

**First description of the juvenile stages of
the two species *Rhinoseius androdon* FAIN & HYLAND, 1980
and *Rhinoseius tiptoni* BAKER & YUNKER, 1964
(Acari: Mesostigmata: Ascidae) found in Colombia***

M. H. J. WIESE¹ & A. FAIN²

¹ Weiherweg 11, D-79219 Staufen, Germany.

² Institut royal des Sciences naturelles de Belgique, rue Vautier 29, B-1000 Bruxelles, Belgium.

Summary

*The first description of all juvenile stages and a redescription of the adult stages are given for the two species *Rhinoseius androdon* FAIN & HYLAND, 1980 and *Rh. tiptoni* BAKER & YUNKER, 1964 in the genus *Rhinoseius* BAKER & YUNKER, 1964 (Acari: Ascidae). Some idiosomal setae (especially s6) which are present in the larva are absent in the protonymph and in the following stages. A dimorphism in the deutonymphs is observed for both species which is interpreted as a sexual dimorphism. The specimens were collected from hummingbirds and from flowers visited by hummingbirds in the Chocó region, Colombia. For the first time larvae of the genus *Rhinoseius* are observed to be phoretic on hummingbirds.*

Key words: Taxonomy. Acari. Ascidae. Flower mites. *Rhinoseius*. Juvenile stages. Colombia.

Résumé

*Les auteurs décrivent, pour la première fois, tous les stades juvéniles et redécrivent les stades adultes de *Rhinoseius androdon* FAIN & HYLAND, 1980 et *Rh. tiptoni* BAKER & YUNKER, 1964 (Acari: Ascidae). Ils observent la disparition de certains poils de l'idiosoma notamment s6, lors du passage de la larve à la protonympe et un dimorphisme dans les deutonymphes, qu'ils supposent être d'ordre sexuel. Les spécimens examinés furent récoltés chez des colibris et dans les fleurs visitées par les colibris, dans la*

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région de Chocó, Colombie. La présence de larves du genre *Rhinoseius* est observée pour la première fois chez les colibris.

Introduction

With the description of *Rhinoseius tiptoni* BAKER & YUNKER, 1964 the new genus *Rhinoseius* BAKER & YUNKER, 1964 was established by these authors. LINDQUIST & EVANS (1965) synonymized a second genus *Tropico-seius* BAKER & YUNKER, 1964 with this genus as *Rhinoseius*. The mites of that genus belong to the ecological group of the Neotropical 'hummingbird flower mites' (COLWELL, 1979). These mites live in flowers visited by hummingbirds (Aves: Trochilidae) and use hummingbirds for phoretic purpose (see COLWELL, 1973; COLWELL & NAEEM, 1994; see also FAIN *et al.*, 1977b; HYLAND *et al.*, 1978; NAEEM *et al.*, 1985; O'CONNOR *et al.*, 1991; OHMER *et al.*, 1991). FAIN (1992) argued to divide the species of this genus into three groups: "tiptoni", "ornatus" and "wetmorei". The two species *Rh. androdon* FAIN & HYLAND, 1980 and *Rh. tiptoni* belong to the group "tiptoni" (for the definition of this group see also WIESE & FAIN 1993, 1996). Until now juvenile stages were described only for five species of the genus. These are *Rh. rafinskii* MICHARDZINSKI & LUKOSCHUS, 1980 and *Rh. richardsoni* HUNTER, 1972 for the group "tiptoni", *Rh. colwelli* HUNTER, 1972 and *Rh. chocoensis* WIESE & FAIN, 1996 for the group "ornatus" and *Rh. bakeri* DUSBABEK & CERNY, 1970 (juvenile stages described by FAIN & SMILEY, 1995) for the group "wetmorei". In the revision of the *Ascidae* by LINDQUIST & EVANS (1965) no juvenile stage of the genus *Rhinoseius* was yet known. Juvenile stages were not used until now in characterizing different groups within the genus *Rhinoseius*.

Material and methods

For the chaetotaxy of the idiosomal setae we follow LINDQUIST & EVANS (1965). The legs are described according to EVANS (1963). All measurements are given for all known types of the species in micrometers. If not contrarily advised lengths and widths of idiosoma and shields are the maximum measurements for each specimen. In the redescription of the adult stages the corresponding measurements for the female holotype and the male allotypes are given in parenthesis [] when necessary. For the determination of the adults the material mentioned in FAIN (1992) and WIESE & FAIN (1996) was available. The allotypes are deposited in the Institut royal des Sciences naturelles de Belgique (IRSNB) for both species. Paratypes are deposited in the same Institute and in the Alexander Koenig Zoological Research Institute and Zoological Museum (ZFMK), Bonn, Germany.

Locality

The specimens were collected during August and September 1991 in Bajo Anchicayá (3°46'N/77°10'W) in the Dept. Valle del Cauca, Colombia in an altitude of 180 to 600 m above sea level. The localities were primary and secondary forests. Anchicayá is situated in the eastern part of

the Chocó region (see FABER-LANGENDOEN & GENTRY, 1991; GENTRY, 1982, 1986) on the western slope of the Cordillera Occidental.

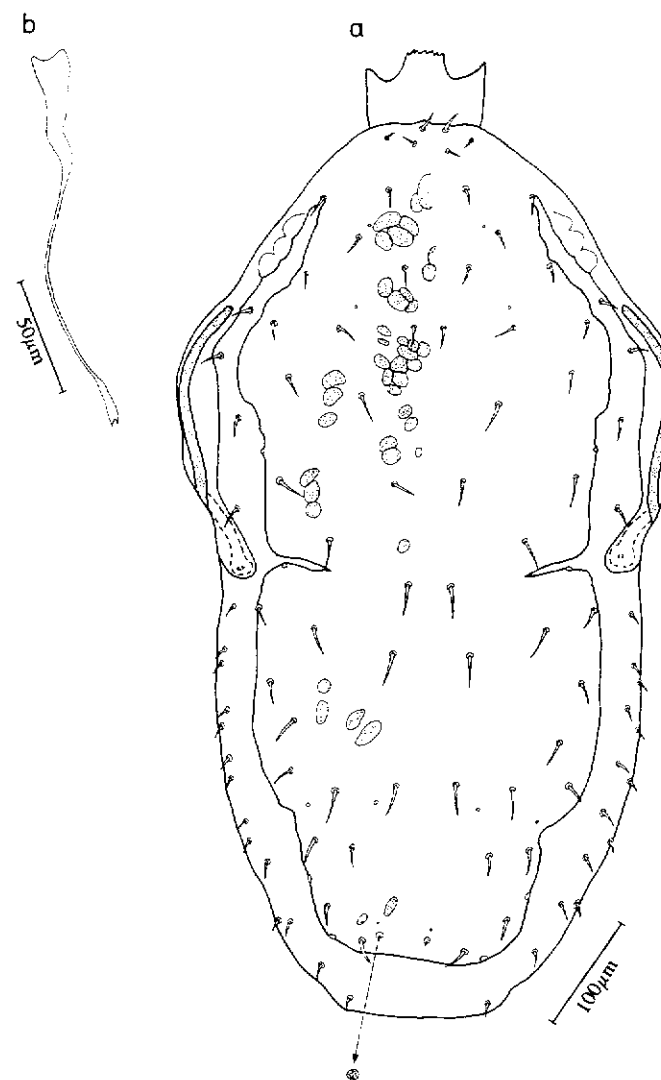


Fig. 1. *Rhinoseius androdon* female in dorsal view (1a), inseminating organ (1b). From host No. 394.



Fig. 2. *Rhinoseius androdon* female in ventral view. From host No. 394.

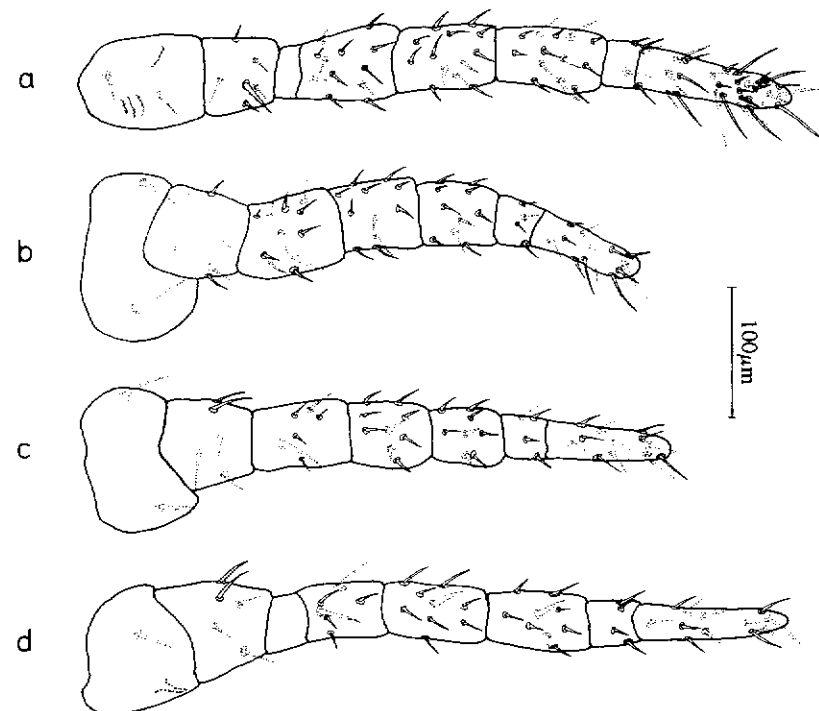


Fig. 3. *Rhinoseius androdon* legs I to IV in the female (a, b, c, d). From host No. 394.

Redescription of the adult stages found in Anchicayá

Rhinoseius androdon FAIN & HYLAND, 1980

FEMALE (Fig. 1-3)

DORSUM - Length of dorsal shield varies between 627 and 671[648], width between 305 and 331[375]. Dorsal shield of type B with lateral incisions and without suture as in holotype. Podonotal part of dorsal shield with 16 and opisthonotal part with 14 pairs of setae as in holotype. Setae *s6* and *J3* lacking as in holotype. Distinct striation absent on dorsal shield as in holotype. Length of setae *j1*, *j2* and *j3* 15-18[15], of setae *j6* 25-29[27], of setae *z1* 10-15[9] and of setae *Z5* 19-21[21]. *J5* replaced by a bundle of microspinules, which is also observed in the holotype. Peritremes short, ending near setae *r2* as in holotype. **VENTER** - Sternal shield without anterior lobes as in holotype. Anal shields 142-159[160] long and 96-113[93] wide. Setae *Jv1*, *Jv2* 29-36[30] and setae *Jv4*, *Jv5* 10-16[10] long. Inseminating organ without distinct maturation pouch as in holotype. Membranous adductor canal 160 long at best. **LEGS** - Coxa I ventral with several rows of denticles as in holotype. Tibia III bears 8[8] and tibia IV 9[9]

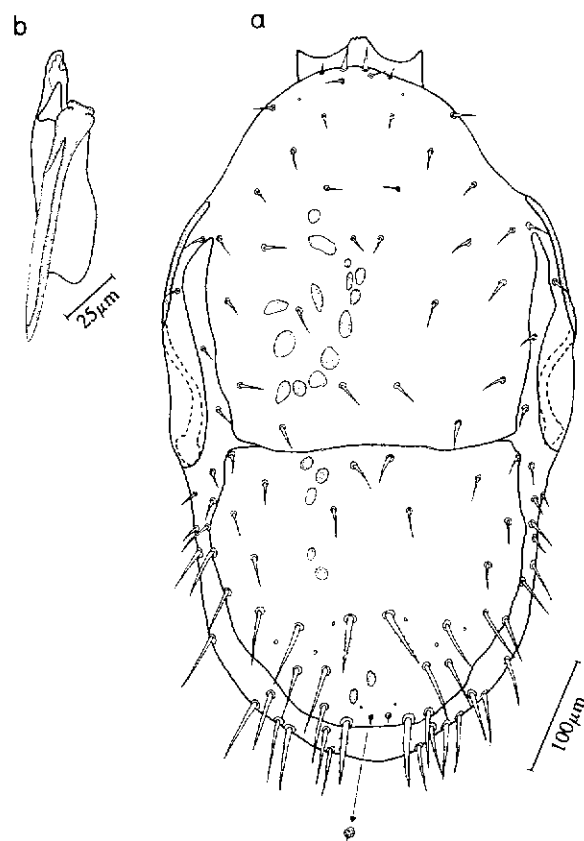


Fig. 4. *Rhinoseius androdon* male in dorsal view (4a), spermatodactyl (4b). From host No. 262.

setae. 4[4] setae present on the basitarsus I. The complete chaetotaxy of the legs is given below. **GNATHOSOMA** - Tectum as in holotype with a denticulate anterior margin.

