

## On some little known and a new species of Myobiidae (Acari) associated with rodents

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### Summary

Four little known and one new species of myobiid mites (Acari Myobiidae) associated with rodents are described and depicted : *Radfordia eremici* sp. n., *Radfordia subuliger* EWING, 1938, *R. neotomae* JAMESON et WHITAKER, 1975, *Radfordia ewingi* (FOX, 1937) and *Cryptomyobia rotundata* (LAWRENCE, 1951). A new species group "subuliger" is created for the first three species, all associated with North American rodents of the family Sigmodontidae. The place of *R. ewingi* into the subgenus *Graphiurobia* is confirmed. A new hypothesis about the homology of the idiosomal setae in male and female myobiids is proposed.

**Keywords** : Taxonomy. Acari. Myobiidae. Rodentia.

### Résumé

Nous décrivons, ou redécrivons, ici quatre espèces mal connues et une espèce nouvelle de Myobiidae (Acari), toutes associées à des rongeurs, c'est à dire *Radfordia eremici* sp. n., *Radfordia subuliger* EWING, 1938, *R. neotomae* JAMESON et WHITAKER, 1975, *Radfordia ewingi* (FOX, 1937) et *Cryptomyobia rotundata* (LAWRENCE, 1951). Un nouveau groupe d'espèces "subuliger" est créé pour les trois premières espèces, associées à des rongeurs nordaméricains de la famille Sigmodontidae. Une nouvelle hypothèse sur l'homologie des poils idiosomaux des Myobiidae, males et femelles, est proposée.

### Introduction

Mites of the subfamily Myobiinae (Acari Myobiidae) are obligate parasites of rodents. The high degree of host specificity in myobiid mites is generally considered to be a result of parallel evolution (FAIN, 1994). This subfamily includes to date nine genera (BOCHKOV, 1999). Most of these species have been adequately described. For a few ones, however, the descriptions is insufficient and does not allow us to recognize them with certainty or to assign them to a right genus or a subgenus. Four of these poor known species are redescribed and redepicted in present work. In addition , a new species *Radfordia (Radfordia) eremici* sp.n. is described. A new hypothesis about the homology of the idiosomal

setae in myobiid males and females is proposed.

The material studied in this paper has been deposited in the collections of the Institut royal des Sciences naturelles de Belgique, Bruxelles. All the measurements are in micrometers ( $\mu\text{m}$ ). We follow the setal nomenclature of the idiosoma proposed by (FAIN, 1973) except for some genital setae in the female (BOCHKOV, 1997).

### Genital shield and dorsal chaetotaxy of the male idiosoma

We will discuss here, very briefly, the homologies observed in the chaetotaxy of the idiosoma in the males of Myobiidae. True homologies are clearly marked for the following setae : *vi*, *ve*, *sci*, *sce*, *ll* and *l5*. Owing to the sexual dimor-

phism of these mites the homologies of the other groups of setae seem less evident. However, a study of some primitive genera of Myobiidae has revealed that these homologies between males and females also exist.

The dorsal chaetotaxy of the male idiosoma is closely connected with the chaetotaxy of the genital shield (GS). Males of the most primitive species of different myobiid genera associated with marsupials, i.e. *Xenomyobia* FAIN et LUKOSCHUS, 1976 and *Archemyobia* JAMESON, 1955 bear eight or nine pairs of setae on the GS and seven or six pairs of setae on the dorsum of hysterosoma, respectively. The maximum number of dorsal hysterosomal setae, including the setae of GS, is 15 pairs for all the known myobiid males. In the females of these species, there are two pairs of anal setae (*ai* and *ae*), three pairs of genital setae (*g1-g3*), three pairs of paragenital setae (*pg1-pg3*) and ten pairs of dorsal hysterosomal setae (*d1-d5* and *l1-l5*) (BOCHKOV, 1997). The paragenital setae, as a rule, are absent in the males of the prostigmatic mites. Therefore, the females and males of these genera bear an equal number of dorsal hysterosomal setae (15 pairs), excluding the paragenital setae in females but including the setae of the GS in males.

This similarity in the number of hysterosomal setae confirms the homology between these setae in myobiid females and males. The five pairs of the setae on GS are homologous with the setae of the female genital area (two pairs of anal setae and three pairs of genital setae). Three other pairs of the setae situated on the GS shield in males of *Archemyobia*, are probably the median setae *d1-d3*.

We may conclude from these observations that the full chaetom of myobiid males consists of the following setae: *vi*, *ve*, *sci*, *sce*, *d4-d5*, *l1-l5*, all situated off GS and *ai*, *ae*, *g1-g3*, *d1-d3*, all situated on GS. It is, however more difficult to establish the homologies between the setae situated on the GS.

It should be noted that the number of setae on GS and the setae *d4* and *l2* situated near to GS are very often reduced in the males of the subfamily Myobiinae.

