BULLETIN DE L'INSTITUT ROYAL DES SCIENCES NATURELLES DE BELGIQUE, ENTOMOLOGIE, 57: 111-120, 1987
BULLETIN VAN HET KONINKLIJK BELGISCH INSTITUUT VOOR NATUURWETENSCHAPPEN, ENTOMOLOGIE, 57: 111-120, 1987

Observations on the hypopi of the genus *Forcellinia* OUDEMANS, 1924 (Acari, Acaridae)

by A. FAIN

Summary

The hypopus of *Forcellinia wasmanni* (MONIEZ, 1892) (Acari, Acaridae) is redescribed from specimens collected by WASMANN. The hypopus of *Forcellinia galleriella* WOMERSLEY, 1963 is described for the first time from *Iridomyrmex humilis,* in Australia. A key is given to the hypopi of the *Forcellinia*-type. This type of hypopus is produced in three different genera of Acaridae.
Key-words: Taxonomy, Acari, Acaridae.

Résumé

L'hypope de *Forcellinia wasmanni* (MONIEZ, 1892) (Acari, Acaridae) est redécrit d'après des spécimens récoltés par WASMANN. L'hypope de *F. galleriella* WOMERSLEY, 1963 est décrit, pour la première fois, d'*Iridomyrmex humilis,* d'Australie. Une clé est donnée des hypopes du type «*Forcellinia*». Ce type d'hypope est produit dans trois genres différents d'Acaridae.
Mots-clefs: Taxinomie, Acari, Acaridae.

Introduction

Recent investigations on the life cycle of glycyphagid mites have shown that different genera (based on adult stages) produce the same morphological type of hypopus (heteromorphic deutonymph) during their development. Similar observations have been made for other families of Astigmata, e.g. the Acaridae and the Hemisarcoptidae.
In the Glycyphagidae a good example is that of the hypopus of the *Dermacarus*-type. This phenotype is involved in the life-cycle of four genera (*Dermacarus* HALLER, 1880, *Lepidoglyphus* ZACHVATKIN, 1936, *Glycyphagus* HERING, 1838 and *Zibethacarus* RUPES and WHITAKER, 1968) and of two subgenera of *Glycyphagus (Myacarus* ZACHVATKIN, 1941 and *Zapodacarus* FAIN *et al.,* 1985) (see FAIN and LUKOSCHUS, 1974, FAIN and PHILIPS, 1981 and FAIN and SPICKA, 1986).
In the Acaridae the hypopi of the genus *Sancassania* OUDEMANS, 1916 (? = *Caloglyphus* BERLESE, 1923) are morphologically almost identical with those of *Rhizoglyphus* CLAPARÈDE, 1869. They differ only by the presence in *Sancassania* of an additional seta (seta *aa*) in the basal half of the tarsus I, which is absent in *Rhizoglyphys* (see FAIN, 1977). Moreover, the hypopi described so far in the genus *Schwiebea* are not separable, at the genus level from those of the genus *Rhizoglyphus.*
ZACHVATKIN (1941), has shown that *Mycetoglyphus fungivorus* OUDEMANS, 1932 produces hypopi which are hardly separable from those of *Forcellinia wasmanni.*
Another genus and species, *Tyrophagus formicetorum* VOLGIN, 1948 also produces hypopi that belong to the same phenotype as those of *Forcellinia wasmanni* (see FAIN and CHMIELEWSKI, 1987).
In the Hemisarcoptidae the hypopi of the genera *Hemisarcoptes* LIGNIÈRES, 1893, *Nanacarus* OUDEMANS, 1902, *Congovidia* FAIN and ELSEN, 1971 and *Congovidiella* FAIN and ELSEN, 1971 belong to the same general morphological type and are difficult to distinguish from each other.
These observations show that in these families it is generally very difficult or impossible, in the absence of adult stages, to recognize with certainty the genus to which an hypopus belongs. In order to prevent confusion we believe that in the description of a new hypopial form and, as long the corresponding adults are unknown, the hypopus should be named after the hypopial group to which it belongs (e.g. *Dermacarus*-type, *Forcellinia*-type, etc...) and should not be included in a genus (e.g. *Glycyphagus, Lepidoglyphus, Zibethacarus,* etc...) to which it is believed to belong (FAIN and SPICKA, 1986).
In this paper we redescribe the hypopus of *Forcellinia wasmanni* and we describe for the first time the hypopus of *Forcellinia galleriella* WOMERSLEY, 1963, found on an ant, *Iridomyrmex humilis* in Western Australia.
The hypopus of *F. wasmanni* described herein belongs to the MICHAEL collection deposited in the British Museum (Natural History), London. It had been sent, with a lot of other specimens including adults, by WASMANN to MICHAEL, and had been found in the same habitat and locality as the typical series examined by MONIEZ. No specimens of the typical series

described by MONIEZ are left in the National Museum d'Histoire naturelle de Paris or in the University of Lille where MONIEZ had worked. We may therefore consider that the types are lost.
All the measurements used herein are in microns (μm).