MALE (Fig. 4-6)

DORSUM - Dorsal shield with length of 510-554[585] and width of 290-324 [345]. Dorsal shield of type C with lateral incisions and complete suture as in allotype. Podonotal part of dorsal shield with 17[17] pairs of setae with *r2* on the shield and *s5* lacking as in allotype. Opisthonotal part of the shield with 14 to 16[14] pairs of setae, depending on the position of the setae *R2* and *R4*. Setae *s6* and *J3* lacking as in holotype. Distinct striation absent on dorsal shield as in allotype. Length of setae *j1* 20-26 [30] and of *Z5* 59-65[60]. *J5* replaced by a bundle of microspinules, which is also

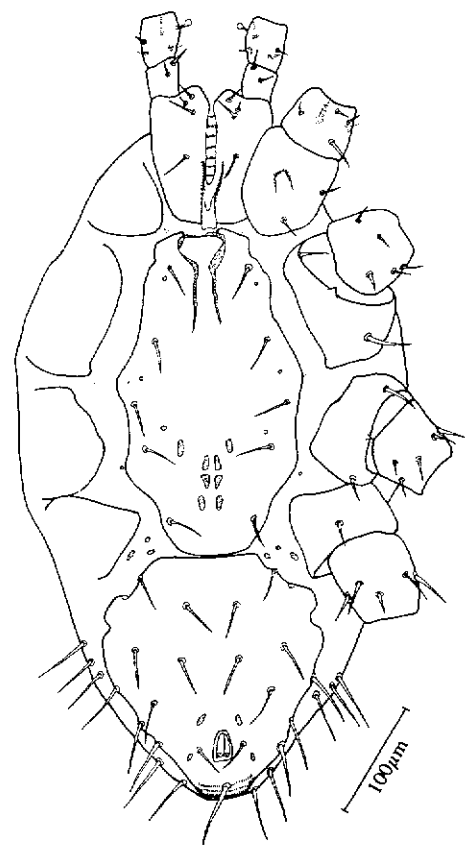


Fig. 5. *Rhinoseius androdon* male in ventral view. From host No. 262.

observed in the allotype. Peritremes short as in allotype. **VENTER** - Ventri-anal shield 200-215[210] long and 179-203[205] wide with setae *Jv1* to *Jv5* and *Zv1* to *Zv3* inserting on the shield as in allotype. **LEGS** - Coxa I with one ventral row of denticles in the form of a spatula as in allotype. The general chaetotaxy of the legs is the same as in females. The number of conical spines are the following: one (*av*) for femur II and genu II each and two for tarsus II, no spinelike setae can be observed on tibia II and tarsus III as in allotype. Length of spine on femur II 18-23[20]. The complete chaetotaxy of the legs is given below. **GNATHOSOMA** - Tectum as in allotype and female. Spermatodactyl 105[100] long at its best without appendix as in allotype.

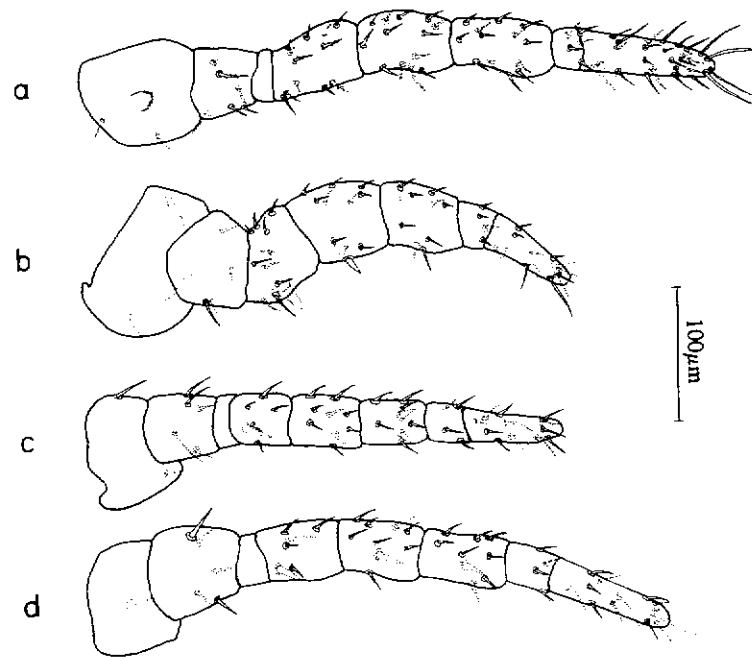


Fig. 6. *Rhinoseius androdon* legs I to IV in the male (a, b, c, d). From host No. 262.

***Rhinoseius tiptoni* BAKER & YUNKER, 1964**

FEMALE (Fig. 7-9)

DORSUM - Dorsal shield of type B as holotype, 532-620[600] long and 284-316[312] wide. Podonotal part of dorsal shield with 16 and opisthonotal part with 13 pairs of setae as in holotype. Setae *s6*, *Z4* and *S5* lacking as in holotype. Dorsal shield with distinct striation mainly on the podonotal and the anterior part of the opisthonotal shield. Setae *j1* 3-7 long and shortest dorsal setae. Longest setae of dorsal shield except *Z5* 20-28[31] long. Setae *Z5* 33-51[34] long. *J5* replaced by a bundle of microspinules, which is also observed in the holotype. Peritremes reaching altitude of setae *j2*. **VENTER** - Sternal shield without anterior lobes as in holotype. Anal shields 104-129[143] long and 68-78[85] wide. Setae *Jv1* and *Jv2* 24-36[28] long. Inseminating organ without distinct maturation poach. Membranous adductor canal 200 long at best. The number of opisthogastric setae (without setae of anal shield) is variable between 27 and 33[26] pairs with always one unpair seta in the center of a rectangle given by the setae *Jv1* and *Jv2* of both sides. The holotype shows no such unpair seta. **LEGS** - Coxa I ventral with several rows of denticles as in holotype. Tibia III bears 8[8] and tibia IV 9[9] setae. 4[4] setae present on the basitarsus I. The complete chaetotaxy of the legs is given below. **GNATHOSOMA** - Tectum rounded as in holotype.

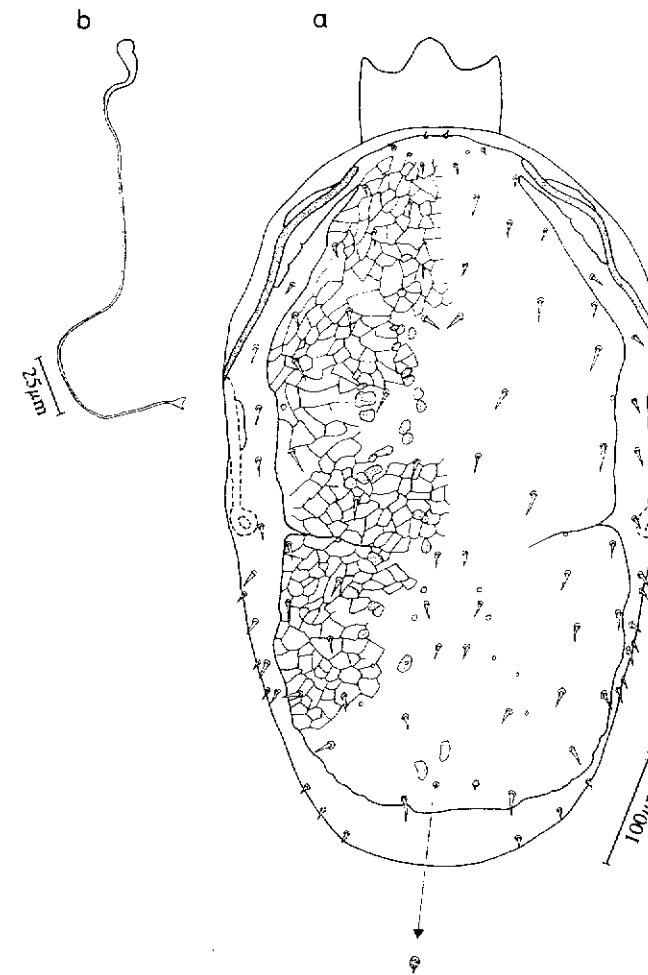


Fig. 7. *Rhinoseius tiptoni* female in dorsal view (1a), inseminating organ (1b). From host No. 453.

MALE (Fig. 10-12)

DORSUM - Dorsal shield with length of 525-576[546] and width of 327-367[353]. Dorsal shield of type A without lateral incisions as in allotype. Podonotal part of dorsal shield with 17 or 18[17] pairs of setae, depending on the position of setae *r3*. Opisthonotal part of dorsal shield with 13 pairs of setae as in allotype. Setae *s6*, *Z4* and *S5* lacking as in allotype. Setae *z4* and *s4* 59-76[73] long, resembling thick clubs as in allotype. Setae *r6*, *R1*, *S2*, *S3* and *S4* as in allotype longer than any other dorsal setae. Setae *S2* 130-194[199] long and always the longest dorsal setae. Setae *Z5* 10-11[10]

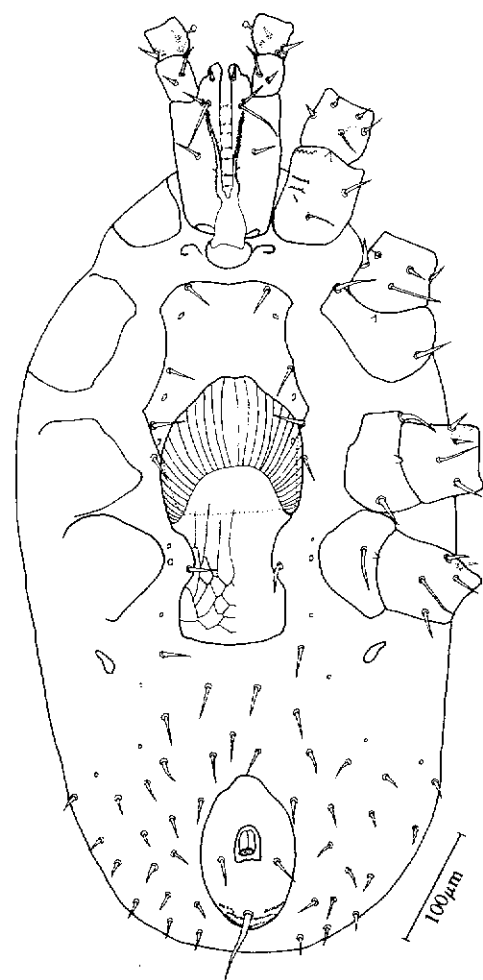


Fig. 8. *Rhinoseius tiptoni* female in ventral view. From host No. 453.

long. Dorsal shield with distinct striation only in the central part as in allotype. *J5* replaced by a bundle of microspinules, which is also observed in the allotype. Peritremes as in allotype. **VENTER** - Ventrianal shield fragmented as in allotype. Fragmented ventral shield shows high variability in its shape. Four of the 22 collected specimen from Anchicayá exhibit an unpair seta each as in the females. The allotype has no such seta. Number of opisthogastric pairs of setae constant without hypertrichy as in the females. **LEGS** - Coxa I with several ventral rows of denticles as in allotype. The general chaetotaxy of the legs is the same as in females. The number of conical spines are the following: one (*av*) for femur II and genu II each

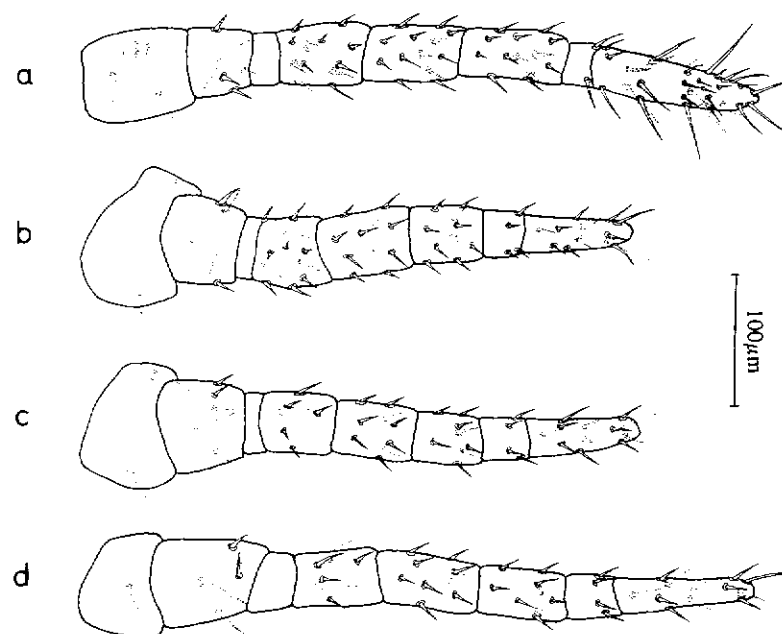


Fig. 9. *Rhinoseius tiptoni* legs I to IV in the female (a, b, c, d). From host No. 212.

and two for tarsus II, no spinelike setae can be observed on tibia II and tarsus III as in allotype. Spine on femur II 35-42[33] long with a diameter of 16-19[12]. The complete chaetotaxy of the legs is given below. **GNATHOSOMA** - Tectum rounded as in allotype and female. Spermatodactyl 42[43] long at its best without appendix as in allotype.