## Systematics

### Genus *Radfordia* EWING, 1938

#### Subgenus *Radfordia* s.str.

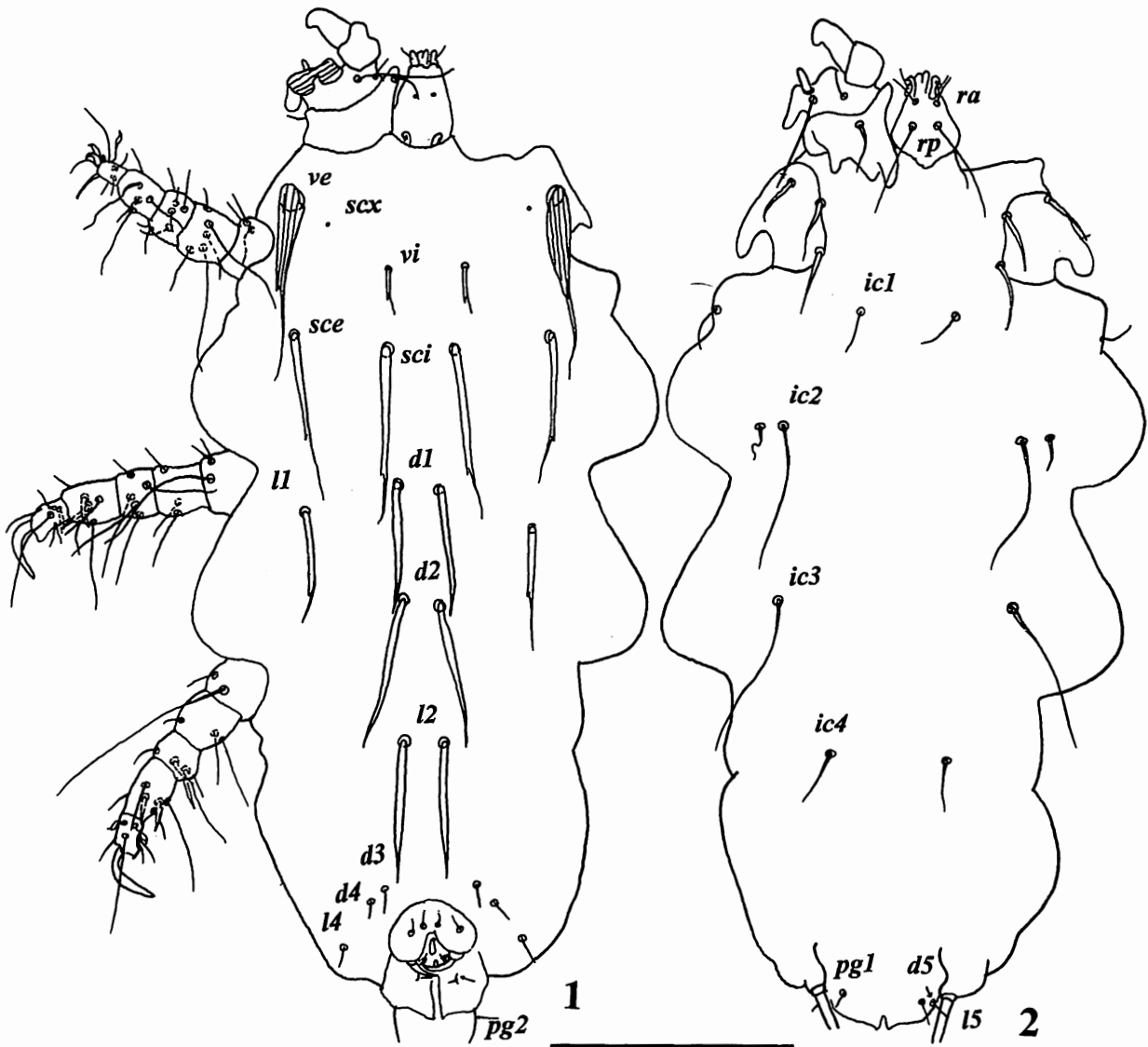
#### Species group "subuliger"

This new species group is created herein for the three species i.e. *Radfordia subuliger* EWING, 1938, *R. eremici* sp. n. and *R. neotomae* JAMESON et WHITAKER, 1975, all associated with North American Sigmodontidae (Rodentia). The males of this species group have a genital shield which is a unique for the genus *Radfordia* sensu BOCHKOV (1999). This shield is ovoid and bears six pairs of setae (Figs. 4, 10), whilst in the other subgenera of the genus *Radfordia*, it is, as a rule, conical and bears only five -free pairs of setae. The females have intermediate characters between the subgenera *Radfordia* EWING, 1938, *Microtimyobia* FAIN et LUKOSCHUS, 1976 and *Hesperomyobia* BOCHKOV, 1996 and they differ from the other species of the genus *Radfordia* by the absence of setae *l3*. Unfortunately, the immature instars of this group are still unknown. We think that the study of these immature instars will confirm that these species belong to a distinct subgenus of the genus *Radfordia*. In the meantime, we propose to consider this group as a *incertae sedis* group within the genus *Radfordia*.

#### *Radfordia (Radfordia) subuliger* EWING, 1938

This species was originally described from *Reithrodontomys humilis impiger* (Rodentia Sigmodontidae) in U.S.A. (EWING, 1938). Later on it was recorded from other North American sigmodontids: *Reithrodontomys megalotis* and *Peromyscus leucopus* (FAIN & LUKOSCHUS, 1977).

FAIN and LUKOSCHUS (1976, 1977) established the new subgenus *Microtimyobia* for the myobiids from Arvicolinae (Rodentia Cricetidae). They included *R. subuliger* into this subgenus without redescription. However, *R. subuliger* sharply differs from all the other species of the subgenus *Microtimyobia*. Therefore BOCHKOV (1995) proposed to consider this species as a species of *incertae sedis* within the genus *Radfordia*.



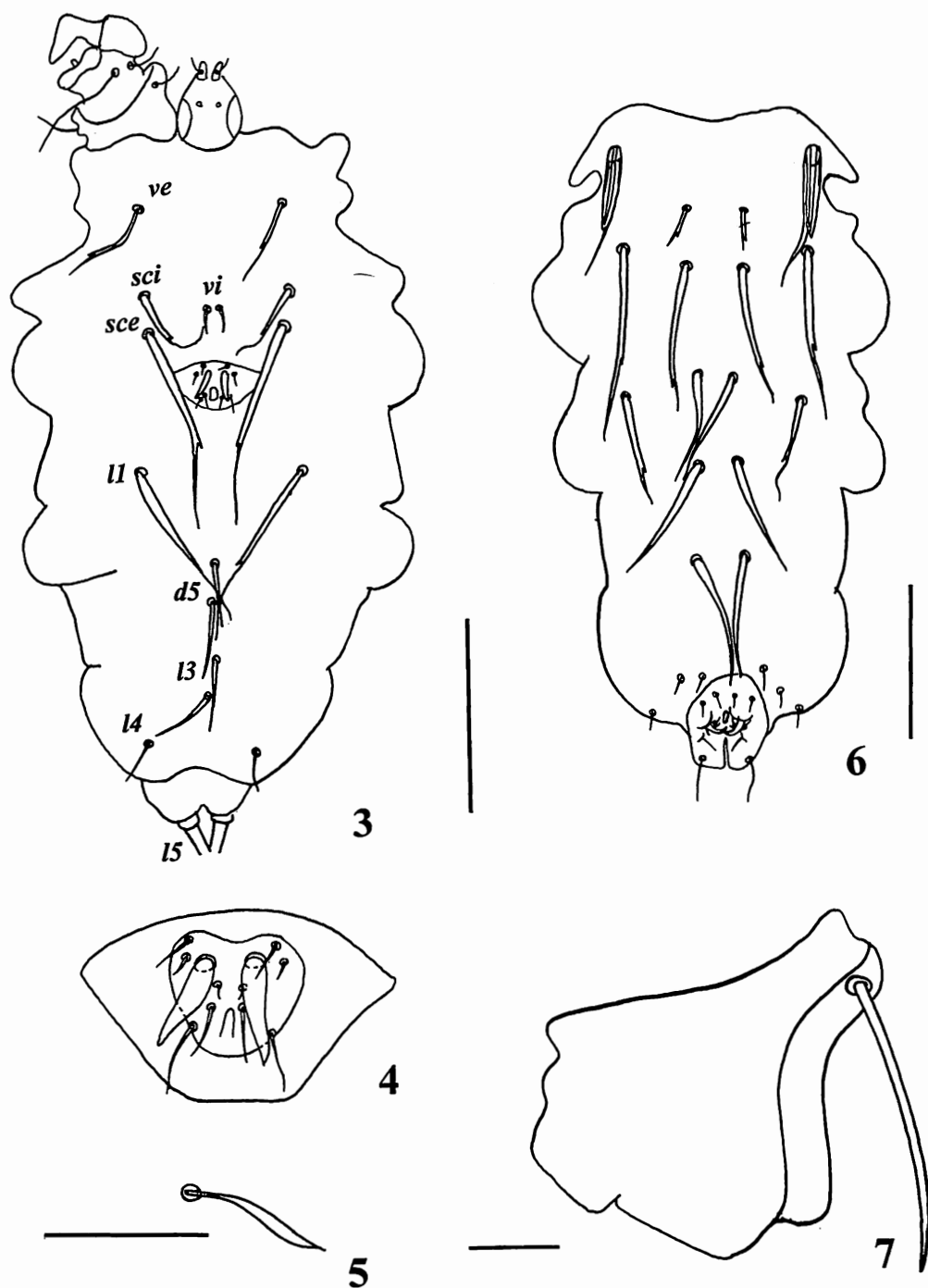
Figs 1-2. *Radfordia subuliger* EWING, 1938. Female in dorsal view (1) and ventral view (2). Scale line 100  $\mu$ m.

