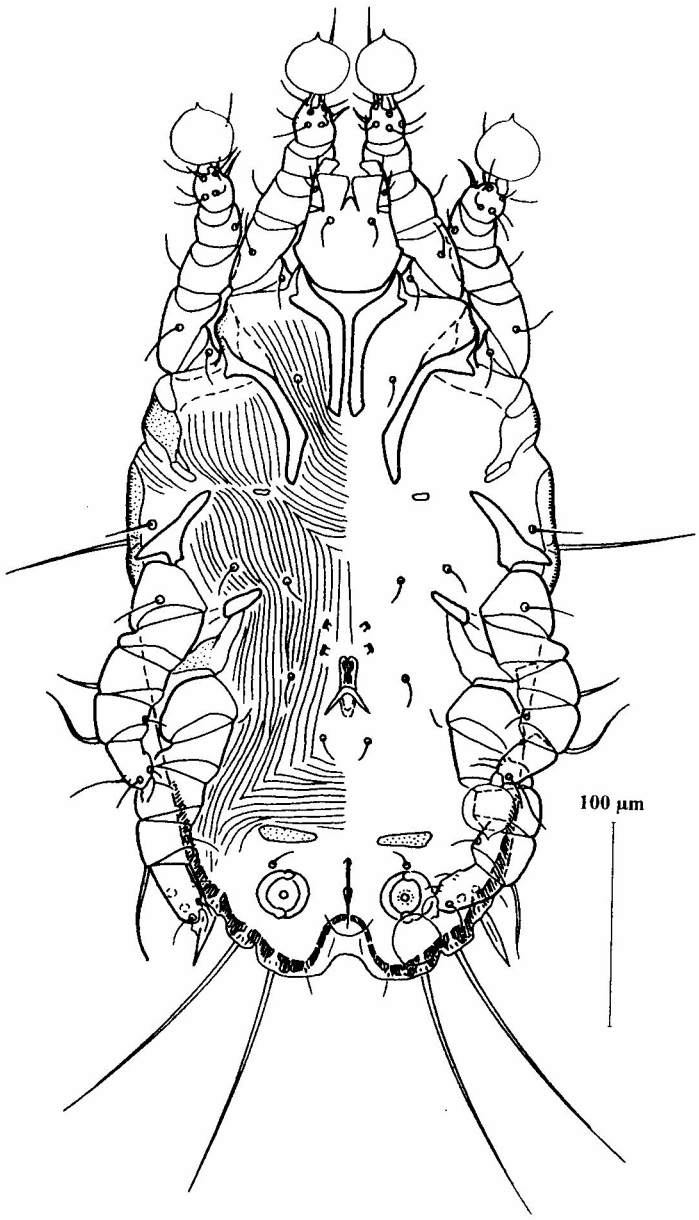
4 - *Avenzoaria bartramica*, male dorsal view



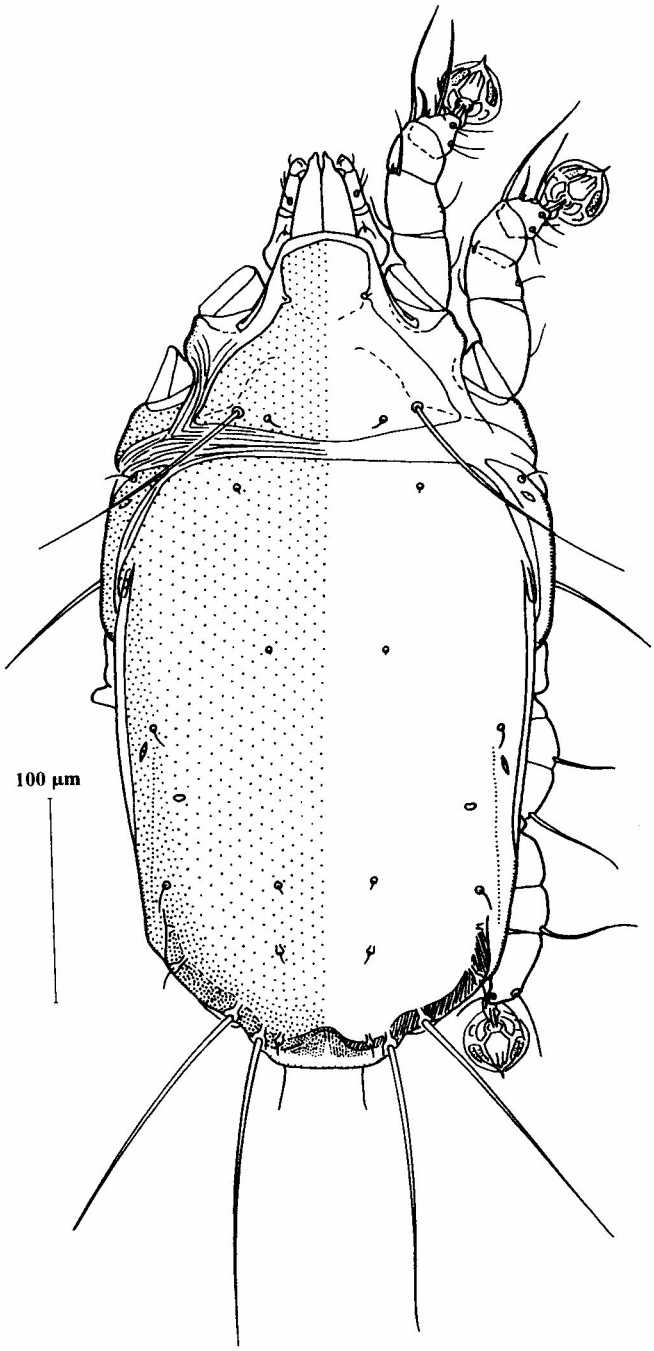
5 - *Avenzoaria bartramica*, male ventral view