Description of the juvenile stages

Rhinoseius androdon FAIN & HYLAND, 1980

DEUTONYMPHS of both types (Fig. 13-18)

DORSUM - Podonotal shield with 15 pairs of setae, setae *s6* absent and *s2* laterad to the shield. Opisthonotal shield with 14 pairs of setae and *J3* absent. Peritremes short, not reaching beyond *s2*. Setae *J5* replaced by a bundle of microspinules. 19 to 22 pairs of setae in the *R*- and *UR*-rows. **LEGS** - Several rows of denticles on coxa I. General chaetotaxy of the legs same as adults. **GNATHOSOMA** - Tectum with a denticulate anterior margin, 10 long.

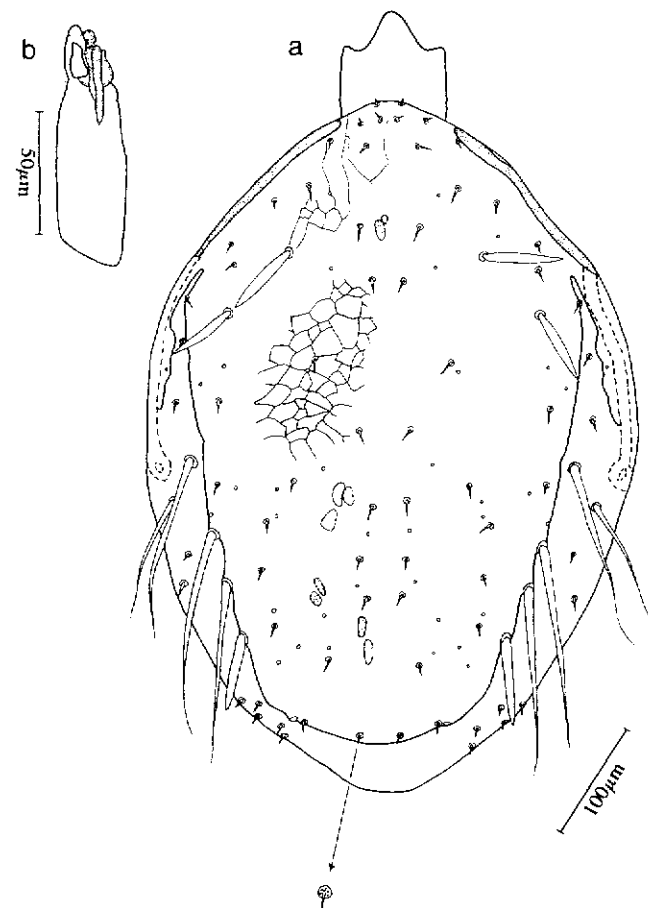


Fig. 10. *Rhinoseius tiptoni* male in dorsal view (4a), spermatodactyl (4b). From host No. 212.

DEUTONYMPHS of female type (Fig. 13-15)

DORSUM - Podonotal shield 254-298 long and 258-295 wide, opisthonotal shield 185-222 long, 160-208 wide and always longer than wide. Length of *j1* 15-30, of *J4* 12-38 and of *Z5* 33-58. Setae of podonotal shield except *j1* 18-30 for the longest (*j6* or *s5*) and 6-13 for the shortest (*z1*) ones. Setae of opisthonotal shield except *Z5* and *J5* 16-41 for the longest (*S5*) and 11-15 for the shortest (*S1*) ones. Setae *Z5*, the posterior setae of *R*- and *UR*-rows and in some cases even more of the posterior setae on opisthonotal shield barbed. **VENTER** - Anal shield 92-118 long and 74-92 wide. Setae *Jv5* 15-34 long. Shortest seta of *R5* to *R7* 20-46 and longest seta 32-

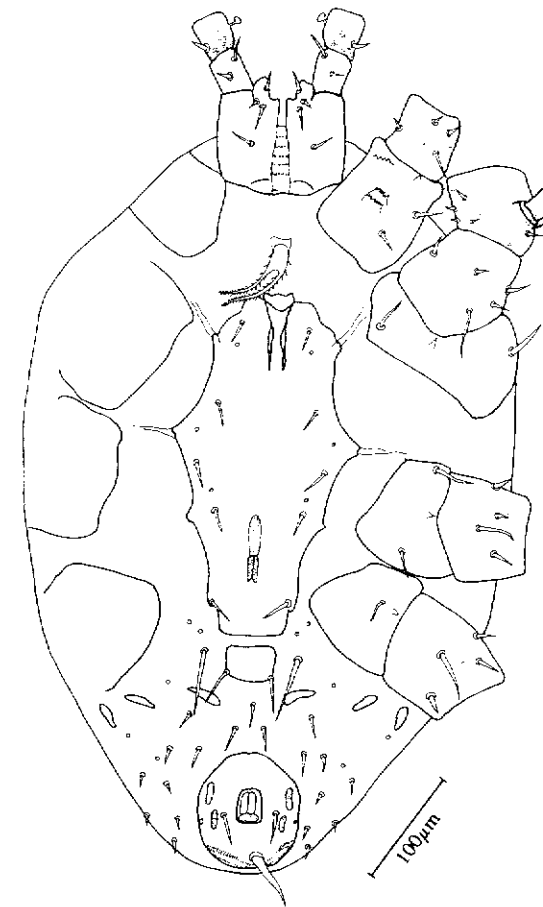


Fig. 11. *Rhinoseius tiptoni* male in ventral view. From host No. 212.

56 long. **LEGS** - Femur II with normal setae *av*, not stronger than other setae of same segment.

DEUTONYMPHS of male type (Fig. 16-18)

DORSUM - Podonotal shield 265-298 long and 265-291 wide, opisthonotal shield 181-203 long, 168-202 wide and always longer than wide. Length of *j1* 27-39, of *J4* 33-43 and of *Z5* 44-58. Setae of podonotal shield except *j1* 20-26 for the longest (*j6* or *s5*) and 7-11 for the shortest (*z1*) ones. Setae of opisthonotal shield except *Z5* and *J5* 37-48 for the longest (*S5*) and 11-15 for the shortest (*S1*) ones. On opisthonotal shield at least all setae with position-number greater or equal two are barbed as most of the

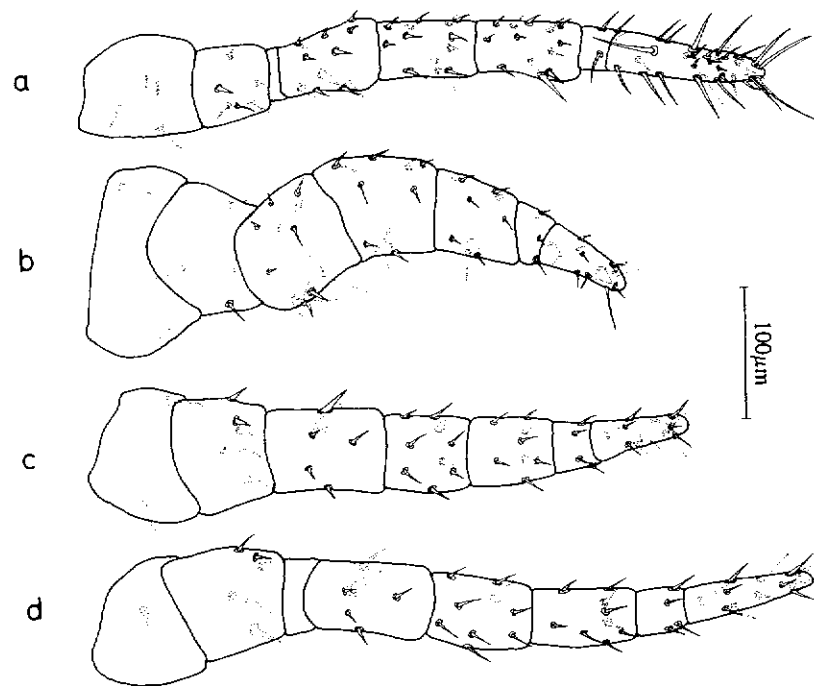


Fig. 12. *Rhinoseius tiptoni* legs I to IV in the male (a, b, c, d). From host No. 212.

setae of *R*- and *UR*-rows. On podonotal shield setae *j1* and *j2* may be barbed. **VENTER** - Anal shield 90-105 long and 72-83 wide. Setae *Jv5* 20-40 long. Shortest seta of *R5* to *R7* 33-42 and longest seta 37-56 long. **LEGS** - Femur II with setae *av* 13-20 long and 3-6 in basal diameter, obviously stronger than other setae of the same segment.

PROTONYMPHS (Fig. 19 & 20)

DORSUM - Length of podonotal shield 218-245, width 200-230. Pygidial shield with 80-105 in length and 90-109 in width, always wider than long but never more than 1.2 times wider than long. On podonotal shield insert 11 pairs of setae (*j1-j6*, *z2*, *z4*, *z5*, *s4*, *s5*) and on pygidial shield 7 (*J4*, *J5*, *Z3*, *Z4*, *Z5*, *S4*, *S5*) pairs. Setae *s6* and *J3* absent. 10 pairs of setae insert on dorsal membran: 3 pairs laterad to the podonotal shield (*r2*, *r3* & *r5*), 6 pairs between both shields (*R1*, *S2*, *Z1*, *Z2*, *J1* & *J2*) and one pair (*S3*) laterad to the anterior part of the pygidial shield. Setae *s6* absent. Length of setae *j1* 16-18 and of *Z5* 22-36, both setae barbed. Podonotal shield (except *j1*) with 12-18 for longest and 7-11 for shortest setae, pygidial shield with 9-14 for longest (except *Z5*) and 7-13 for shortest (except *J5*) setae. Dorsal membrane with 9-14 for longest and 7-10 for shortest setae. Quality of *J5* can't be diagnosed. **VENTER** - Setae *Jv1*, *Jv2*, *Jv5* &

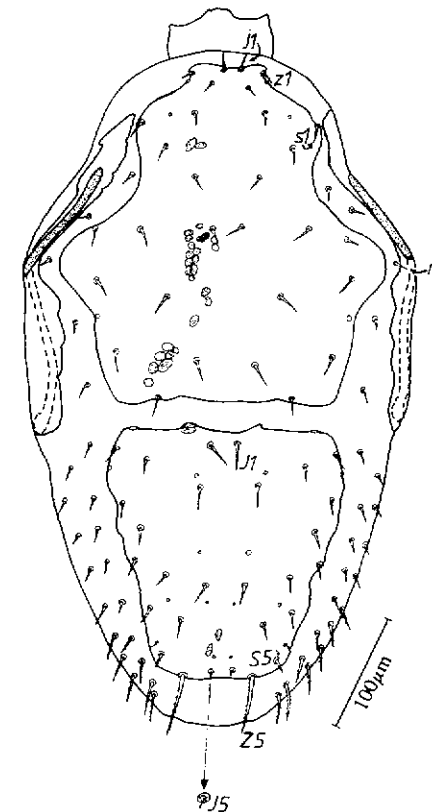


Fig. 13. *Rhinoseius androdon* deutonymph of female type in dorsal view.