**FEMALE** (Figs 1, 2) : Body, including gnathosoma, 410 long and 195 wide. Gnathosomal setae *ra* (antero-ventral setae) hair-like. Setae *vi* narrowly lanceolate, about 17 long. Setae *ve* 85 long, *sci* and *sce* about 55-65 long, *d1*, *d2* and *l2* about 60 long, *l1* 45 long – all lanceolate. Setae *l3* absent. Setae *d3-d5*, and *l4* hair-like, about 8-10 long. Setae *ic1*, *ic2*, *ic3* and *ic4* 20, 50, 60 and 20 long, respectively, all hair-like. **Legs** : Inner lateral seta of trochanter I normally developed, not thickened, about 17 long. Setae of coxae I only slightly thickened. Dorsal setae of trochanters III-IV whip-like. Formula of leg II-IV chaetotaxy (solenidia given in parenthesis): II ta 7(1)-ti 6-ge 7(1)-fe 5-tr3-cx2, III 6-6-5-3-3-0, IV 6-6-5-3-3-0.

**MALE** (Figs 3, 4). Body, including gnathosoma, 400 long and 215 wide. Setae *ve* 60 long,

narrowly lanceolate. Setae *vi* hair-like and only 9 long, situated behind the level of coxae II. Setae *sci* lanceolate, 40 long, situated slightly in front of the bases of setae *sce*. Setae *sce* and *l1* lanceolate, 105 and 90 long, respectively. Setae *d4*, *l2* absent. Setae *d5*, *l3* about 40 long, thickened. Setae *l4* 15 long and only slightly thickened. Setae *ic1*, *ic2*, *ic3* and *ic4* 25, 80, 85 and 35 long, respectively. Genital shield cordiform, it bears 6 pairs of setae (Fig. 4).

**MATERIAL EXAMINED.** One female and 1 male from *Reithrodontomys megalotis*, Willow Slough, Newton Co., Indiana, U.S.A., 09. III. 1970. (Coll. J. WHITAKER). Two females and 2 males from *Peromyscus leucopus*, St. Zenon, Canada, 12. 08. 1972 (Coll. F. LUKOSCHUS). One female and 1 male from the same host species, Douglas Lake, Michigan, U.S.A.,

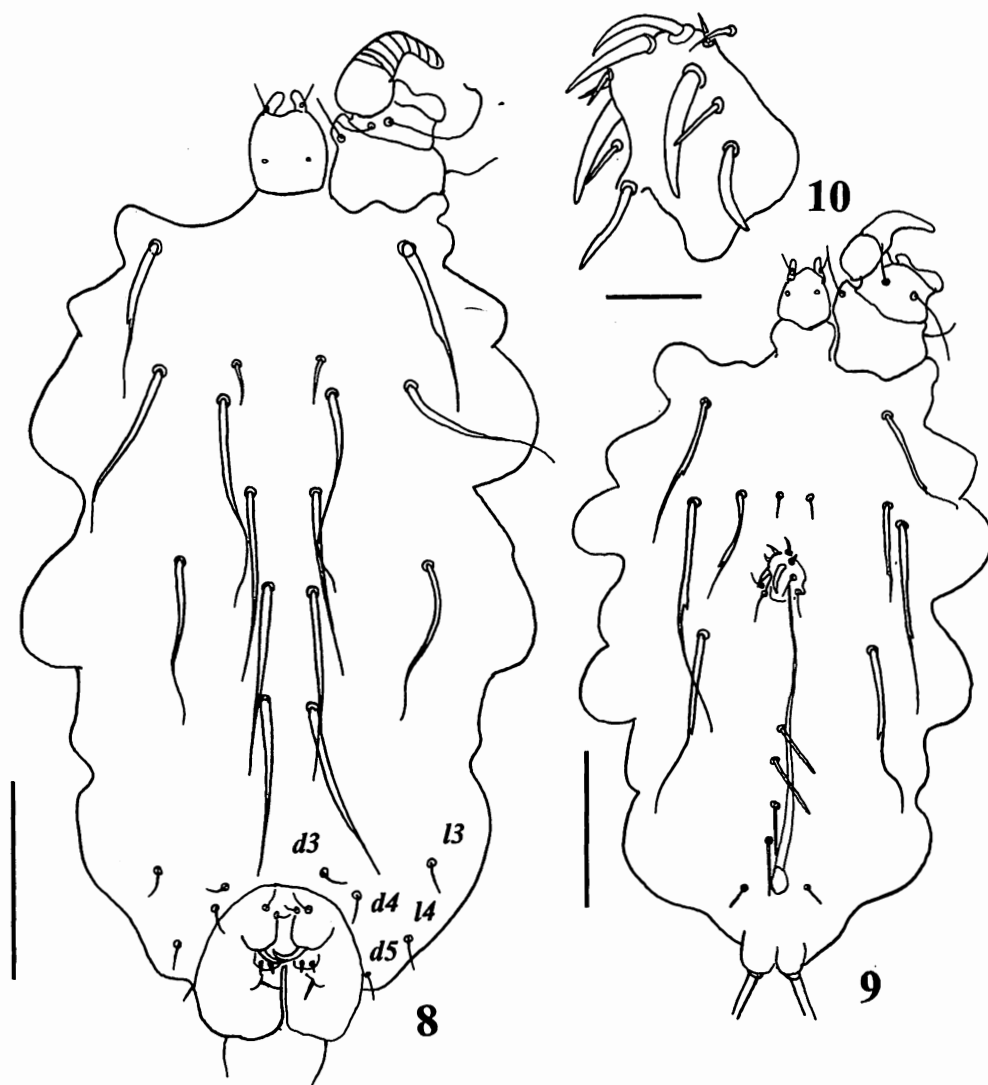


Figs 3-7. *Radfordia subuliger* EWING, 1938, male : dorsal view (3), genital shield (4). *Radfordia eremici* sp. n., female : antero-ventral seta of gnathosoma *ra* (5), dorsal view (6), trochanter I in dorsal view (7). Scale lines 100  $\mu$ m (figs 3, 6), 25  $\mu$ m (figs. 4, 5) and 10  $\mu$ m (fig. 7).