Critical review of the literature

MONIEZ, in 1892, described but without figures, a new species of mite, *Tyroglyphus wasmanni,* represented by both adults and hypopi, the latter being very small (145 long). The mites had been collected by WASMANN in an artificial nest of *Camponotus ligniperdus,* in Prague. The mites were mixed with an enormous number (thousands) of larger hypopi (250 long) that the author assumed to belong to *Tyroglyphus krameri* BERLESE, 1881. In the same paper MONIEZ recorded the presence of these hypopi (*T. wasmanni* and *T. krameri*) in artificial nests of *Formica fusca* in Holland and *Formica sanguinea* in Prague, as well as in natural nests of *Lasius fuliginosus* in Exaeten, Holland.
WASMANN (1897) had sent the same material to MICHAEL who succeeded in rearing *T. wasmanni,* obtaining all the stages of its life cycle, including hypopi. MICHAEL (1903) showed that the small hypopi described by MONIEZ as being those of *T. wasmanni* belonged actually to an anoetid mite, *Histiostoma feroniarum* (= *H. rostroserratum*) whilst the larger hypopi thought to be *T. krameri* represented the true *T. wasmanni.* MICHAEL published the first figures (plate 38) of the adults and of the hypopus of that species. The figure of the hypopus shows all the main characters actually recognized for the genus *Forcellinia* (long sternum, anterior situation of the lateral conoids of the suctorial plate, conoidal aspect of setae *cx I, cx III* and *gp*) except for a few characters inadequately depicted such as the aspect of the *gp* conoid (not simple but bilobate) and the aspect of the tarsal setae.
OUDEMANS (1917), described *Tyroglyphus vandergooti* a new species from an ant in Salatiga (Java). He correctly described and depicted (figures not published) the characteristic bilobate aspect of the setae *gp,* as well as the long sternum and the anterior position of the lateral conoids, all characters shared with *T. wasmanni.*
In 1924, OUDEMANS created the genus *Forcellinia* for *Tyroglyphus wasmanni* and in 1927 he erected for this genus the new family Forcelliniidae.
ZACHVATKIN, 1941, described the hypopus of *Mycetoglyphus fungivorus* OUDEMANS, 1932 from specimens found by him and he synonymized the genus *Mycetoglyphus* OUDEMANS, 1932, with *Forcellinia.*
According to TÜRK and TÜRK (1957) *Mycetoglyphus* is a synonym of *Tyrophagus* OUDEMANS, 1924 and the hypopus (not the adults) described as *Forcellinia fungivora* by ZACHVATKIN could be that of *F. wasmanni.* Moreover these authors assume that the hypopus of *T. fungivoris* is stil unknown.
HUGHES, 1976 agreed that *Mycetoglyphus* is a valid genus and has a hypopus of the *Forcellinia*-type.
Recently, FAIN and CHMIELEWSKI (1987) showed that *Tyrophagus formicetorum* VOLGIN, 1948 also produces hypopi of the *Forcellinia*-type.
The genus *Forcellinia* contains now 15 apparently valid species. Amongst them only 3 are represented by both adults and hypopi (*F. wasmanni, F. fuliginosi* and *F. galleriella*), 3 are represented only by adults (*F. diamesa* ZACHVATKIN, 1941, *F. breviseta* VOLGIN and DZHUMAEV, 1972 and *F. turkmenica* VOLGIN and DZHUMAEV, 1972), and 9 only by hypopi. It is possible that some of the latter actually belong to other genera (*Tyrophagus, Mycetoglyphus,* etc...). Almost all these species were found in nests of ants or their hypopi fixed to the ants.

General characters of the hypopi of the *Forcellinia*-type

These hypopi are characterized as follows:
1. Dorsum strongly convex. Anterior and lateral margins not specially thin or wide and resembling more the *Sancassania* or *Rhizoglyphus* types than the *Cosmoglyphus* or *Garsaultia*-types.
2. Sternum as long as the epimera II.
3. Coxae I and II not extending behind the posterior limits of sternum or epimera II. Coxae III and IV separate in the midline.
4. Setae *cx I* and *cx III* are simple conoids; setae *gp* are bilobate conoids.
5. Suctorial plate well developed with the lateral conoids situated far in front of the posterior suckers.
6. Tarsi I-IV with 9-9-8-8 or 7-7-8-8 setae. A saucerlike seta is present on tarsus I and is inconstant on tarsus II.

Hypopi of the *Forcellinia*-type have been observed in the following genera or species:
1. Genus *Tyrophagus*: only in *T. formicetorum.*
2. Genus *Mycetoglyphus*: only in *M. fungivorus.*
3. Genus *Forcellinia* (syn. *Dorylacarus* MAHUNKA, 1979, syn. nov.): see in the key.

We think that *F. juvenalii* and *F. fraudulenta* described by SEVASTIANOV (1968) do not belong to *Forcellinia* because in these species the setae *cx I* (and in one species also the setae *cx III*) are simple (not conoids) and the conoids *gp* are not bilobate. Another species, *F. rufae* TÜRK and TÜRK, 1957, with a short sternum and widely separate epimera III does not belong to *Forcellinia.*
The genus *Dorylacarus* MAHUNKA, 1972 known from hypopi is not separable from *Forcellinia.* Another

genus based only on adults, *Hungaroglyphus* MAHUNKA, 1962 should be a synonym of *Forcellinia,* and its type species (*H. samsinaki,* 1962) is close to *F. fuliginosi* TÜRK and TÜRK, 1957.