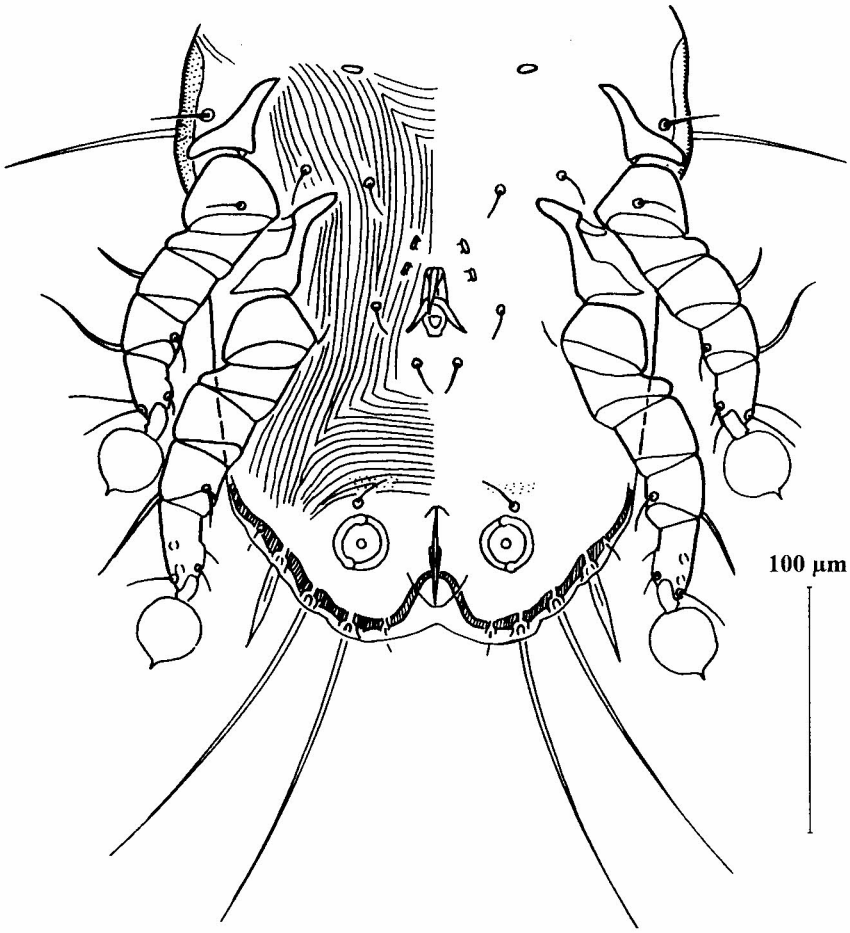
6 - *Bychovskiata semipalmati*, male dorsal view



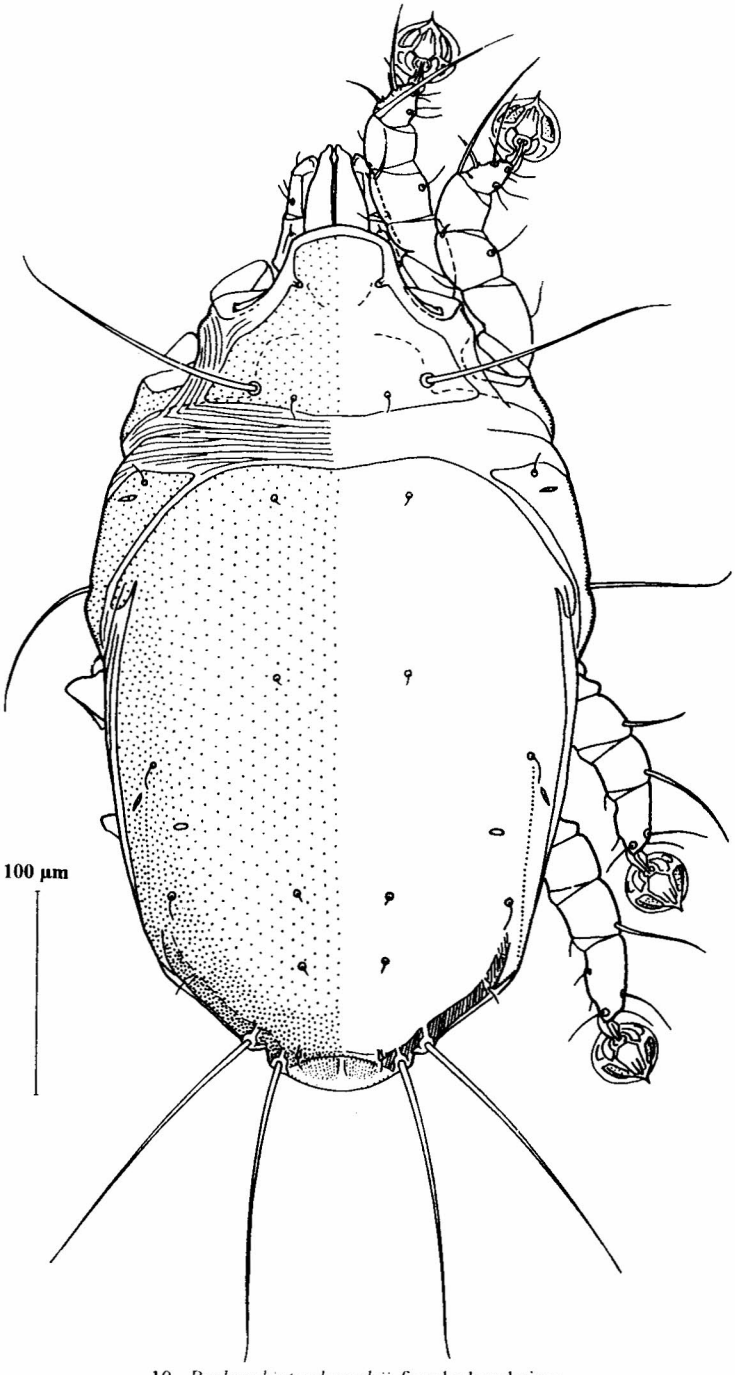