12.VII. 1967 (Coll. WRENN). Three females and 1 male from the same host species, W. Kingston, U.S.A., 18. 04. 1959 (Coll. HYLAND). One female and 1 male from *Peromyscus maniculatus osgoodi*, Frankfort, Michigan, U.S.A.

***Radfordia (Radfordia) eremici* sp.n.**

FEMALE (holotype, Figs 5-7) : Body, including gnathosoma, 420 long and 215 wide (435 long and 200 wide in paratype). Gnathosomal setae *ra* narrowly membranous. Setae *vi* narrowly lanceolate, 26 long (24). Setae *ve* 115 long, *sci* 85 long (80), *sce* 120 long (115), *d1*, *d2* and *l2* about 80-



Figs 8-10. *R. neotomae* JAMESON et WHITAKER, 1975. Female in dorsal view (8), male in dorsal view (9), genital shield of male (10). Scale lines 100  $\mu$ m (figs 8, 9) and 10  $\mu$ m (fig. 10).

90 long, *ll* 70 long (65) – all lanceolate. Setae *l3* absent. Setae *d3-d5*, and *l4* hair-like, about 15-18 long. Setae *ic1*, *ic2*, *ic3* and *ic4* 15, 85, 90 and 25 long, respectively, all hair-like. *Legs* : Inner lateral seta of trochanter I well developed, thickened, about 30 long (35). Setae of coxae I only slightly thickened. Chaetotaxy as in *R. subuliger*.

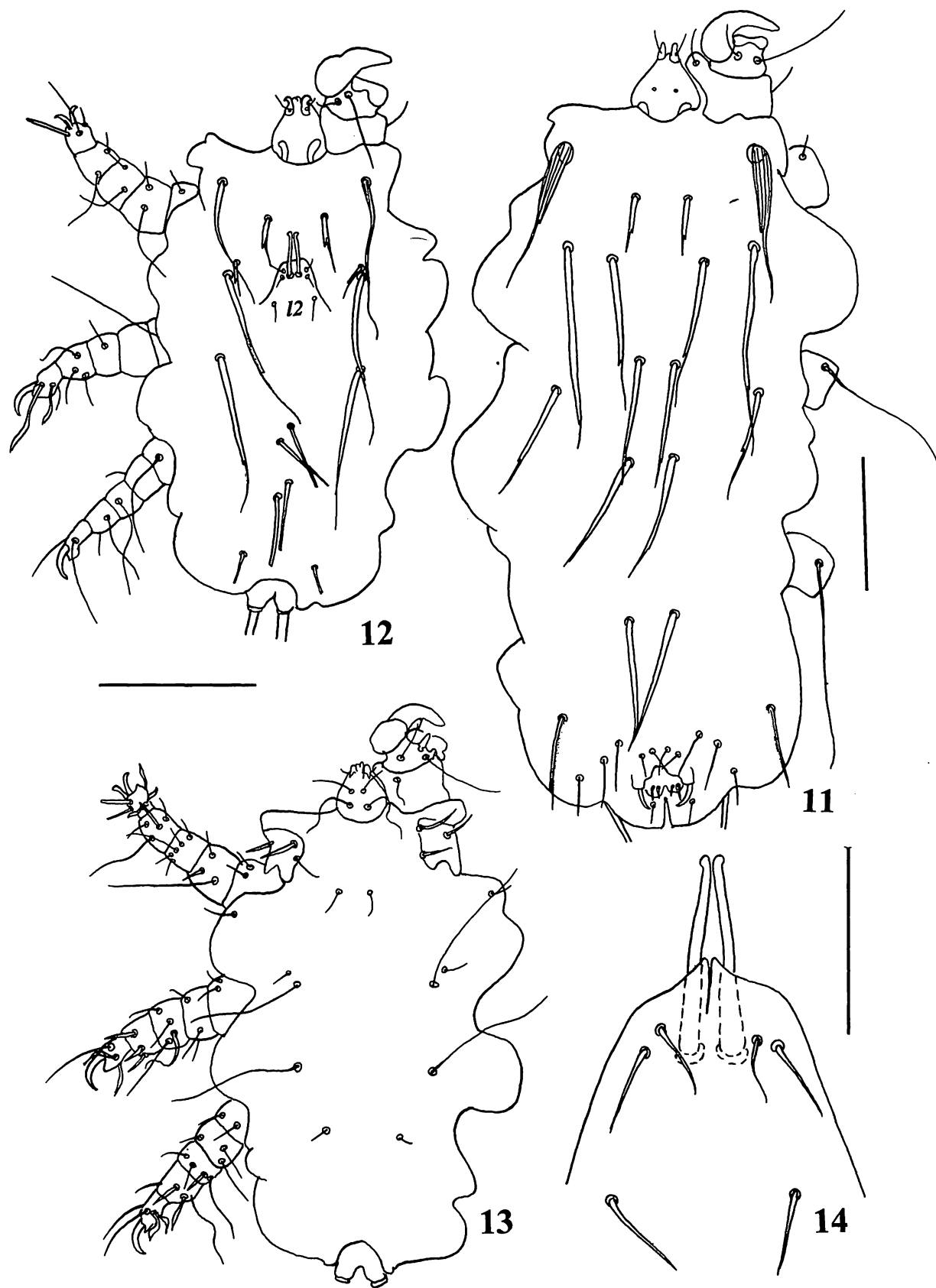
MALE. Unknown.

**DIFFERENTIAL DIAGNOSIS.** This new species is closely related to *R. subuliger* and differs by the following characters: In the female of *R. eremici* sp. n. the setae *sce* are 120 long, the setae *ra* are narrowly membranous, and the inner lateral seta of trochanter I is 30-35 long, thickened. In the female of *R. subuliger* the setae *sce* are 55-65 long, the setae *ra* are hair-like, and the inner lateral seta of trochanter I is 17 long and not thickened.