Key to the hypopi of the *Forcellinia*-type

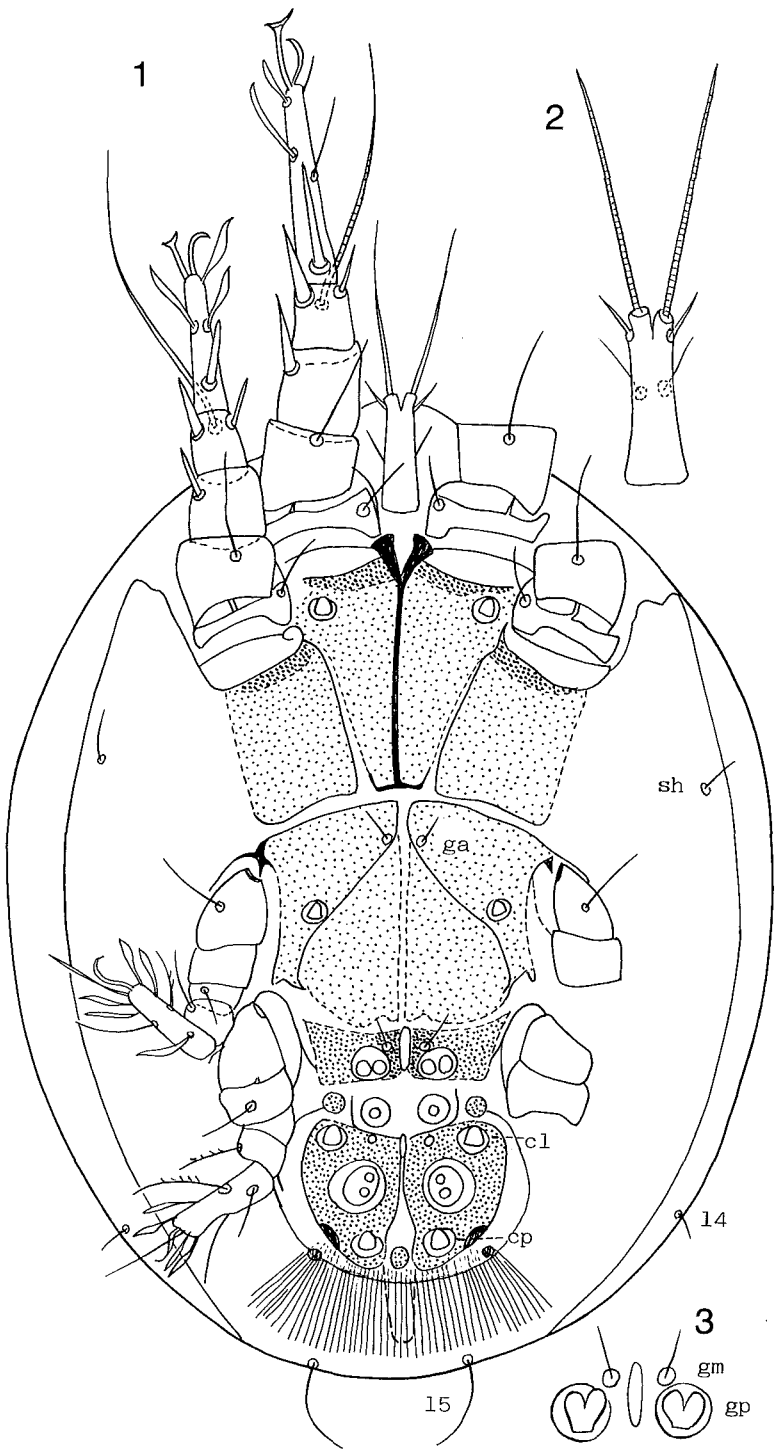
(Remark: The hypopus of *Mycetoglyphus fungivorus* OUD. described by ZACHVATKIN is not included in this key. It appears very close to the hypopus of *F. wasmanni.*)