Zv2 present. Length of *Jv5* 7-15, setae barbed. Longest opisthogastric setae except *Jv5* 17-24 and at least three times longer than the shortest setae with length of 0,2-6. Anal shield 38-80 long and 42-61 wide, with postanal seta 29-43 long. **LEGS** - Coxa I with rows of denticles. The general chaetotaxy of the legs is given below. **GANTHOSOMA** - Tectum with a denticulate anterior margin.

LARVAE (Fig. 21 & 22)

DORSUM - Podonotal shield 185-210 long, 145-167 wide and with 9 pairs of setae (*j1*, *j3*, *j4*, *j5*, *j6*, *z2*, *z4*, *z5*, *s4*). Pygidial shield 52-74 long, 78-87 wide and with 2 pairs of setae (*Z3* & *Z4*) except *J5* which couldn't be identified in all cases. Dorsal membrane with three pairs of setae: no setae insert laterad to the podonotal shield, 2 pairs (*s6* and *S3*) insert between podonotal and pygidial shield and 1 pair (*S4*) inserts laterad to the pygidial shield. Setae *S5* and *Z5* insert ventrally. Setae *j1* 9-12 long. Length of

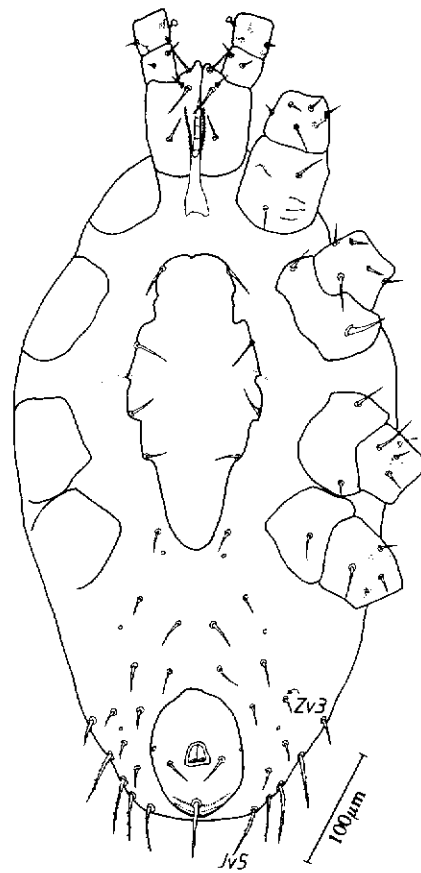


Fig. 14. *Rhinoseius androdon* deutonymph of female type in ventral view.

setae on podonotal shield except *jl* 7-10 for the longest and 4-8 for the shortest, on pygidial shield 5-8 for *Z3* and 2-5 for *Z4* and on dorsal membrane 5-8 for the longest and 2-4 for the shortest setae. VENTER - Setae *Jv1*, *Jv2*, *Jv5* and *Zv2* present beside *S5* and *Z5* with lengths of longest seta 14-23 and of shortest seta 2-6. Anal shield 33-44 long and 43-53 wide. Postanal seta 18-26 long. Paraanal seta 37-60 long, always longer than anal shield and about two times longer than postanal seta. LEGS - Longest setae on trochanter II and III 24-33 long and always as long as the respective segment. GNATHOSOMA - Tectum distally rounded.

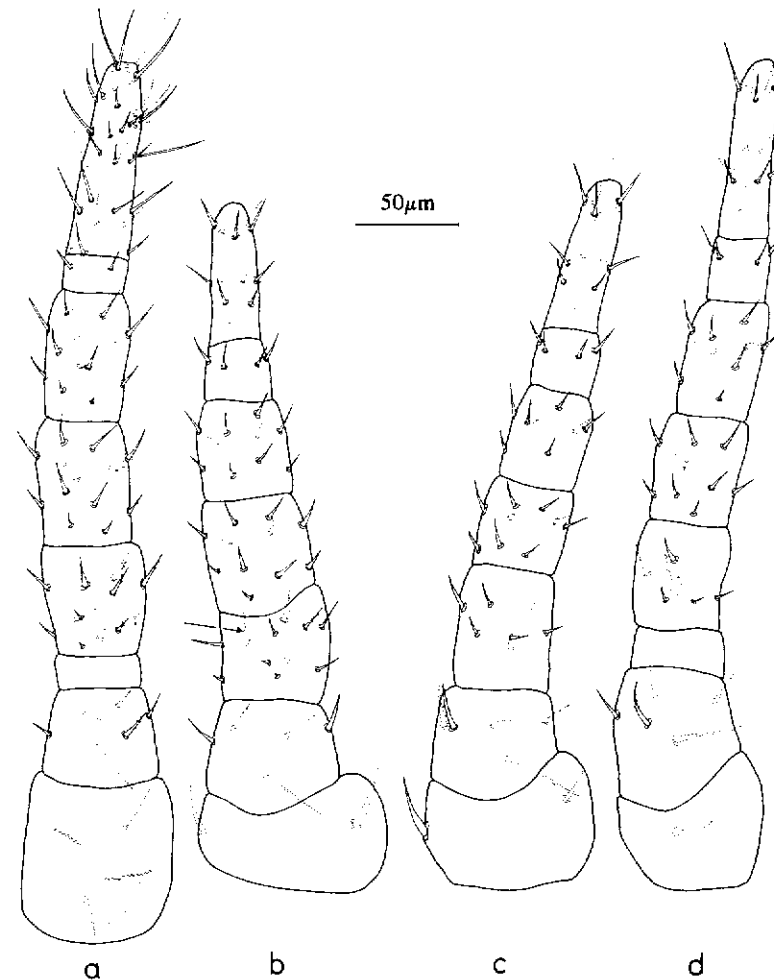


Fig. 15. *Rhinoseius androdon* legs I to IV in the deutonymph of female type (a, b, c, d). The seta *av* is marked.

***Rhinoseius tiptoni* BAKER & YUNKER, 1964**

DEUTONYMPHS of both types (Fig. 23-28)

DORSUM - Podonotal shield with 15 pairs of setae, *s6* absent and setae *s2* laterad to the shield. Opisthonotal shield with 13 pairs of setae, *Z4* and *S5* absent. Length of setae *jl* 3-6, of setae *zl* 4-9 and of *Z5* 12-22. Setae *J5* replaced by a bundle of microspinules. VENTER - Setae *Jv1* 14-22 and *Jv3* 7-13 long. LEGS - Several rows of denticles on coxa I. General chaetotaxy of the legs same as adults. GNATHOSOMA - Tectum distally rounded.

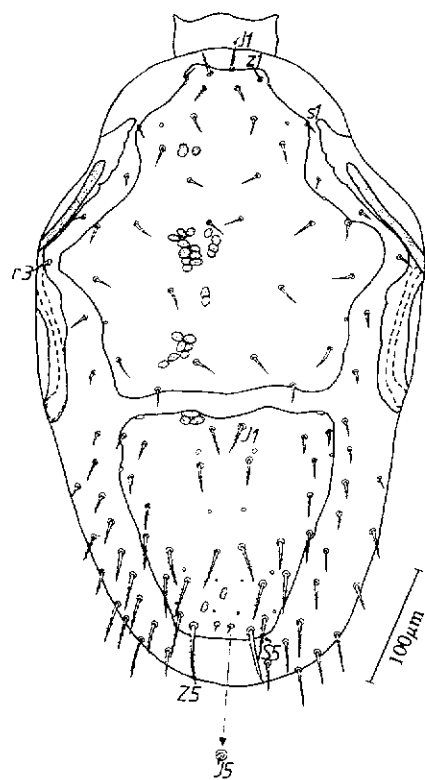


Fig. 16. *Rhinoseius androdon* deutonymph of male type in dorsal view.

DEUTONYMPHS of female type (Fig. 23-25)

DORSUM - Podonotal shield 265-295 long and 250-298 wide, opisthonotal shield 174-200 long, 200-248 wide and always wider than long. Setae of podonotal shield except *j1* 14-18 for the longest (*z4*) and 6-10 for the shortest (*z1*) ones. Setae of opisthonotal shield except *Z5* and *J5* 9-12 for the longest (*S2*) and 6-10 for the shortest (*S1*) ones. No barbed setae on opisthonotal shield. **VENTER** - Anal shield 72-91 long and 55-72 wide. Setae *Jv5* 3-6 and *R5* to *R7* 1-5 long. One unpair seta inserts on opisthogaster. **LEGS** - Femur II, Genu II and Tarsus II with normal setae *av* each, not stronger than other setae of same segment. **GNATHOSOMA** - Tectum 25-32 long.

DEUTONYMPHS of male type (Fig. 26-28)

DORSUM - Podonotal shield 273-316 long and 280-327 wide, opisthonotal shield 189-218 long, 211-262 wide and always wider than long. Setae of podonotal shield except *j1* 13-23 for the longest (*z4*) and 8-13 for the

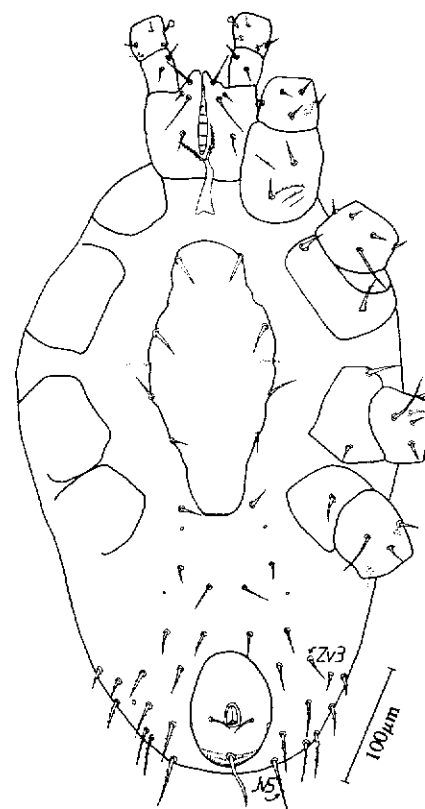


Fig. 17. *Rhinoseius androdon* deutonymph of male type in ventral view.

shortest (*z1*) ones. Setae of opisthonotal shield except *Z5* and *J5* 12-20 for the longest (*S2*) and 7-11 for the shortest (*S1*) ones. No barbed setae on opisthonotal shield. **VENTER** - Anal shield 70-85 long and 60-70 wide. Setae *Jv5* 4-8 and *R5* to *R7* 1-6 long. One unpair seta may insert on opisthogaster. **LEGS** - Femur II, Genu II and Tarsus II each with setae *av* stronger than other setae of same segment and formed as a spine. **GNATHOSOMA** - Tectum 24-30 long.