**TYPE DATA.** Female holotype and one female paratype from *Peromyscus eremicus*, Arizona, U.S.A. Other data unknown. Holotype and paratype are deposited in the Institut royal des Sciences naturelles de Belgique, Bruxelles, Belgique.

***Radfordia (Radfordia) neotomae* JAMESON et WHITAKER, 1975**

This species was described from a female ex *Neotoma fuscipes* (Rodentia Sigmodontidae) in U.S.A. (JAMESON & WHITAKER, 1975). FAIN and LUKOSCHUS (1977) included this species into the subgenus *Radfordia* s.str. Later on, BOCHKOV (1996) described the subgenus *Hesperomyobia* for myobiids associated with Sigmodontidae and *R. neotomae* was provisionally included into this subgenus. However, the study of the male of



Figs 11-14. *Radfordia ewingi* (FOX, 1937). Female in dorsal view (11), male in dorsal view (12) and ventral view (13), genital shield of male (14). Scale lines 100  $\mu$ m (figs 11-13) and 25  $\mu$ m (fig. 14).

*R. neotomae*, unknown before, has shown that its genital shield is very similar to that of *R. subuliger*. Furthermore, females of the both species are similar, excluding the absence of setae *l3* in *R. subuliger* and the absence of setae *ic3* and *ic4* in *R. neotomae*.

**FEMALE** (Fig. 8) : Body, including gnathosoma, 480 long and 250 wide. Gnathosomal setae *ra* hair-like. Setae *vi* almost hair-like, about 16 long. Setae *ve* 75 long, *sci* and *sce* about 100 and 90 long, *d1*, *d2* and *l2* about 85-90 long, *l1* 80 long – all lanceolate. Setae *d3-d5*, *l3* and *l4* hair-like, about 18 long. Setae *ic1* 17 long, *ic2* 25 long. Setae *ic3* and *ic4* absent. **Legs** : Inner lateral seta of trochanter I normally developed, not thickened, about 20 long. Setae of coxae I only slightly thickened. Dorsal setae of trochanters III-IV whip-like. Formula of leg II-IV chaetotaxy as in *R. subuliger*.

**MALE** (Figs 9, 10). Body, including gnathosoma, 430 long and 130 wide. Setae *ve* 80 long, narrow lanceolate. Setae *vi* hair-like and only 13 long, situated behind level of coxae II. Setae *sci* lanceolate, 70 long, situated anterior bases of

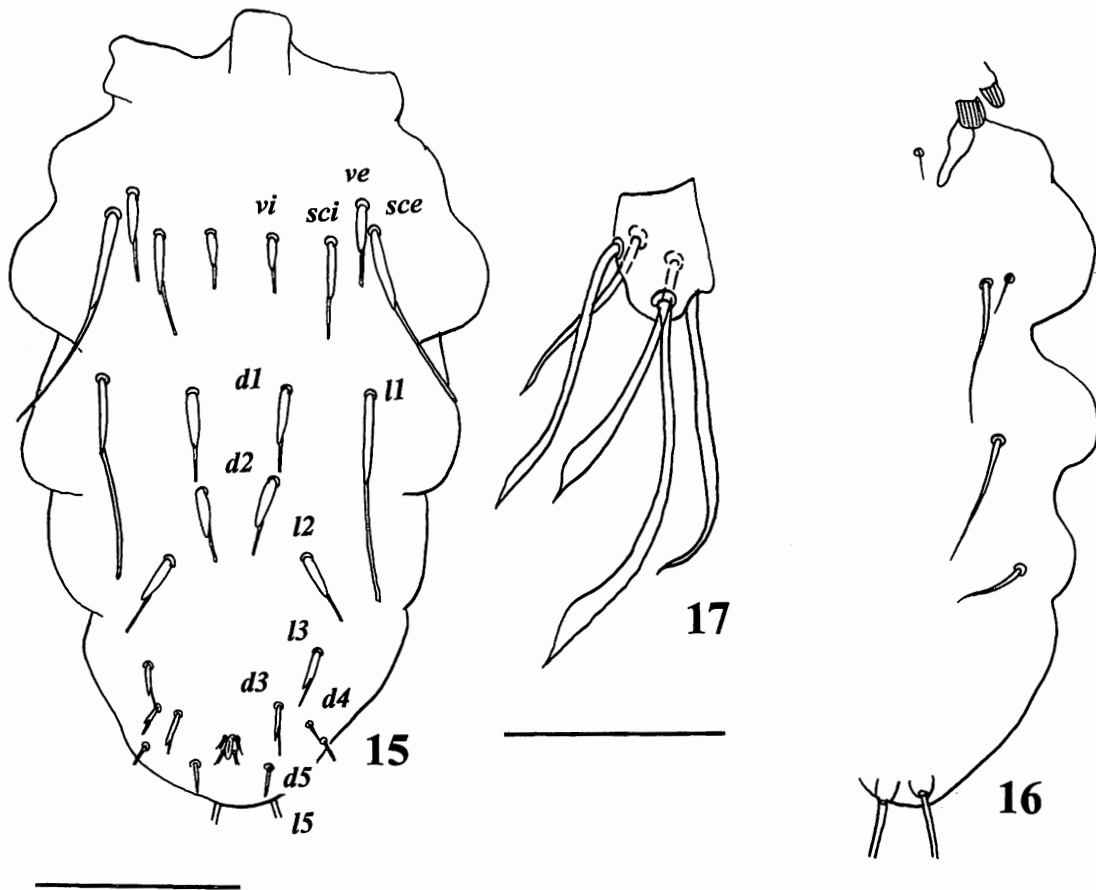
setae *sce*. Setae *sce* and *l1* lanceolate, 130 and 115 long, respectively. Setae *d4*, *l2* absent. Setae *d5* and *l3* about 35 long, thickened. Setae *l4* 13 long and only slightly thickened. Setae *ic3* and *ic4* absent. Genital shield ovoid, it bears 6 pairs of setae (Fig. 10).

**MATERIAL EXAMINED.** Four females and 4 males from *Neotoma cinerea*, Natural Area, Abbott CK., Jackson Co., Oregon, U.S.A., 13. VII. 1984. One female and 1 male from *Neotoma fuscipes*, Tiller, Douglas Co., Oregon, U.S.A., 13. X. 1984.

### Subgenus *Graphiurobia* FAIN, 1972

#### *Radfordia (Graphiurobia) ewingi* (FOX, 1937)

This species was described from *Zapus hudsonicus americanus* (Rodentia Zapodidae) in U.S.A. (FOX, 1973). FAIN and LUKOSCHUS (1977) included this species into the subgenus *Graphiurobia* without re-description. The original description was very poor and BOCHKOV (1994) proposed to consider this species as a species *incertae sedis* within the genus



Figs 15-17. *Radfordia ewingi* (FOX, 1937), tritonymph. Dorsal view (15) and ventral view (16), tarsus IV in dorsal view (17). Scale lines 100  $\mu$ m (figs 15, 16) and 25  $\mu$ m (fig. 17).