1. All the dorsal setae very thin and very short . 2.
   Some or all dorsal setae are long . . . 5.
2. Palposoma as long as wide, with its base strongly dilated and twice as wide as the palps.
   From ants: *Labidus coecus* (Costa Rica)
   . . . *Forcellinia laesionis* MAHUNKA, 1979
   Palposoma either rectangular or with its base much les enlarged . . . . . 3.
3. The cuticle behind the suctorial plate with long longitudinal or oblique striations.
   From various ants: *Camponotus ligniperdus, Formica spp, Lasius fuliginosus* (Europe) . . . . . .
   . . . *Forcellinia wasmanni* (MONIEZ, 1892)
   The cuticle behind the suctorial plate not striated . . . . . 4.
4. Dorsal cuticle with a distinct pattern of very small pale spots. Tarsi I-II with 7 setae (the *p* and *q* lacking). Coxae I-III only partly punctate, coxae IV completely punctate. Palposoma 1.5 times longer than wide, with base slightly wider than the palps. Ratio length: width of body 1.24 to 1.3.
   From ants: *Iridomyrmex humilis* (Australia) . . . . . .
   . . *Forcellinia galleriella* WOMERSLEY, 1963
   Dorsal cuticle without pattern. Tarsi I-II with 9 setae. Palposoma rectangular, slightly longer than wide. Ratio length: width of body 1.4.
   From ants: *Lasius fuliginosus* (Germany)
   . . *Forcellinia fuliginosi* TÜRK and TÜRK, 1957
5. Setae *d1* as long as the hysteronotum.
   From ants: *Eciton burchelli* (Costa Rica) and *E. mexicanum* (Ecuador) . . .
   Forcellinia mystax (MAHUNKA, 1978) comb. nov.
   Setae *d1* mich shorter than hysteronotum . 6.
6. All the dorsal setae long and flagelliform. Cuticle behind suctorial plate with longitudinal striations.
   From the soil (Greece) . . . . .
   . . . *Forcellinia flagellifera* MAHUNKA, 1972
   Either with only the hysteronotal setae long and flagilliform, or all dorsal setae shorter. Cuticle behind suctorial plate either striated or not . . . . . 7.
7. Propodonotal setae very short and thin, hysteronodal setae long, thin and flagelliform. Palposoma long and narrow. Cuticle behind suctorial plate with longitudinal striations.
   From ants: *Plagiolepis longipes* and *Dolichoderus bituberculatus* (Java) . .
   . . *Forcellinia vandergooti* (OUDEMANS, 1917) comb. nov.
   From the soil (Maurice Is.) . . .
   . . . *Forcellinia hauseri* MAHUNKA, 1978
   Propodonotal setae either equal or slightly unequal to the hysteronotal setae. Striation behind the suctorial plate and palposoma variable . . . 8.
8. Cuticle behind suctorial plate with longitudinal striations. Body widened anteriorly and more or less triangular in shape. All dorsal setae smooth, the setae *d1* and *d2* about twice as long (18 to 20) as *sc i, sc e, d3* and *d4* (10 to 12).
   From ants: *Formica rufa* (SSSR and Poland) . . . . . .
   . . *Tyrophagus formicetorum* VOLGIN, 1948
   Cuticle behind sectorial plate not striated. Body not triangular. Dorsal setae not as above . . . . . 9.
9. Dorsal setae smooth, the setae *sc i, sc e, l3* and *l4* three or four times as long as *d1* and *d2.*
   From ants: *Eciton rapax* and *E. lucanoides* (Ecuador) . . . . . .
   . . . *Forcellinia bipunctata* MAHUNKA, 1978
   Dorsal setae barbed. Setae *sc i* and *sc e* either subequal to or shorter than *d1* and *d2* . . . . . 10.
10. Setae *d1-d5* equal or subequal to *l1 - l4* and modified (dilated in their middle third and at apex and with apical part curved and barbed).
    From beetles (Ghana) . . . . .
    . . *Forcellinia macromastix* MAHUNKA, 1973
    Dorsal setae not dilated in middle part or at apex and not curved. Setae *d2* to *d4* and *l2* longer and thicker than *l1, l2, h, l4* and *l5.*
    From ants: *Labidus praedator* and *Nomomyrmex esenbecki* (Costa Rica)
    Forcellinia rugosa (MAHUNKA, 1979) comb. nov.

Description of the species

Forcellinia wasmanni (MONIEZ, 1892)

We redescribe herein the hypopus of *F. wasmanni*



Figs. 1-3. Forcellinia wasmanni *(MONIEZ, 1892): Hypopus in ventral view (1); palposoma (2); genital area (3) (Specimen from the Michael collection) (cp = posterior conoid; cl = lateral conoid).*

from specimens of the MICHAEL collection conserved in the British Museum (see above).

Hypopus (Figs. 1-4; 8-12):
Length and width of 7 specimens: 235 × 180; 240 × 192; 249 × 190; 255 × 195; 256 × 201; 264 × 200; 265 × 190. Dorsum strongly convex. Body extending slightly over the basal segments of legs I-II and almost completely over the palposoma. Legs relatively long. Sternum long arriving posteriorly at the same level as epimera II. Coxal fields I and II not extending behind these epimera. Coxal fields III and IV separated in the midline. Setae *cx I, cx III* and *gp* are conoids, the *gp* being bilobate. Lateral conoids of suctorial plate in front of the posterior suckers. Cuticle behind the suctorial plate longitudinally striated. Dorsal setae