PROTONYMPHS (Fig. 29 & 30)

DORSUM - Length of podonotal shield 222-254, width 214-251. Pygidial shield with 72-95 in length and 122-142 in width, always over 1,5 times wider than long. On podonotal shield insert 11 pairs of setae (*j1-j6*, *z2*, *z4*, *z5*, *s4*, *s5*) and on pygidial shield 6 pairs (*J3*, *J4*, *J5*, *Z3*, *Z5*, *S4*). Setae *s6*, *Z4* and *S5* absent. 10 pairs of setae insert on dorsal membran: 3 pairs laterad to the podonotal shield (*r2*, *r3* & *r5*), 6 pairs between both shields (*R1*, *S2*, *Z1*, *Z2*, *J1* & *J2*) and one pair (*S3*) laterad to the anterior part of

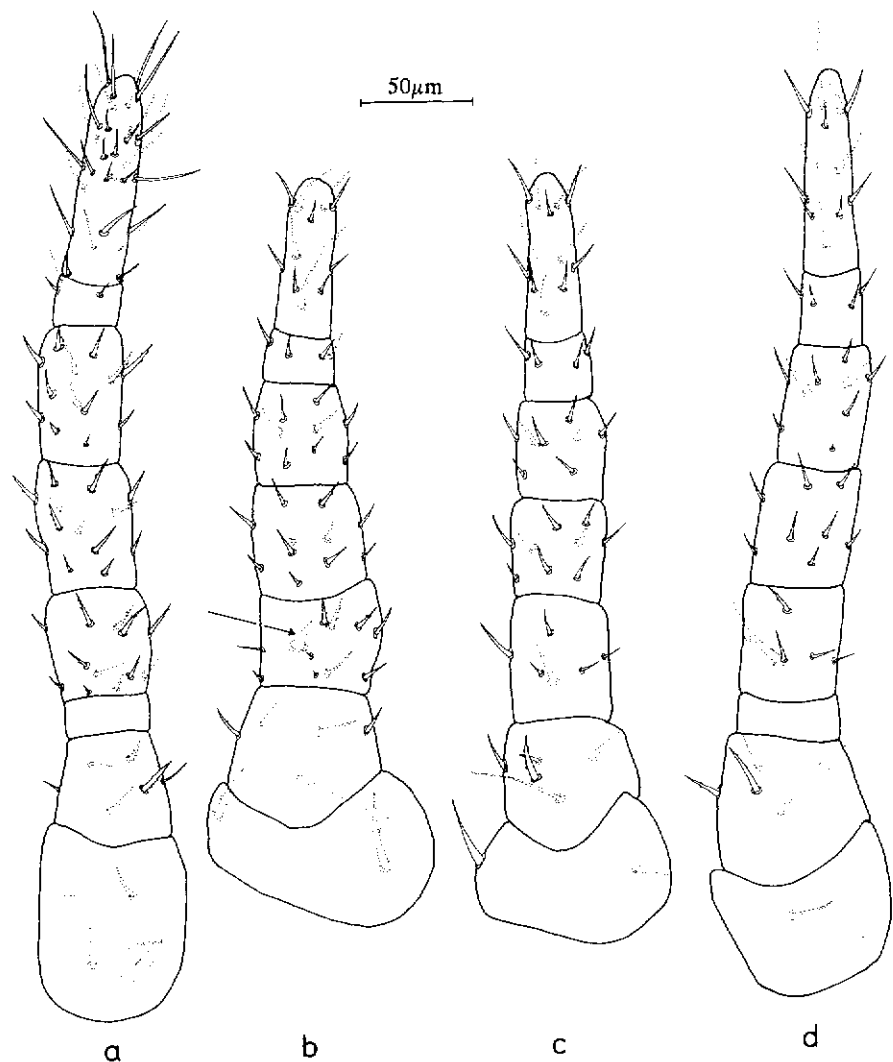


Fig. 18. *Rhinoseius androdon* legs I to IV in the deutonymph of male type (a, b, c, d). The seta *av* is marked.

the pygidial shield. Setae *s6* absent. Length of setae *j1* 5-9 and of *Z5* 9-13. Podonotal shield (except *j1*) with 12-20 for longest and 5-9 for shortest setae, pygidial shield with 6-12 for longest (except *Z5*) and 3-6 for shortest (except *J5*) setae. Dorsal membrane with 8-10 for longest and 3-7 for shortest setae. Quality of *J5* can't be diagnosed. VENTER - Setae *Jv1*, *Jv2*, *Jv5* & *Zv2* present. Length of *Jv5* 4-7. Longest opisthogastric setae except *Jv5* 16-20 and never more than 2,5 times longer than the shortest setae

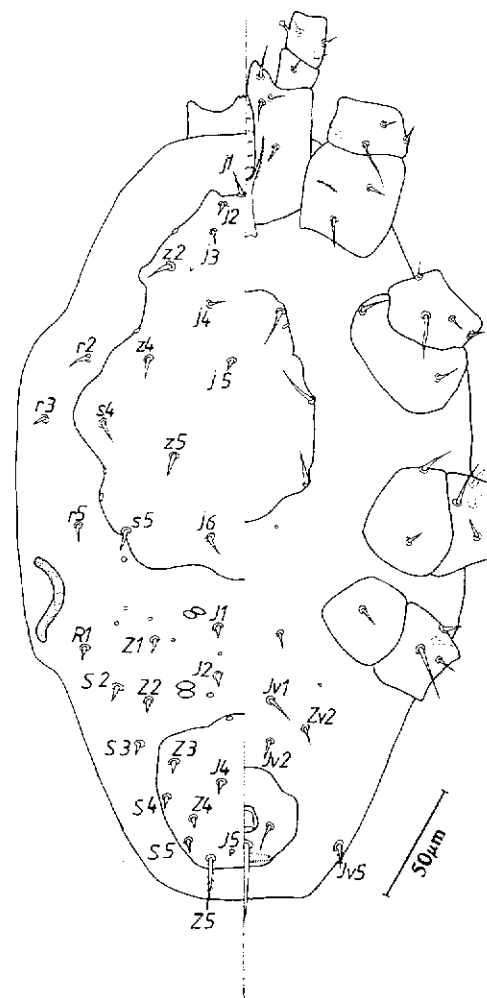


Fig. 19. *Rhinoseius androdon* protonymph in dorsal (left part) and ventral (right part) view.

with length of 8-10. Anal shield 53-65 long and 48-63 wide, with postanal seta 16-22 long. LEGS - Coxa I with rows of denticles. The general chaetotaxy of the legs is given below. GANTHOSOMA - Tectum distally rounded.

LARVAE (Fig. 31 & 32)

DORSUM - Podonotal shield 185-210 long, 145-167 wide and with 9 pairs of setae (*j1*, *j3*, *j4*, *j5*, *j6*, *z2*, *z4*, *z5*, *s4*). Pygidial shield 52-74 long, 78-

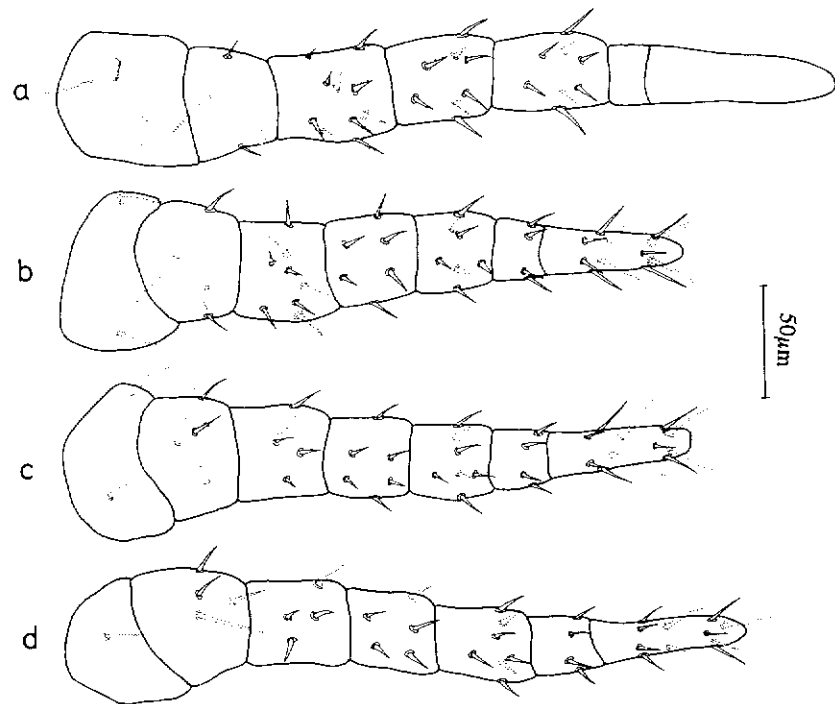


Fig. 20. *Rhinoseius androdon* legs I to IV in the protonymph (a, b, c, d).

87 wide and with 2 pairs of setae (Z3, Z4) except J5 which couldn't be identified in all cases. On dorsal membrane insert three pairs of setae: no setae laterad to the podonotal shield, 2 pairs (s6 and S3) between podonotal and pygidial shield and 1 pair (S4) laterad to the pygidial shield. Setae S5 and Z5 insert ventrally. Setae j1 5-6 long. Length of setae on podonotal shield except j1 7-10 for the longest and 4-6 for the shortest, on pygidial shield 3-6 for Z3 and Z4, which are for each specimen of nearly equal length. Setae on dorsal membrane 0,5-6 long and of nearly equal length for each specimen. **VENTER** - Setae Jv1, Jv2, Jv5, Zv2, S5 and Z5 present with lengths of longest seta 12-17 and of shortest seta 1-4. Anal shield 31-37 long and 47-54 wide. Postanal seta 12-20 long. Paraanal seta 24-33 long and never longer than anal shield. **LEGS** - Longest setae on trochanter II and III 20-28 long and nearly as long as the respective segment. **GNA-THOSOMA** - Tectum distally rounded.

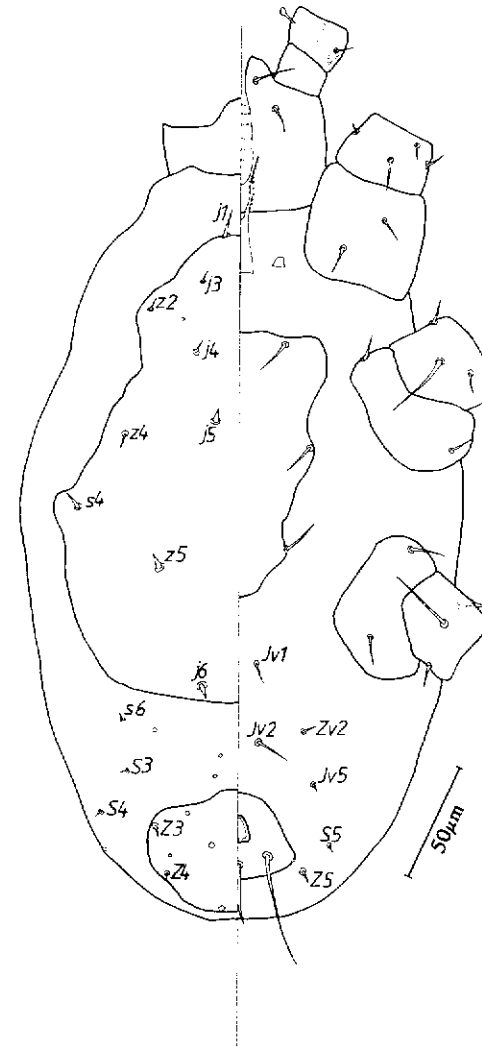


Fig. 21. *Rhinoseius androdon* larva in dorsal view (left part) and ventral (right part) view.

Chaetotaxy of the legs

ADULTS & DEUTONYMPHS:

Leg I - trochanter (1, 0/2, 1/1, 1); femur (2, 3/1, 2/2, 2); genu (2, 3/2, 3/1, 2); tibia (2, 3/2, 3/1, 2).

Leg II - trochanter (1, 0/2, 0/1, 1); femur (2, 3/1, 2/2, 1); genu (2, 3/1, 2/1, 2); tibia (2, 2/1, 2/1, 2).

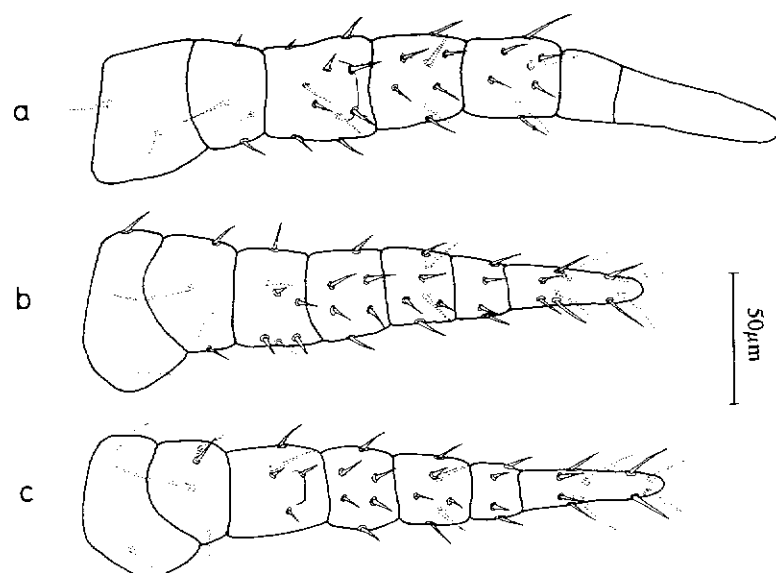


Fig. 22. *Rhinoseius androdon* legs I to III in the larva (a, b, c).