7 - *Bychovskiata semipalmati*, male ventral view



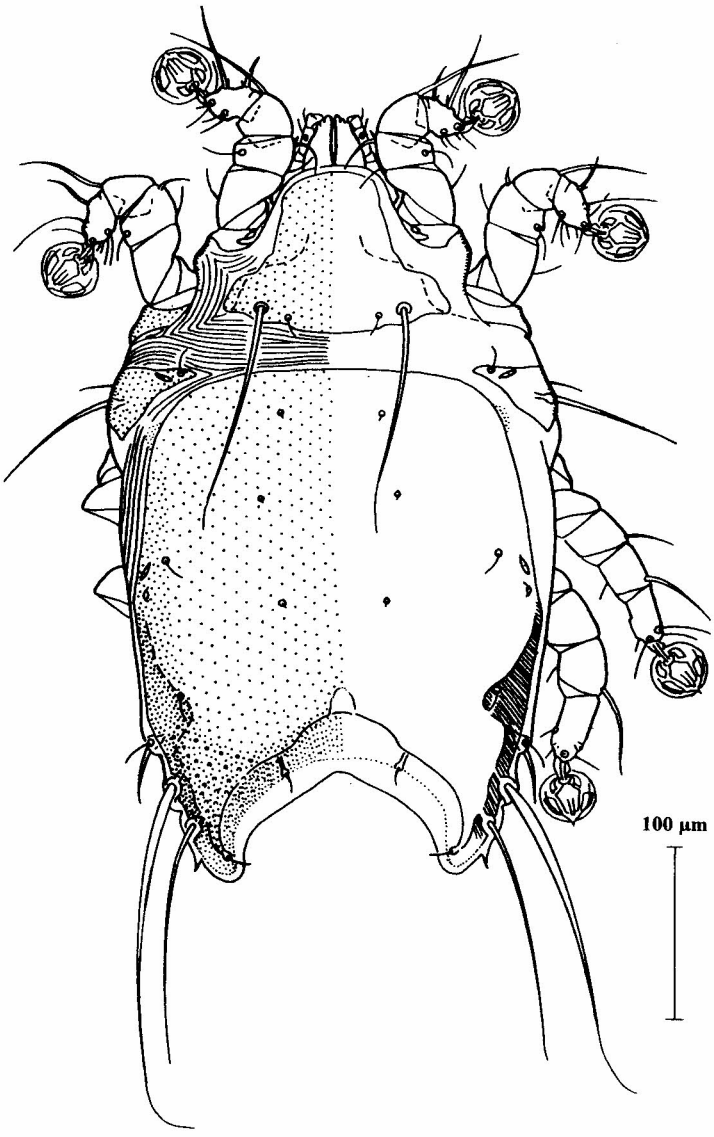
8 - *Bychovskiata semipalmati*, female dorsal view



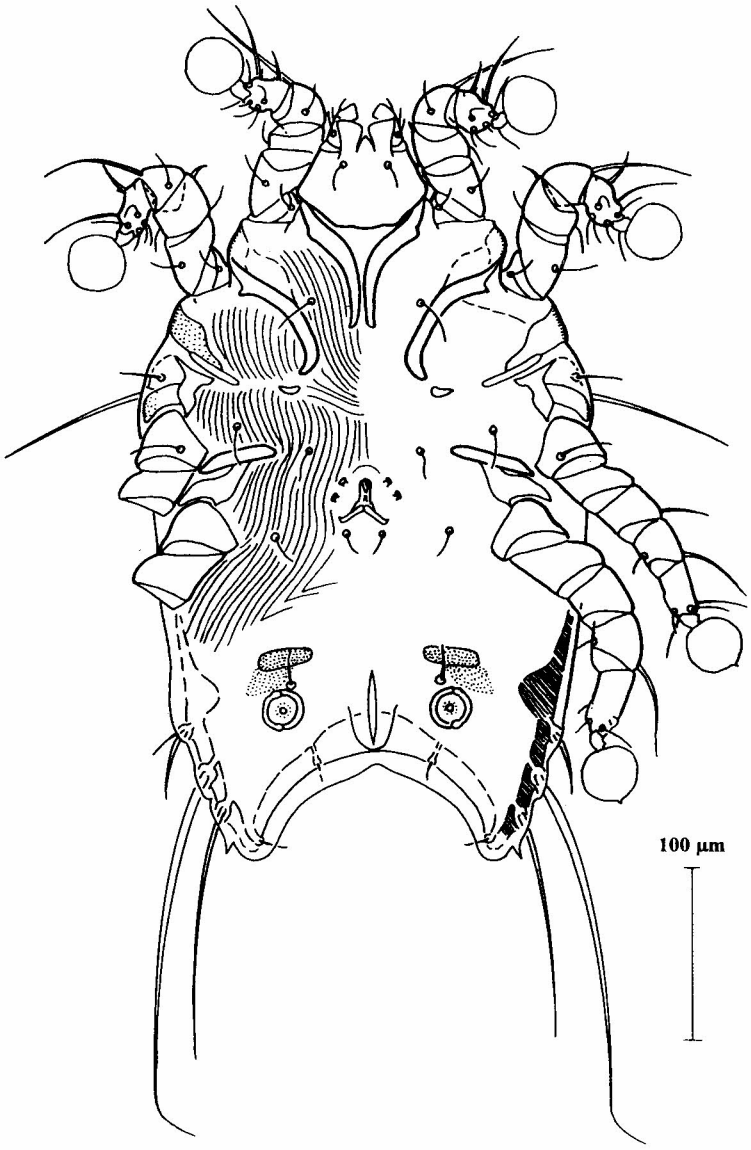