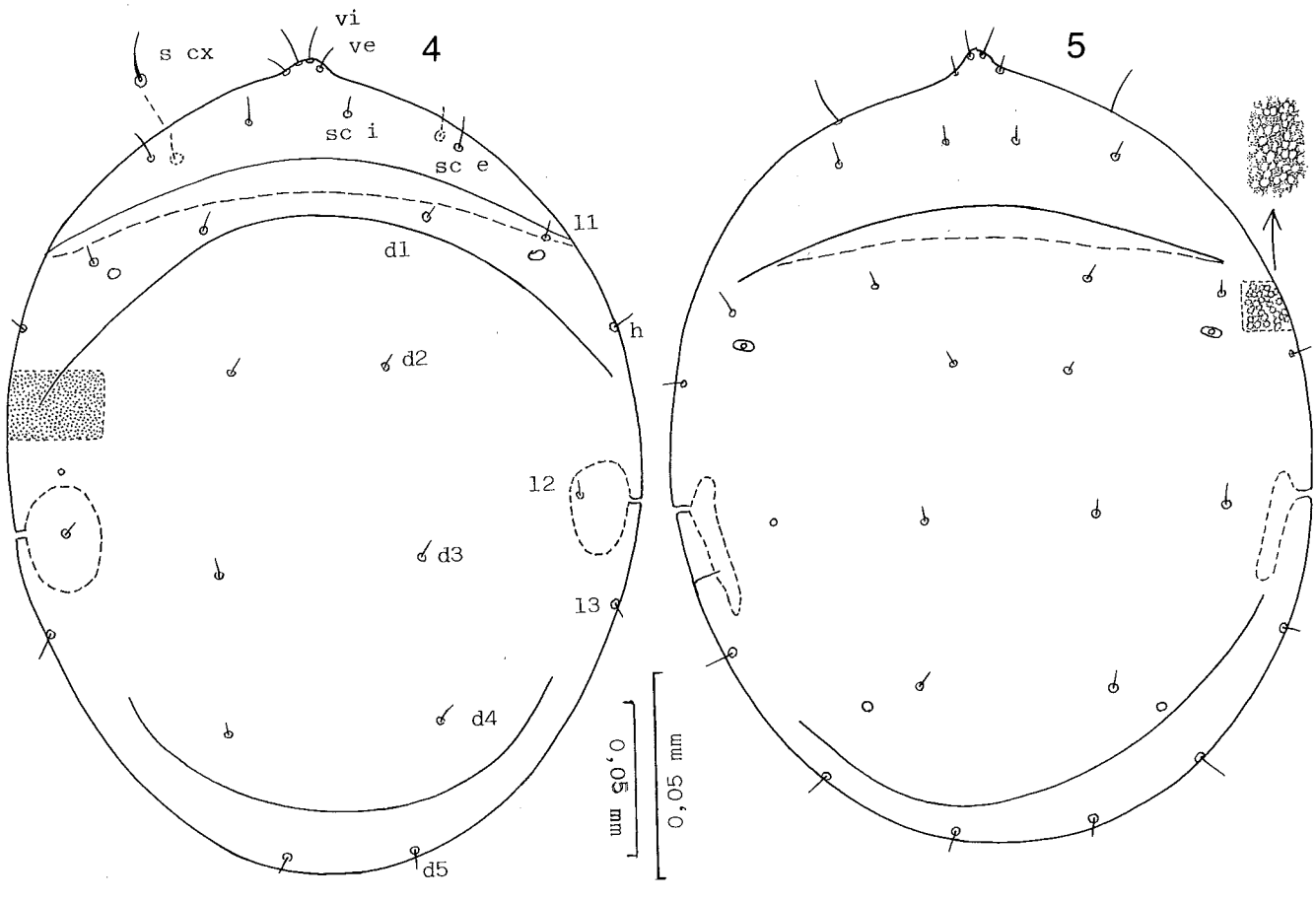
very short, the *s cx* short covered by the body. Length of the tarsi: 49-36-21-23. Leg chaetotaxy: Tarsi 9-9-8-8-, Tibiae 2-2-1-1, Genua 2-2-1-0, Femora 1-1-0-1. Tarsi I with apically a strong dorsal saucer like seta, 1 short and thin seta and 1 longer foliate seta, ventrally 1 thin and short and 1 longer foliate setae; median third with 2 ventral foliate setae; basal third with one strong and long ventral spine and one thin and long dorsal seta (*aa*). Tarsus II as tarsus I but seta *aa* (dorso-basal) is missing but the *ba* (dorsomedian) is present (Figs. 8-10). Tarsus III with 8 setae (5 foliate, one slightly barbed, one simple and one apical slightly membranous). Tarsus IV with 8 setae (4 foliate, 3 simple and 1 barbed). Solenidia: *ω1* (I) is basal with the apex bulbous; *ω3* (I), close to *ω1* is long and thin; *ω2* is thin and relatively very long. Tibias I-II with 2 thick unequal spines.