Leg III - trochanter (1, 1/2, 0/1, 0); femur (1, 2/1, 1/0, 1); genu (2, 2/1, 2/1, 1); tibia (2, 1/1, 2/1, 1).

Leg IV - trochanter (1, 1/2, 0/1, 0); femur (0, 2/1, 1/1, 1); genu (2, 2/1, 3/0, 1); tibia (2, 1/1, 3/1, 1).

Tarsus II to IV bearing 16 setae.

PROTONYMPHS:

Leg I - trochanter (1, 0/2, 0/0, 1); femur (2, 2/1, 2/1, 2); genu (1, 2/1, 2/1, 1); tibia (1, 2/1, 2/1, 1).

Leg II - trochanter (1, 0/2, 0/0, 1); femur (1, 2/1, 2/1, 1); genu (1, 2/0, 2/0, 1); tibia (1, 1/1, 2/1, 1).

Leg III - trochanter (1, 1/1, 0/1, 0); femur (1, 2/1, 1/0, 0); genu (1, 2/0, 2/0, 1); tibia (1, 1/1, 2/1, 1).

Leg IV - trochanter (1, 1/2, 0/0, 0); femur (0, 2/1, 1/0, 0); genu (0, 2/1, 2/0, 0); tibia (1, 1/1, 2/1, 1).

Tarsus II to IV bearing 15 setae.

LARVAE:

Leg I, II & III same as protonymph, except femur II with seta *pl* absent (1, 2/1, 2/1, 0) and tarsus II & III bearing 14 setae each.

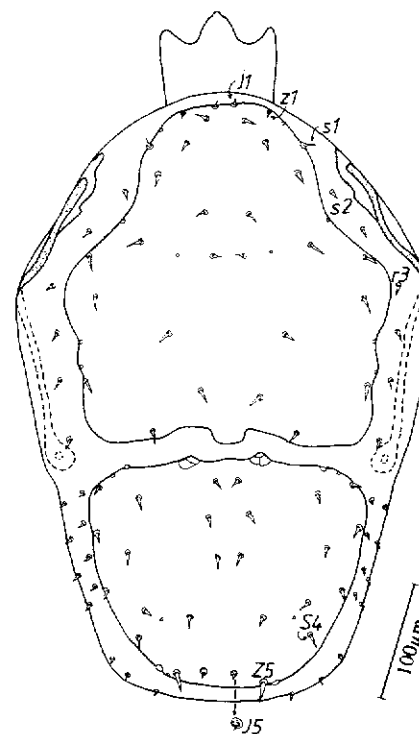


Fig. 23. *Rhinoseius tiptoni* deutonymph of female type in dorsal view.

Hosts

Rh. androdon FAIN & HYLAND, 1980:

Mites were collected from flowers of the following species:

undetermined *Liliaceae* sp. 1 No. 224, 26.VIII.1991 (1♀, 2♂♂, 1 protonymph, 4 larvae and 5 eggs); other flower, same data, No. 225 (3♂♂, 1 deutonymph of male type, 6 protonymphs, 14 larvae); other flower, same data, No. 226 (1♂, 1 protonymph, 4 larvae, 5 eggs); other flower, same data, No. 227 (3♀♀, 6♂♂, allotype of deutonymphs of both types, 3 deutonymphs of female type, 1 deutonymphs of male type, allotype protonymph, 7 protonymphs, allotype larva, 2 larvae, 5 eggs); undetermined *Ericaceae* sp. 5 No. 565, 3.VII.1991 (2♀♀, 4♂♂, 2 deutonymphs of male type, 7 protonymphs); undetermined *Ericaceae* sp. 4 No. 572, 16.VIII.1991 (1♂, 1 protonymph, 4 larvae); undetermined *Ericaceae* sp. 6 No. 573, 20.VIII.1991 (9♀♀, 8♂♂, 13 deutonymphs of female type, 6 deutonymphs of male type, 2 protonymphs); undetermined *Ericaceae* sp. 7 No. 574, 20.VIII.1991 (4♀♀, 4♂♂, 1 deutonymph of female type, 1 deutonymph of male type, 3 protonymphs, 1 larva; together with 4♀♀ and

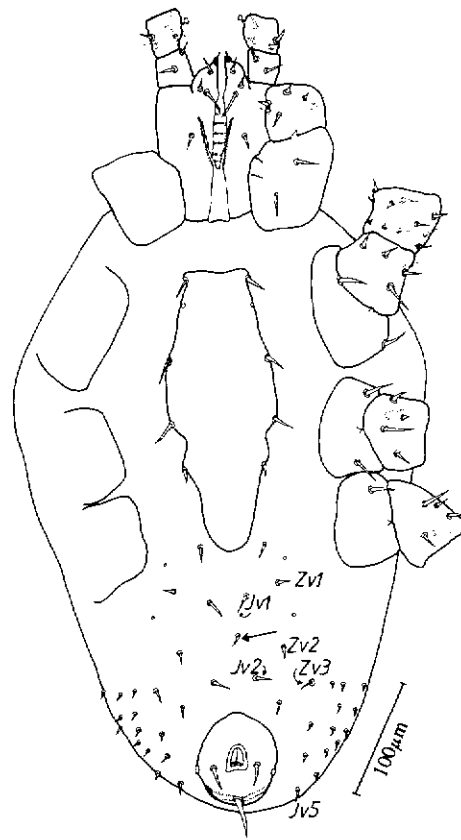


Fig. 24. *Rhinoseius tiptoni* deutonymph of female type in ventral view.

5♂♂ of *Rh. caucaensis* OHMER *et al.*, 1991); undetermined *Ericaceae* sp. 1 No. 575, 1.IX.1991 (1♀, 4♂♂, 1 deutonymph of male type, 2 protonymphs); undetermined *Ericaceae* sp. 3 No. 579, 1.IX.1991 (3♂♂, 1 hatching stage of deutonymph with female); undetermined *Ericaceae* sp. 9 No. 580, 1.IX.1991 (6♂♂, 1 deutonymph of female type); undetermined *Ericaceae* sp. 6 No. 583, 3.IX.1991 (1♀, 1♂, 1 deutonymph of female type, 1 deutonymph of male type, 2 protonymphs, 1 larva).

Mites were collected by M. LEUTFELD from the head feathers and bills of the following hummingbirds:

Androdon aequatorialis No. 006, 18.III.1991 (1♀); female *Phaethornis yaruqui* No. 032, 18.III.1991 (1♀); *Phaethornis yaruqui* No. 108, 25.III.1991 (1♂); *Androdon aequatorialis* No. 192, 6.IV.1991 (1♂); *Androdon aequatorialis* No. 248, 11.IV.1991 (4♂♂, 1 deutonymph of male

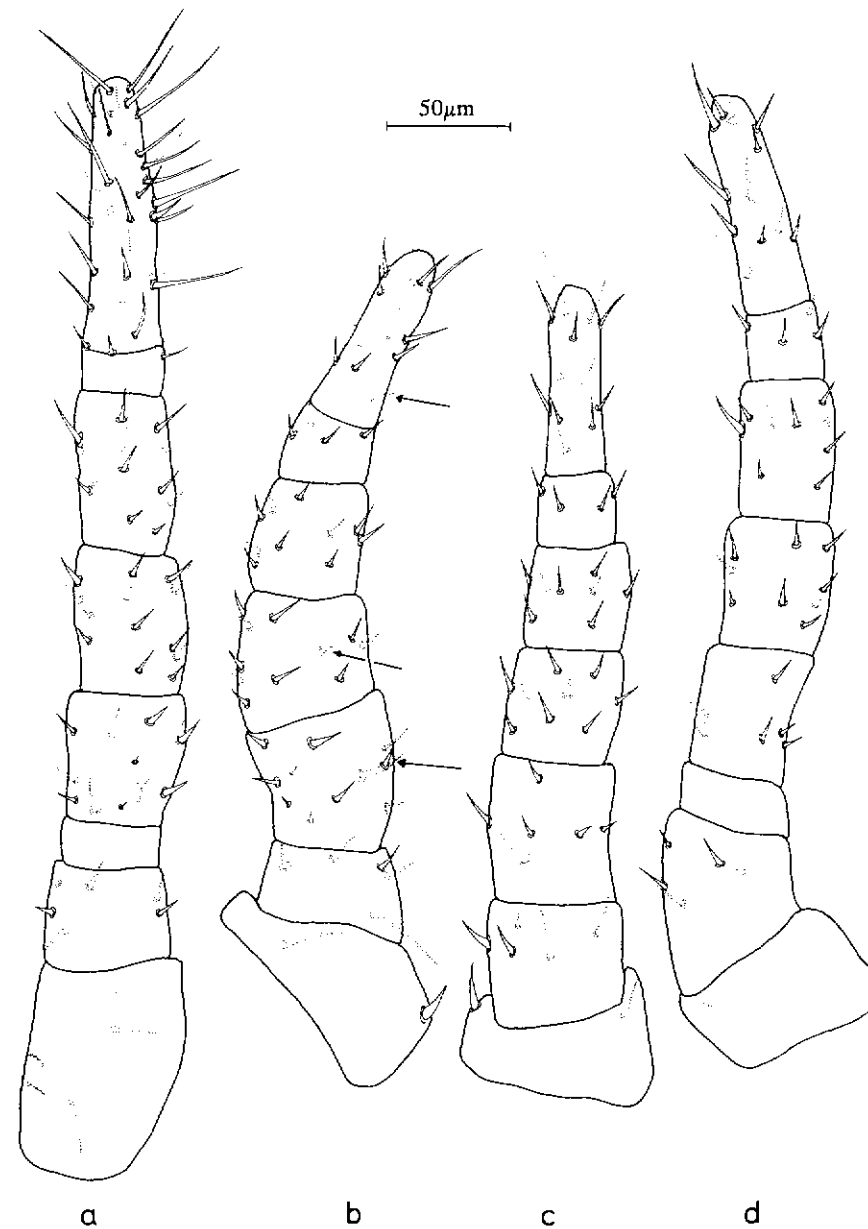
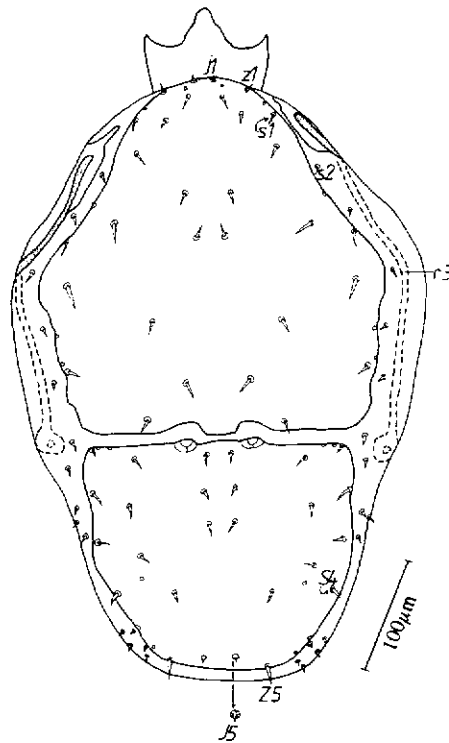
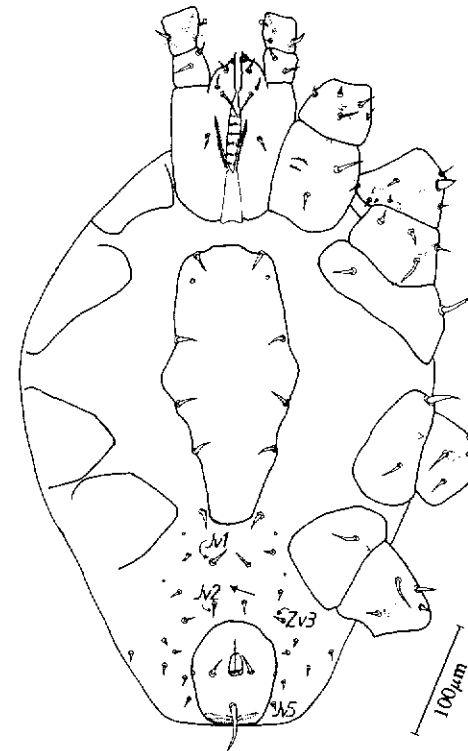


Fig. 25. *Rhinoseius tiptoni* legs I to IV in the deutonymph of female type (a, b, c, d). The setae *av* of femur II, genu II and tarsus II are marked.