9. *Bychovskiata charadrii*, hysterosoma of male, ventral view



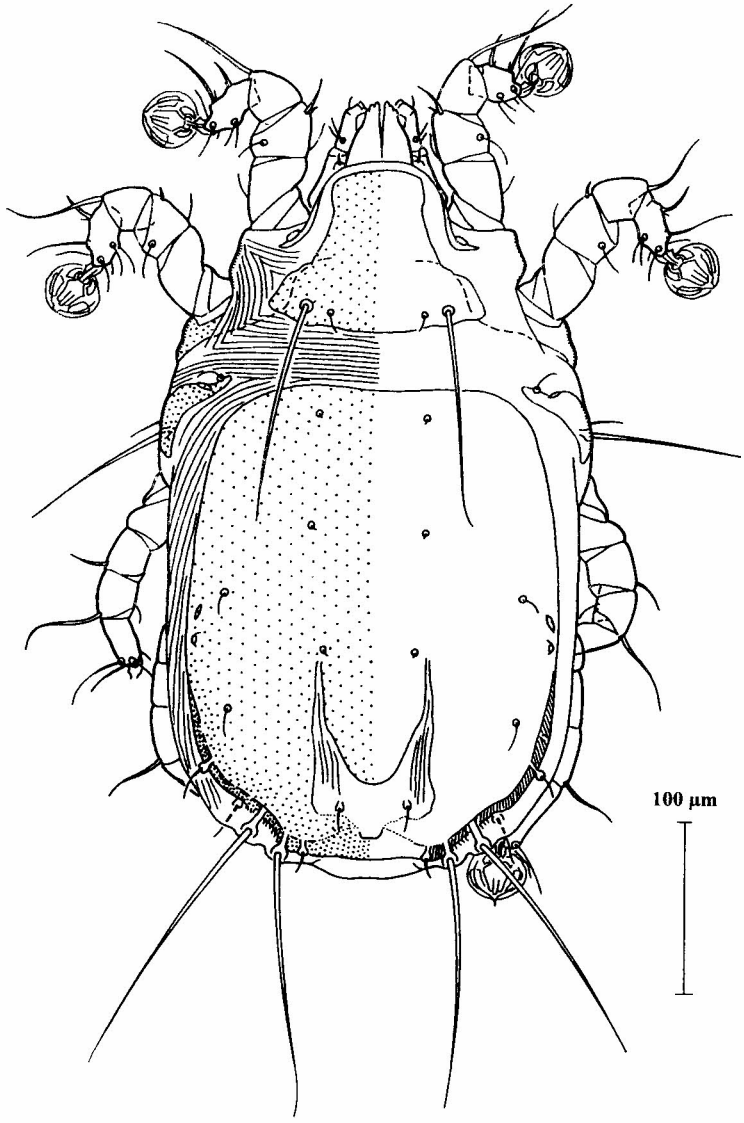
10 - *Bychovskiata charadrii*, female dorsal view