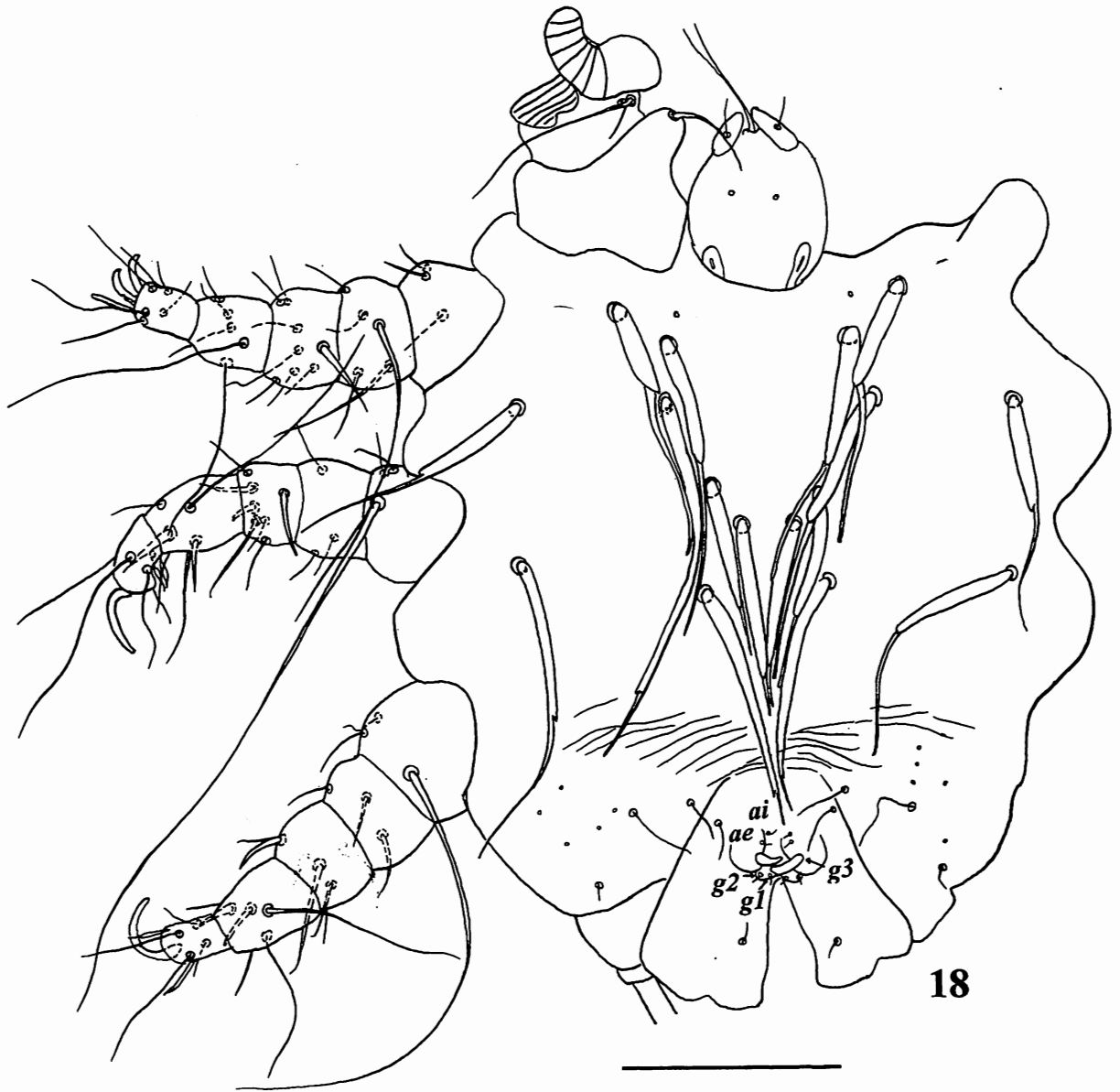


Fig. 18. *Cryptomyobia rotundata* (LAWRENCE, 1951). Female in dorsal view. Scale line 100  $\mu$ m.

*Radfordia*. New material of this species has become available during these last years and we can now redescribe this species and confirm that *R. ewingi* belongs to the subgenus *Graphiurobia*.

**FEMALE** (Fig. 11): Body, including gnathosoma, 600 long and 250 wide. Setae *vi* 15 long and 8 wide. Setae *ve*, *sci*, *sce* and *li* 60, 50, 75 and 35 long, respectively, all lanceolate. Setae *d1*, *d2* and *l2* lanceolate, about 40-45 long. Setae *l3* narrow lanceolate, 30 long. Setae *d3*, *d4* and *l4* hair-like, about 11-18 long. Setae *ic1*, *ic2*, *ic3* and *ic4* 11, 50, 60 and 7 long, respectively. Leg chaetotaxy as in the other species of the subgenus *Graphiurobia*.