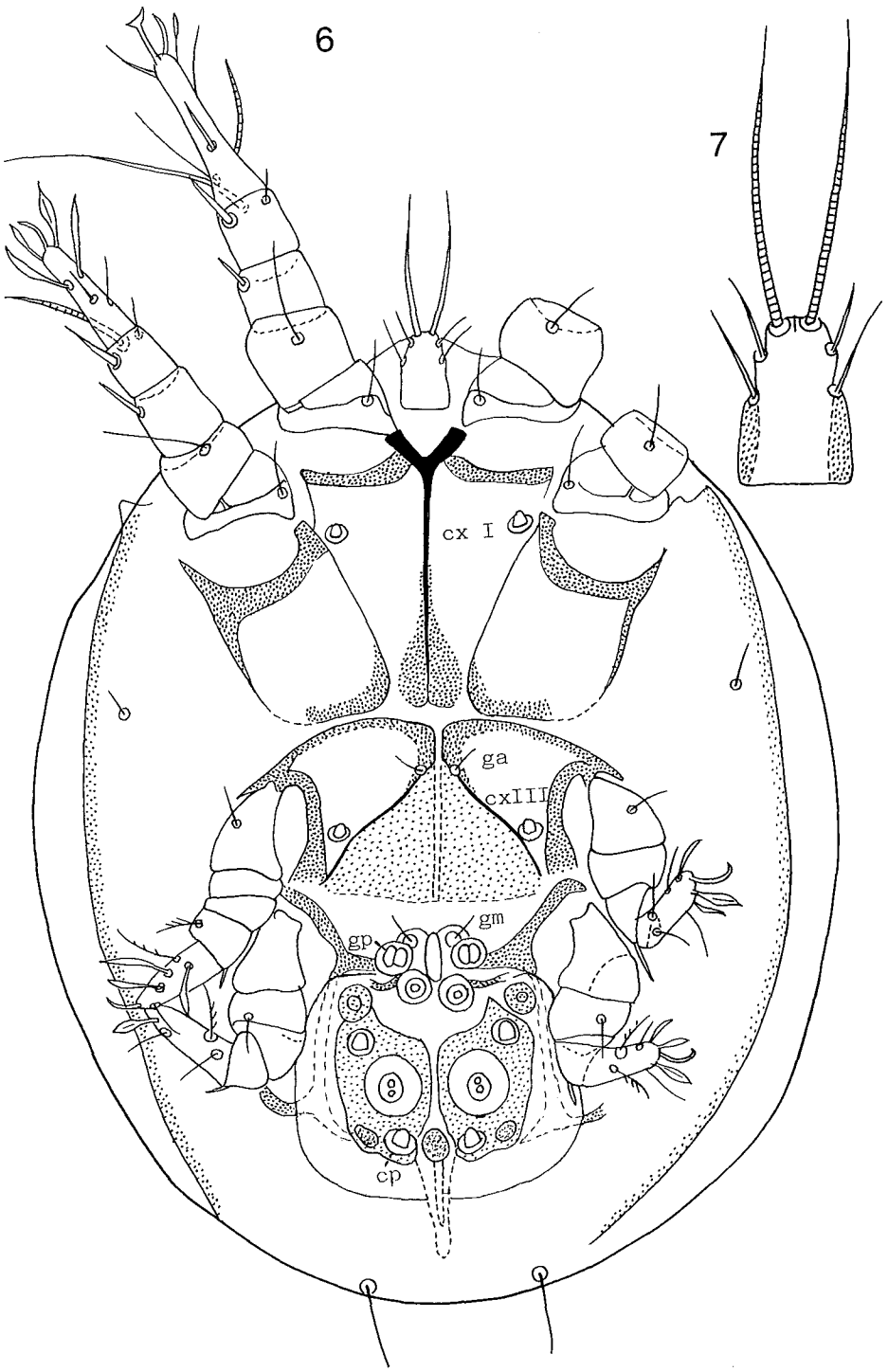
Forcellinia galleriella WOMERSLEY, 1963

This species was described from a bee hive infected with the wax moth *Galleriella melonella* at Perth, Western Australia. Only the adults were found, no deutonymphus were observed.
Recently, Mr. K.T. RICHARDS, W. Australian Department of Agriculture, Perth, sent us two hypopi found attached to the head of an Argentine ant, *Iridomyrmex humilis*. The mites belonged to the genus *Forcellinia* but to an unknown species. New material comprizing 2 additional hypopi and adults was obtained from these ants allowing us to ascertain that these specimens belonged to *F. galleriella*.
We describe herein the hypopi of this species and we give a short description and new figures of the holotype female, completing the original description of WOMERSLEY.

Hypopus (Figs. 5-7; 13-17):
Length and width of two specimens: 186 × 150 and 190 × 145. *Dorsum:* Cuticle with a pattern formed of very numerous small pale spots. Prododonotum 40 long. All dorsal setae very short, except *s cx* and *l5* (14 to 15 long). *Venter:* Palposoma longer (15) than wide (9,5 at base); solenidia alpha 26 long. Coxae I-II puntacte only in their posterior parts. Coxae III punctate only along their antero-internal margins. Coxae IV completely punctate. Suctorial plate relatively large. Posterior suckers much larger than anterior ones. Setae *gp* distinctly bilobate. *Legs:* Tarsi I-IV 31-25-15-16 long respectively. Chaetotaxy of legs: Tarsus I-II with 7 setae, tarsi III-IV with 8 setae. Tarsi I with only the 3 dorso-apical setae, the 2 dorso ventral being missing; middle third with 3 ventral setae and one dorsal (*aa*) situated at the level of *ω3*. Tarsus II as

Figs. 4-5. *Dorsal view of the hypopi of* Forcellinia wasmanni *(MONIEZ, 1892) (4), and of* F. galleriella *WOMERSLEY (5).*