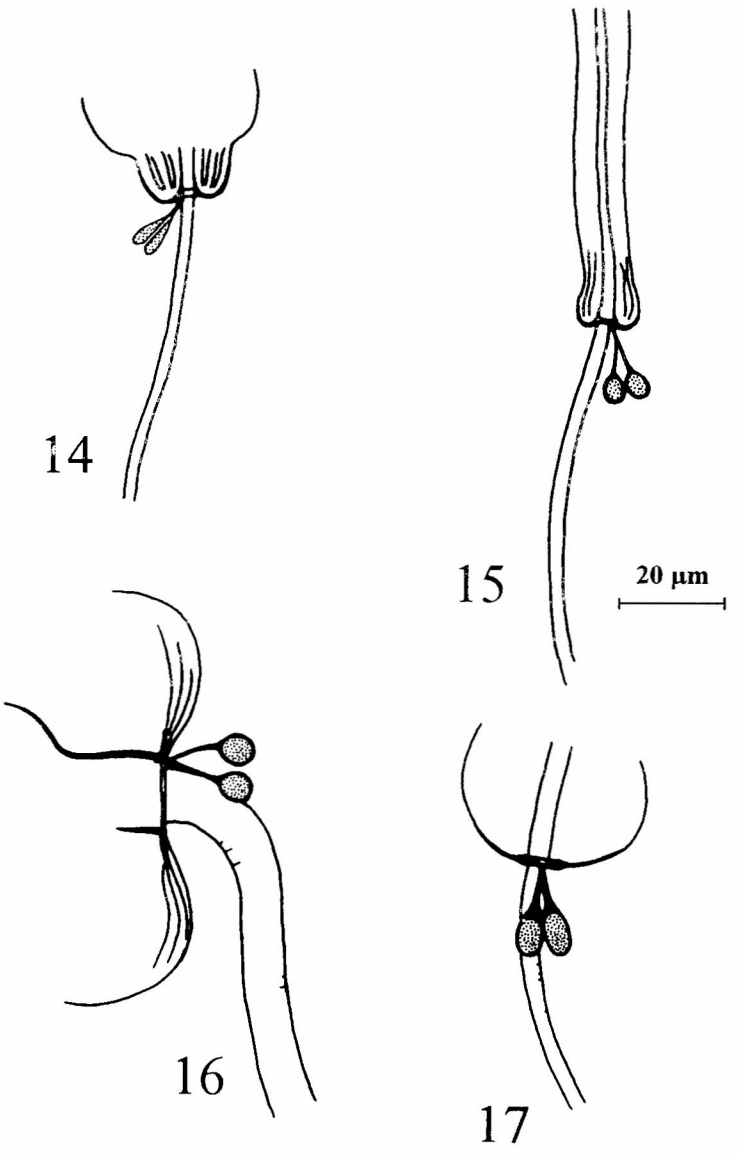
11 - *Bychovskiata chilensis*, male dorsal view



12 - *Bychovskiata chilensis*, male ventral view



13 - *Bychovskiata chilensis*, female dorsal view



14-17 - Female spermatheca. 14 - *Avenzoaria trifolia*, 15 - *Bychovskiata semipalmati*, 16 - *Bychovskiata charadrii*, 17 - *Bychovskiata chilensis*