Fig. 26. *Rhinoseius tiptoni* deutonymph of male type in dorsal view.

type, 3 protonymphs); *Phaethornis yaruqui* No. 250, 11.IV.1991 (1♂); *Phaethornis yaruqui* No. 261, 12.IV.1991 (1 deutonymph of male type); *Androdon aequatorialis* No. 262, 12.IV.1991 (2♂♂, 2 deutonymphs of male type, 3 protonymphs); *Androdon aequatorialis* No. 336, 19.IV.1991 (1♀); *Androdon aequatorialis* No. 341, 20.IV.1991 (1♀); *Phaethornis yaruqui* No. 369, 22.IV.1991 (2 deutonymphs of male type); *Phaethornis yaruqui* No. 394, 30.IV.1991 (2♀♀, 1♂); *Phaethornis yaruqui* No. 419, 3.V.1991 (1♀, 1 protonymph, 1 larva); *Androdon aequatorialis* No. 430, 6.V.1991 (1 deutonymph of male type); female *Amazilia rosenbergi* No. 453, 7.V. 1991 (1 deutonymph of female type); *Androdon aequatoria-* *lis* No. 460, 8.V.1991 (1 deutonymph of female type); female *Androdon aequatorialis* No. 534, 22.X.1991 (3♀♀, 6♂♂, 2 deutonymphs of female type, 1 deutonymph of male type, 1 protonymph); *Phaethornis yaruqui* No. 543, 21.XI. 1991 (1♂); *Phaethornis yaruqui* No. 562, 22.XI.1991 (1♀, 1 deutonymph of female type, 2 protonymphs); *Androdon aequatoria-* *lis* No. 638, 11.I. 1992 (1♀; 1 deutonymph of female type, 1 protonymph); *Phaethornis ya-* *ruqui* No. 659, 13.I.1992 (1 deutonymph of male type); *Phaethornis yaruqui* No. 682, 27.I.1992 (1♀); *Phaethornis yaruqui* No. 686, 27.I.1992 (1 deutonymph of female type); *Phaethornis yaruqui*

Fig. 27. *Rhinoseius tiptoni* deutonymph of male type in ventral view.

No. 695, 28.I.1992 (3♀♀, 1♂); *Androdon aequatorialis* No. 698, 29.I. 1992 (2♀♀, 3♂♂, 3 protonymphs); *Coeligena wilsoni* No. 699, 29.I.1992 (2♀♀); *Heliodoxa jacula* No. 705, 29.I. 1992 (1♀); *Amazilia tzacatl* No. 706, 29.I.1992 (1 deutonymph of female type); *Urosticte benjamini* No. 726, 9.II.1992 (2♀♀, 1♂♂, 2 protonymphs); *Phaethornis yaruqui* No. 806, 8.III.1992 (1 protonymph); *Phaethornis yaruqui* No. 812, 8.III. 1992 (1♀); *Thalurania colombica* No. 838, 18.III. 1992 (1♂); *Phaethornis yaruqui* No. 856, 26.III.1992 (1♂, 1 protonymph); *Phaethornis yaruqui* No. 867, 31.III. 1992 (1♂, 1 deutonymph of male type, 1 protonymph).

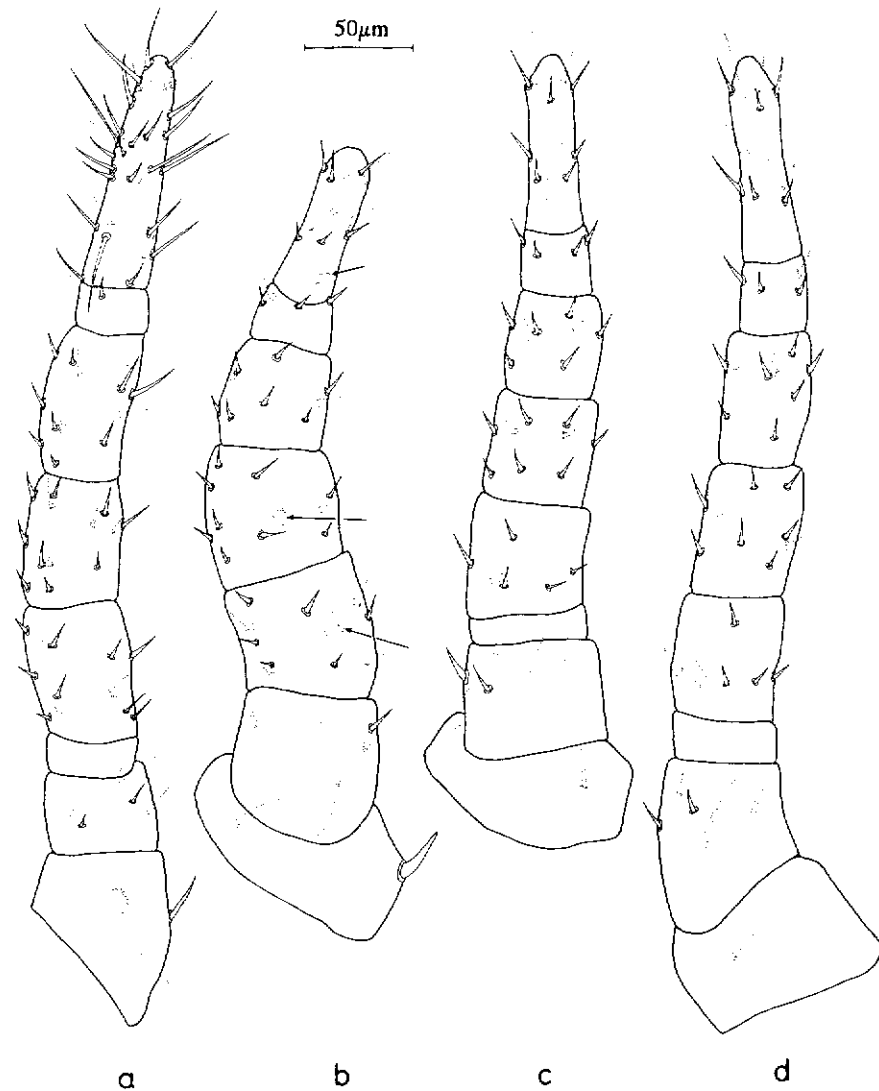


Fig. 28. *Rhinoseius tiptoni* legs I to IV in the deutonymph of male type (a, b, c, d). The setae *av* of femur II, genu II and tarsus II are marked.

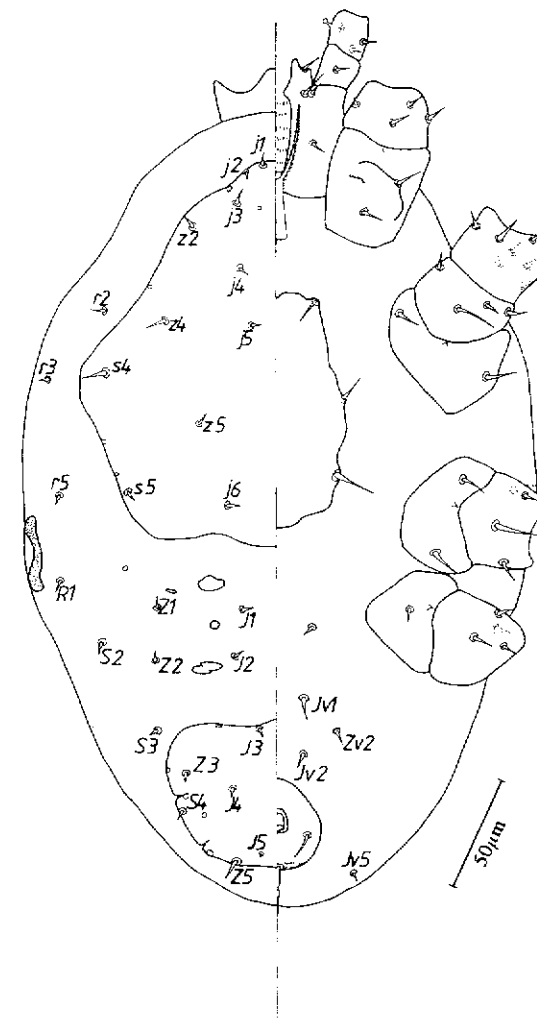


Fig. 29. *Rhinoseius tiptoni* protonymph in dorsal (left part) and ventral (right part) view.

***Rh. tiptoni* BAKER & YUNKER, 1964:**

Mites were collected from flowers of the following species:

In the following flowers of an undetermined *Gesneriaceae* sp. 1 one male was collected each: No. 34, 13.VIII.1991; No. 35, same data; No. 249, 8.IX.1991; No. 251, same data; No. 385, 17.IX.1991; No. 386, same data; No. 407, same data. One female was collected in No. 396, same data. In all these flowers numerous *Rh. chochoensis* WIESE & FAIN, 1996 were found in all stages.

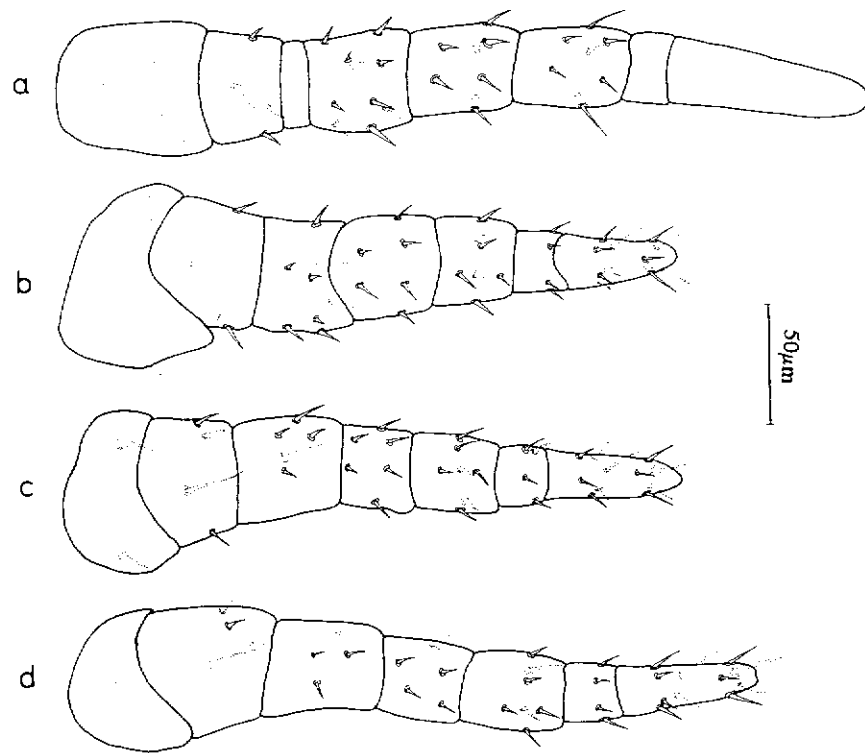


Fig. 30. *Rhinoseius tiptoni* legs I to IV in the protonymph (a, b, c, d).

Undetermined *Gesneriaceae* sp. 3 No. 90, 15.VIII.1991 (1♂); *Gesneriaceae* sp. 5 No. 210, 24.VIII.1991 (8 larvae); other flower, No. 211, same data (1♀, 1 protonymph); other flower, No. 212, same data (2♀♀; 4♂♂; allotype of deutonymphs of both types, 2 deutonymphs of female type, 2 deutonymphs of male type, allotype protonymph, 2 protonymphs); other flower, No. 213, same data (1♀, 1♂, 1 deutonymph of female type, 3 deutonymphs of male type, 2 protonymphs, allotype larva, 2 larvae); other flower, No. 214, same data (2♀♀, 2♂♂, 2 deutonymphs of female type, 3 deutonymphs of male type, 2 protonymphs, 4 eggs); undetermined *Gesneriaceae* sp. 6 No. 228, 26.VIII.1991 (1♀, 1 deutonymph of male type, 2 protonymphs); undetermined *Gesneriaceae* sp. 7 No. 229, 28.VIII.1991 (3♀♀, 2♂♂, 1 deutonymph of female type, 7 protonymphs, 11 larvae); undetermined *Gesneriaceae* sp. 8 No. 236, 5.IX.1991 (1♀); undetermined *Gesneriaceae* sp. 11 No. 565, 3.VII.1991 (1♂, 1 egg).