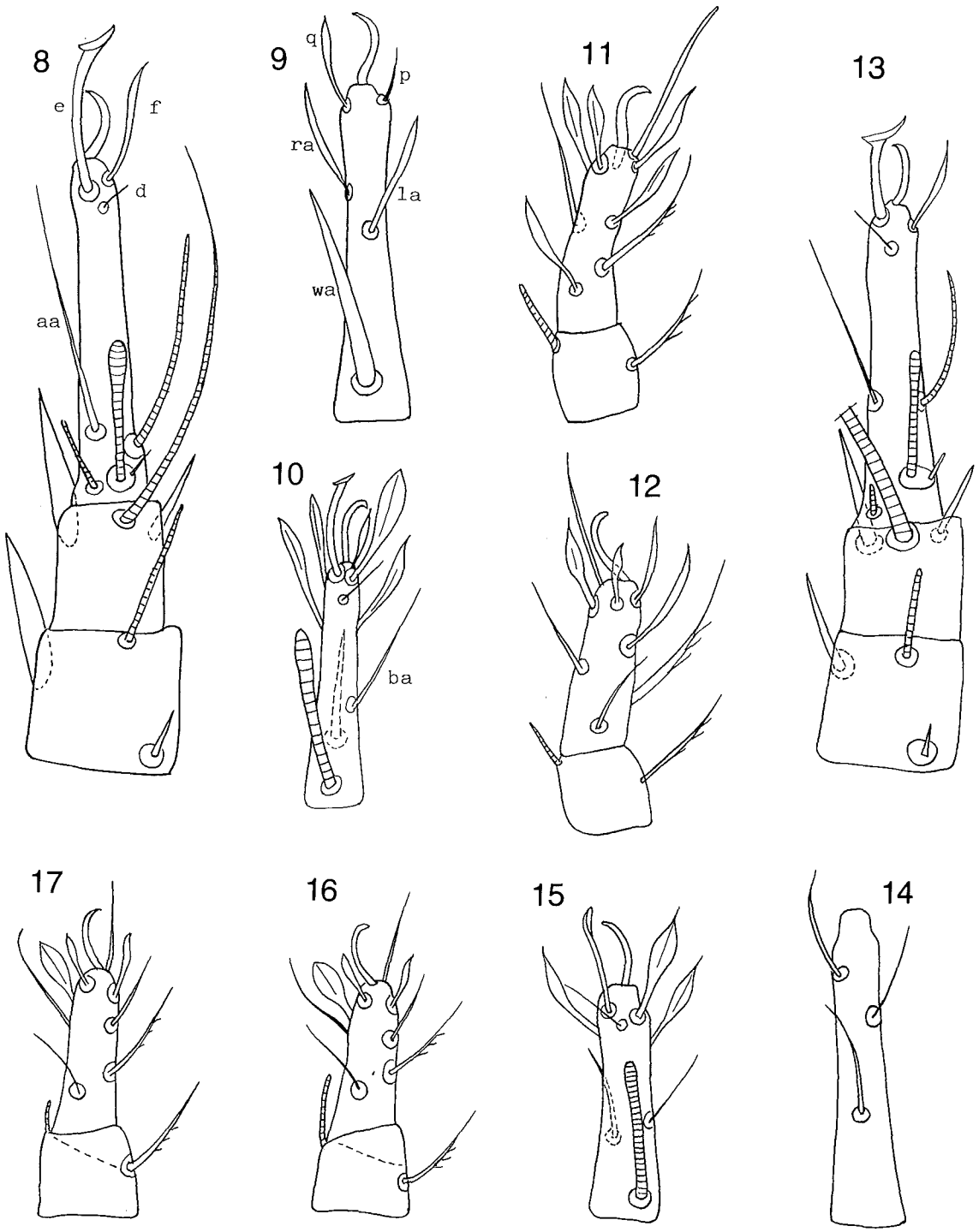




Figs. 6-7. Forcellinia galleriella *WOMERSLEY. Hypopus holotype in ventral view (6); palposoma (7) (cp = posterior conoid).*