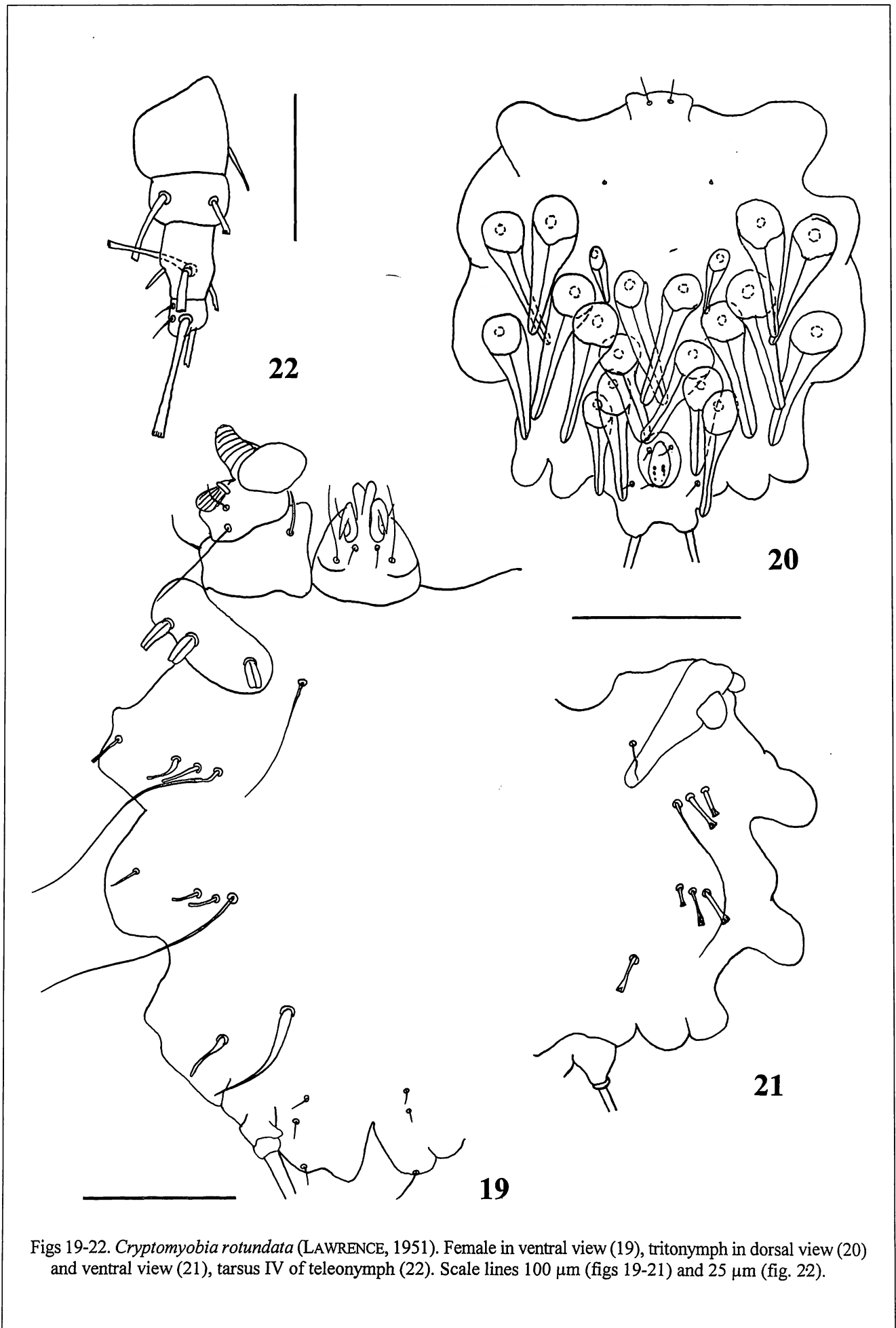
**MALE** (Figs 12-14): Body, including gnathosoma, 365 long and 235 wide. Setae *vi*, *ve*, *sci*, *sce* and *li* 35, 115, 20, 125 and 90 long, respec-

tively, all narrowly lanceolate. Setae *l2* hair-like, 17 long. Setae *d4* absent. Setae *d5* and *l4* about 60 long, thickened. Setae *l4* hair-like, 20 long. Setae *ic1*, *ic2*, *ic3* and *ic4* 15, 80, 90 and 10 long, respectively. Genital shield with 3 pair of setae, 2 pairs of hair-like and 1 pair of strong, finger-like (Fig. 14).

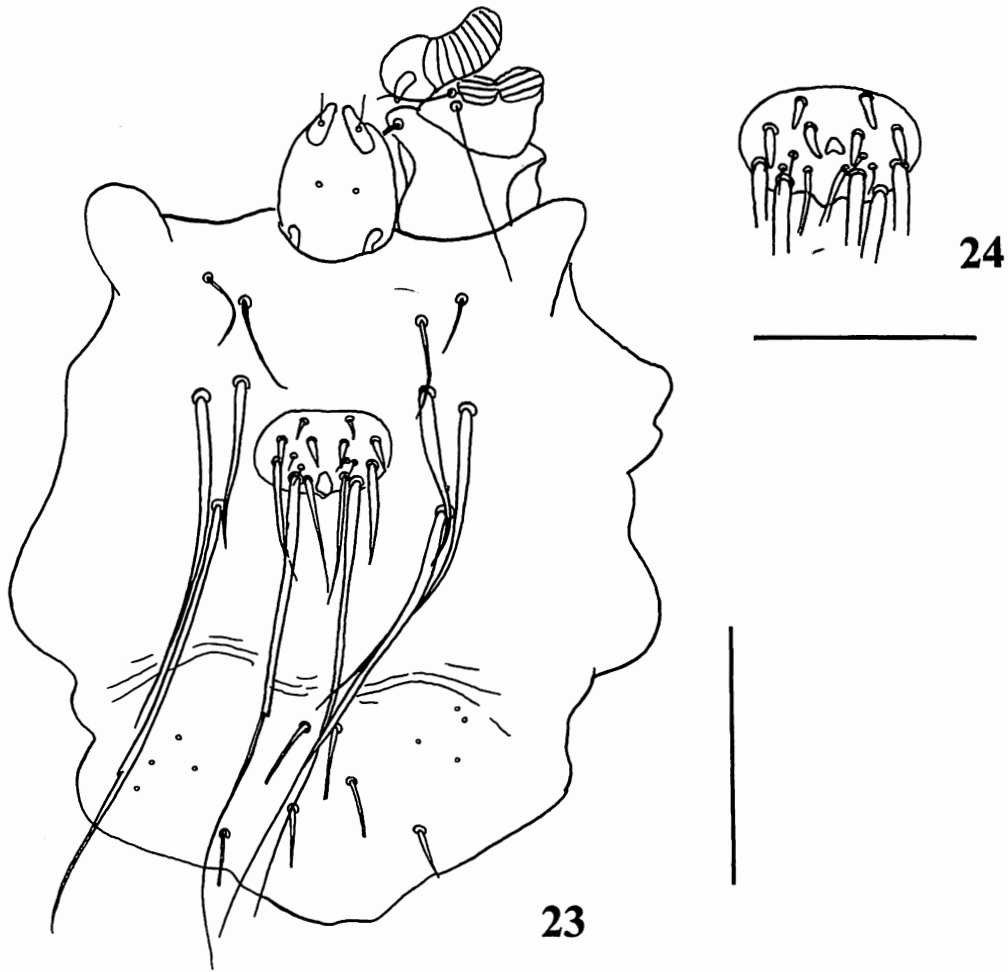
**TRITONYMPH** (Figs 15-17): Length of setae: *vi* 33, *ve* 60, *sci* 65, *sce* 115, *d1* 60, *d2* 55, *d3* 20, *d4* 18, *d5* 17, *li* 115, *l2* 55, *l3* 40, *l4* 17. Anal region with 2 pairs of well developed setae. Setae *ic1*, *ic2*, *ic3* and *ic4* 10, 60, 65 and 15 long, respectively. Tarsi IV normally developed, without claw and protrusion, bearing 5 setae. Coxae I with 2 setae, coxa II with one seta.