Mites were collected by M. LEUTFELD from the head feathers and bills of the following hummingbirds:

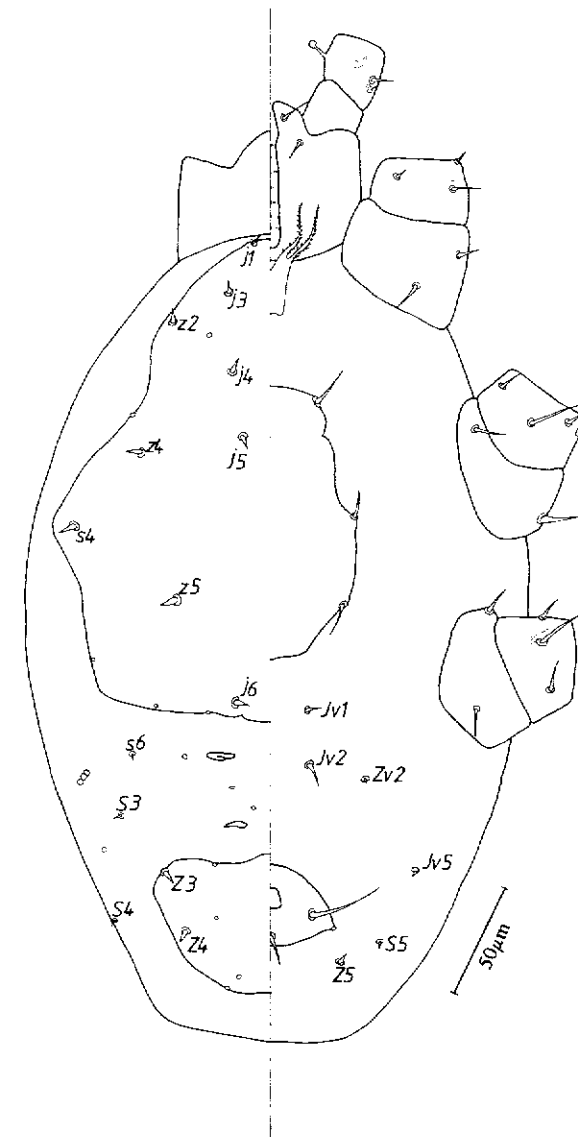


Fig. 31. *Rhinoseius tiptoni* larva in dorsal view (left part) and ventral (right part) view.

Phaethornis yaruqui No. 032, 18.III.1991 (1♀); *Phaethornis yaruqui* No. 120, 29.III.1991 (1♀, 1♂); *Phaethornis yaruqui* No. 151, 31.III.1991 (2♀♀, 1 deutonymph of male type, 1 protonymph); *Phaethornis yaruqui* No. 429, 6.V.1991 (1♀); *Amazilia rosenbergi* No. 453, 7.V.1991 (1♀); *Phaethornis yaruqui* No. 485, unknown date (1 deutonymph of male type);

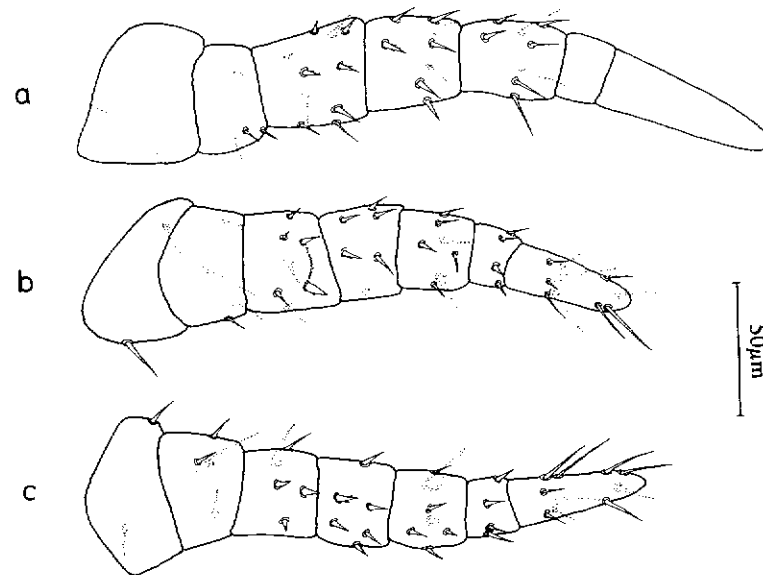


Fig. 32. *Rhinoseius tiptoni* legs I to III in the larva (a, b, c).

Phaethornis yaruqui No. 543, 21.XI.1991 (1♀); *Phaethornis yaruqui* No. 682, 27.I.1992 (1♂); *Phaethornis yaruqui* No. 695, 28.I.1992 (1 deutonymph of female type, 1 protonymph); *Amazilia tzacatl* No. 706, 29.I.1992 (1♂, 1 deutonymph of male type); *Phaethornis yaruqui* No. 802, 7.III.1992 (2♀♀, 1 deutonymph of male type, 1 larva).

Discussion

For the first time it was possible to characterize the setae in the adults with certainty after LINDQUIST & EVANS (1965) by using all juvenile stages. We are now sure, that setae *s6* are absent in both species in all stages except the larvae if we accept the chaetotaxy of LINDQUIST & EVANS (1965) for all developmental stages. Setae *J3* and not *J4*, as supposed by FAIN & HYLAND (1980), should be absent in all stages of *Rh. androdon* if we accept the taxonomic concept of LINDQUIST & EVANS (1965) for the protonymphs. For the adult stages of *Rh. tiptoni* we could give the complete chaetotaxy also for the first time.

The assumed loss of some larval dorsal setae in the further ontogenesis of both species is an interesting point. This could mean that the general chaetotaxy proposed by LINDQUIST & EVANS (1965) for the larvae and protonymphs of the *Ascidae* should carefully be reexamined, because the identification of setae *s6* for all stages of *Rh. androdon* and *Rh. tiptoni* is

based on its characteristic position in the larvae and protonymphs as given by these authors. MICHERDZINSKY & LUKOSCHUS (1980) for instance avoided the same problem in their description of the species *Rh. rafinskii* - setae *s6* should disappear from larvae to protonymphs when the concept of LINDQUIST & EVANS (1965) is applied - by diverging from the chaetotaxy given by LINDQUIST & EVANS (1965) for the protonymphs: the seta *s5* of LINDQUIST & EVANS (1965) is named '*s6*' by MICHERDZINSKY & LUKOSCHUS (1980). In this way the authors suppose, that setae *s6* remain in the protonymphs as in the further stages while setae *s5* are absent in all developmental stages. According to their position in relation to the setae '*s6*' also the setae *r5* of LINDQUIST & EVANS (1965) are named '*r6*' in *Rh. rafinskii* by MICHERDZINSKY & LUKOSCHUS (1980).

Additionally setae *s4* seem to insert in the protonymphs of *Rh. rafinskii* on the dorsal membrane laterad to the podonotal shield as given in the description by MICHERDZINSKY & LUKOSCHUS (1980). We feel that the authors failed in this last point, because the corresponding setae insert on the dorsal shield of the larva and of the other developmental stages of this species as given by the authors.

An important result of our examinations is, that the larvae of *Rh. tiptoni* are in apparent contrast to all other stages of this species not only equipped with setae *s6* but also with setae *Z4* and *S5*. These three pairs of setae seem to be disappeared in the protonymphs when the taxonomic concept of LINDQUIST & EVANS (1965) is applied. This observation could mean a total revision of the concept given by LINDQUIST & EVANS (1965) if we assume, that all setae of the larvae should appear in the protonymphs at least. This possibility was yet excluded by the examination of the hatching stages of larvae with protonymphs, which we yet realized for a species of the group "ornatus" (*Rh. chocoensis* WIESE & FAIN, 1996). The lineage of each seta was observed through all developmental stages. The results of this work were in exact correspondence with the concept of LINDQUIST & EVANS (1965). This seems to be the case also for a species of the group "wetmorei" (*Rh. bakeri* DUSBABEK & CERNY, 1970 in the description of FAIN & SMILEY, 1995), of which hatching stages are yet not known.

Thus the only valid interpretation of the phenomenon in *Rh. androdon* and *Rh. tiptoni* seems to be that from the larvae to the protonymphs of at least *Rh. tiptoni* some setae get definitively lost. This would be unique within the *Ascidae*. An examination of hatching stages should be conducted for the two species *Rh. androdon* and *Rh. tiptoni* as for *Rh. rafinskii* and *Rh. bakeri*, which demands further collections. For these three species of the group "tiptoni" it should be clarified, if the setae mentioned above disappear from the larvae to the protonymphs or if the general taxonomic concept of the *Ascidae* is not valid at least for these two species.

Independend of the results of these examinations we suppose, that the ontogeny of all species in the group "tiptoni" may exhibit some unique characteristics at least within the genus *Rhinoseius* which may be: dimorphism of deutonymphs (not yet examined in *Rh. rafinskii*), loss of some

setae from larva to protonymphs or general divergence from the podosomal chaetotaxy of the *Ascidae*. This would underline the separation of the group 'tiponi' as a possible monophyletic group within *Rhinoseius*.

A further and unique phenomenon is the dimorphism in the deutonymphs of the two examined species. For *Rh. androdon* this dimorphism is evident in the quality of the dorsal setae (more barbed and longer setae in the males), the size of the dorsal shields (slightly taller in the males) and the seta *av* of femur II (stronger and spinelike in the males). For *Rh. tiptoni* the dimorphism is evident in the number of the opisthosomal setae (hypertrichy in the females) and the quality of the setae *av* of femur II, genu II and tarsus II (stronger and spinelike in the males). A similar dimorphism of juvenile stages is, as far as we see, not known in the genus *Rhinoseius* as in the whole *Ascidae*. The interpretation of this dimorphism as a sexual dimorphism in the deutonymphs is based on the following observations.

First a hatching stage of a female-type deutonymph with a female was found for the species *Rh. androdon* (Flower No. 579). Secondly the seta *av* of femur II is a discrete and sexual dimorphic character in the adults. This seems to be the case also for the deutonymphs, where this seta is obviously stronger in the one type of deutonymphs which we suppose to be the male-type. As a third reference of a sexual dimorphism we value, that the character of the dorsal setae corresponds in *Rh. androdon* with the appearance of the seta *av* of femur II in the adults of different sexes as in the deutonymphs of different types. The fourth reference is the observation, that in *Rh. tiptoni* the opisthogastric hypertrichy in the females occurs in that deutonymph-type, which shows no hypertrophic setae *av* on its femora, genua and tarsus II as it is the case in the adult females. While these arguments are plausible and the examined material shows no contradictions, a truth proof should be given by the examination of hatching stages in both sexes for each species. A sexual dimorphism in the deutonymphs could underline the intense sexual competition among male hummingbird flower mites and thus the significance of sexual selection in the evolutionary radiation of this group (see also COLWELL, 1986 a&b). It should be carefully examined, if the corresponding species exhibit a precopulatory mate guarding as do some *Phytoseiidae* (see AMANO & CHANT, 1977) and some *Tetranychidae* (see POTTER *et al.*, 1976; ENDERS, 1991). In a similar way we assume that the heteromorphism of the males in some species of *Rhinoseius* (see overview in WIESE & FAIN, 1996) does represent an intense sexual competition resulting in alternative male-phenotypes combined with alternative mating behaviour. First results of examinations on populations of *Rh. chocoensis* (data unpublished) confirm different mating behaviour of heteromorph and homeomorph males which agrees well with a system described by HAMILTON (overview in HAMILTON, 1979) for fig wasps (Hymenoptera: *Agaonidae*) and other insects.

A further remarkable observation is the collection of a larva of each species from different hummingbirds. These are the first larvae of hummingbird flower mites found on hummingbirds as there is until now no

similar report (see also COLWELL, 1979; COLWELL, 1986a&b; FAIN, HYLAND & AITKEN, 1977a; FLECHTMAN & JOHNSTON, 1978; LUZ ZAMUNDO, 1985).

The chaetotaxy of the legs is in accordance with the chaetotaxy for species of the group "tiponi" or "ornatus" within the genus *Rhinoseius* as given in WIESE & FAIN (1993 & 1996).

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