**MATERIAL EXAMINED.** One female and 11 tritonymphs from *Zapus hudsonicus*, Rhode Island,





Figs 19-22. *Cryptomyobia rotundata* (LAWRENCE, 1951). Female in ventral view (19), tritonymph in dorsal view (20) and ventral view (21), tarsus IV of teleonymph (22). Scale lines 100  $\mu$ m (figs 19-21) and 25  $\mu$ m (fig. 22).



Figs 23-24. *Cryptomyobia rotundata* (LAWRENCE, 1951), male. Dorsal view (23), genital shield (24). Scale lines 100  $\mu\text{m}$  (fig. 23) and 25  $\mu\text{m}$  (fig. 24).

U.S.A., 05. X. 1968 (Coll. A. FAIN). One female and 1 male from the same host species, Sudbury, Canada, 26. V. 1970 (Coll. LUKOSCHUS). One male and 2 tritonymphs from *Zapus princeps*, Pikes Peak, Colorado, U.S.A., 01. IX. 1932.

**Genus *Cryptomyobia* RADFORD, 1954**

**Subgenus *Cryptomyobia* s.str.**

***Cryptomyobia rotundata* (LAWRENCE, 1951)**

This species was described from *Cryptomys hottentotus* (Rodentia Bathyergidae) in South Africa (LAWRENCE, 1951). Later on, the female was redescribed by ZUMPT & COFFEE (1971).

We redescribe here this species from the female, the male and the tritonymph.

**FEMALE** (Figs 18, 19): Body, including gnathosoma, 395 long and 315 wide. Setae *vi*, *ve*, *sci*, *sce*, *d1*, *d2*, *l1* and *l2* 130, 115, 150, 85, 80, 90, 125 and 110 long, respectively, all lanceolate. Bases of setae *vi* and *ve* close to each other.

Setae *sce* situated far from *sci*. Setae *d3*, *d4*, *l3* and *l4* 40, 25, 28 and 10 long, respectively, all hair-like. Setae *ic1*, *ic2*, *ic3* and *l4* 45, 100, 110 and 60 long, respectively. Setae *ic1-ic3* hair-like, setae *ic4* strongly thickened. All coxal setae finger-like except hair-like *cx III-3*. Dorsal setae of trochanters III-IV whip-like. Formula of leg II-IV chaetotaxy (solenidia given in parenthesis): II ta 7(1)-ti 6-ge 7(1)-fe 5-tr3-cx3, III 6-6-7-3-3-3, IV 6-6-5-3-3-1.

**MALE** (Figs. 23, 24). Body, including gnathosoma, 325 long and 250 wide. Setae *vi* and *ve* 40 and 25 long, respectively, almost hair-like. Setae *sci*, *sce* and *l1* 60, 150 and 230 long, respectively, all lanceolate. Setae *d4* and *l2* absent. Setae *d5*, *l3* and *l4* 35, 30 and 20 long, respectively, all thickened. Genital shield ellipsoidal, bearing 8 pairs of setae, setae *d3* 215 long (Fig. 24). Ventral and legs chaetotaxy as in female, but setae *cxIV-1* hair-like.

**TRITONYMPH** (Figs. 20-22). Setae *vi*, *ve*, *sce*, *d1- d3* and *l1-13* about 65-80 long, all foliate,

with maximal width about 27. Setae *sci* 30 long, narrowly foliate. Setae *d4* and *l4* about 6 long, hair-like. Setae *d5* and anal setae absent. Setae *ic1* 25 long, *ic2* 100 long, all hair-like. Setae *ic3* and *ic4* finger-like. All setae coxae II-III finger-like. Tarsi IV normally developed, bearing 4 setae, without claw and protrusion.

MATERIAL EXAMINED. Three females and one male from *Cryptomys hottentotus*, Zovo, Angola, 15. VIII. 1962 (Coll. MACHADO). One female and 3 tritonymphs from the same host species, Town Bush, Pietermaritzburg, III. 1951 (Coll. ZUMPT).

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#### References

- BOCHKOV A.V., 1994. - Mites of the subgenus *Graphiurobia*, genus *Radfordia* (Myobiidae) of the fauna of Russia and adjacent countries. *Parasitologiya*, 28 : 421-428. (In Russian with English summary).
- BOCHKOV A.V., 1995. - Mites of the subgenus *Microtimyobia* (Acariformes: Myobiidae: *Radfordia*) of the fauna of Russia and adjacent countries. *Parasitologiya*, 29 : 480-492. (In Russian with English summary).
- BOCHKOV A.V., 1996. - *Hesperomyobia* (Acari: Myobiidae: *Radfordia*), a new subgenus of myobiid mites from rodents of the family Hesperomyidae (Rodentia). *Acarina*, 4 : 39-42.
- BOCHKOV A.V., 1997. - New classification of mites of the genus *Radfordia* (Acariformes: Myobiidae). *Entomologicheskoe Obozrenie*, 76 : 684-704. (In Russian with English summary)
- BOCHKOV A.V., 1999. - Classification and host-parasite relations of mites of the subfamily Myobiinae (Acariformes, Myobiidae). *Entomological Review*, 79 : 666-675.
- FAIN A., 1973. - Notes sur la nomenclature des poils idiosomaux chez les Myobiidae avec description de taxa nouveaux (Acarina: Trombidiformes). *Acarologia*, 15 : 279-309.
- FAIN A. & LUKOSCHUS F.S., 1976. - Observations sur les Myobiidae d'Insectivores avec description de taxa nouveaux (Acarina : Prostigmates). *Acta Zoologica et Pathologica Antverpiensia*, 66 : 121-188.
- FAIN A. & LUKOSCHUS F.S., 1977. - Nouvelles observations sur les Myobiidae parasites de rongeurs (Acarina: Prostigmates). *Acta Zoologica et Pathologica Antverpiensia*, 69 : 11-98.
- FOX I., 1937. - A new cheyletid mite (Acarina) parasitic on the Carolina jumping mouse *Zapus hudsonicus americanus* (BARTON). *Proceedings of the Entomological Society of Washington*, 39 : 227-230.
- LAWRENCE R.F., 1951. - New fur-mites from South African mammals. *Annals of the Natal Museum*, 12 : 91-133.
- JAMESON E.W. & WHITAKER J.O., 1975. - Three new species of *Radfordia* (Myobiidae: Acarina) from rodents (Muridae and Cricetidae). *Journal of Medical Entomology*, 12 : 341-344.
- ZUMPT F. & COFFEE G., 1971. - The genus *Radfordia* in the Ethiopian Region, with descriptions of two new species (Acarina: Trombidiformes, Myobiidae). *Annals of Natal Museum*, 21 : 97-105.