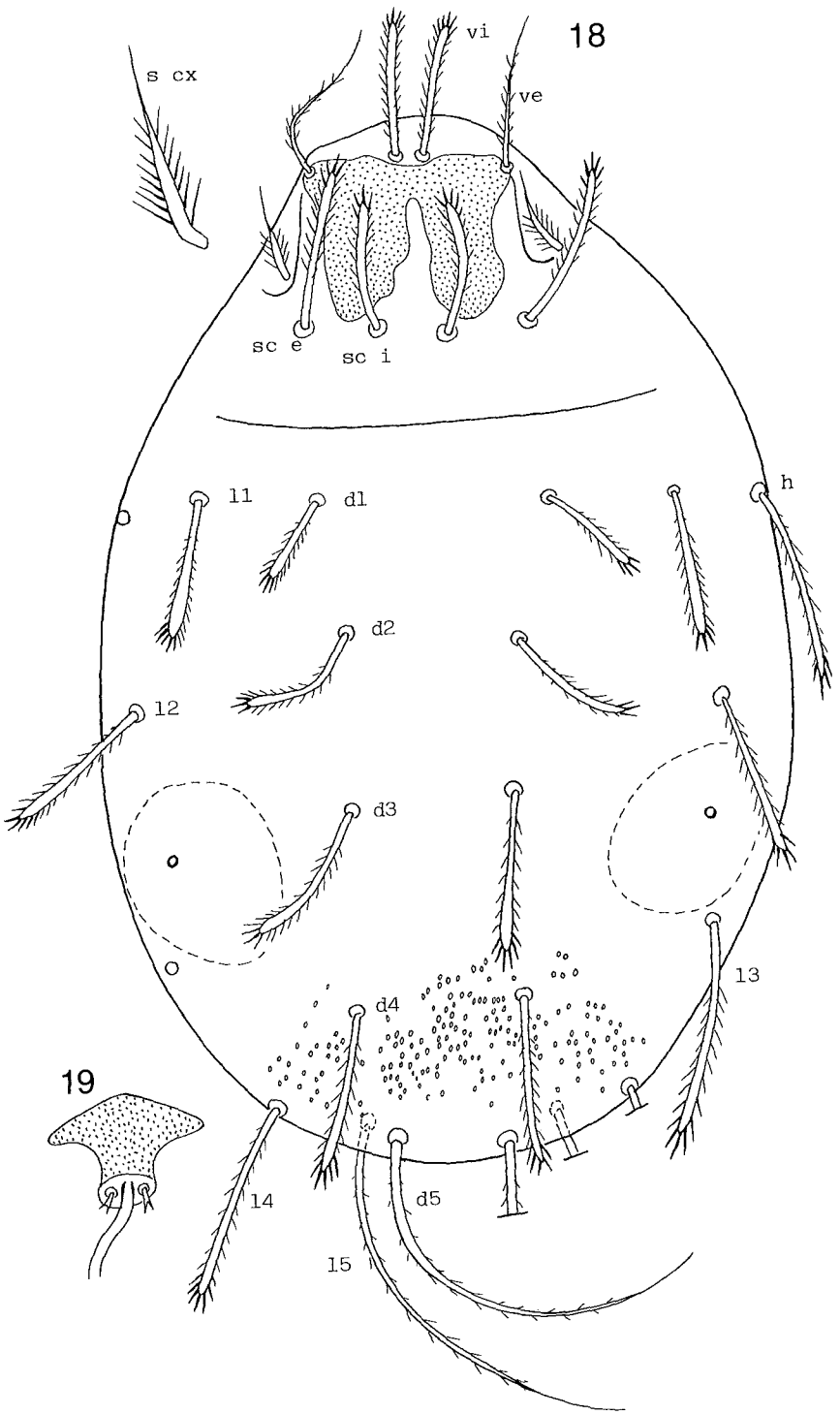
tarsus I but the saucer-like seta is replaced by a thinner foliate seta slightly dilated apically, the *aa* is absent but the *ba* is present. Tarsi III-IV with 8 setae: one barbed, 3 foliate (the posterior one very wide) and 4 simple. Tibiae with 2-2-1-1 setae, those of tibiae I-II being spines. Solenidia: Tarsus I with *ω1* basal and slightly dilated at apex; *ω3* thin situated at the base of the median third of the tarsus; *ω2* much shorter than in *F. wasmanni.* Genu with *sigma* much shorter than in *F. wasmanni.*

Female (holotype) (Figs. 18-24):
Idiosoma 456 long and 292 wide. Spermatheca with sclerotized walls and T-shaped. *Dorsum:* Posterior border of propodonotal shield very deeply incised. This incision is present in all the paratypes (5 females and 3 males) that we have examined, it was not mentioned by Womersley. Length of setae (including the barbs prolonging the seta): *vi* 63, these setae are thick, barbed and slightly spatulate apically, that means flattened dorso-ventrally (when the setae are lying down



Figs. 8-17. *Figs. 8-12.* Forcellinia wasmanni*(MONIEZ, 1892), Hypopus: Apical segments of leg I in dorsal view (8); tarsus I in ventral view (9); tarsus II in dorsal view (10); tarsi and tibiae III (11) and IV (12).*
Figs. 13-17. Forcellinia galleriella *WOMERSLEY, Hypopus (holotype): Apical segments of leg I, dorsally (13); tarsus I in ventral view (14); tarsus II in dorsal view (15); tarsi and tibiae III (16) and IV (17).*

one on the body) and enlarged transversely; *ve* 60, thinner than the *vi*, except that they have less barbs in their basal half, they measure: *sc i* 60; *sc e* 75; *d1* 45; *d2* 55; *d3* 72; *d4* 72; *l1* 65; *l2* 75; the *l3* is lacking in the holotype, in a paratype it is 105 long; (in a paratype) is 100 long. The *l4* is barbed but not distinctly expanded apically, it is 100 long. The *d5* is 170 long, it is gradually attenuated towards the apex and bears a few very short barbs. Setae *l5* as *d5* but slightly thinner and 155 long. The cuticle behind the setae *d4* bears numerous very small (diameter 1 to 2.5) rounded or oval elevations. *Venter:* There are 6 pairs of anal setae, the *a1, a5* and *a6* are very short (9 to 12); *a2* and *a3* are 15-18 long; *a4* 55-60 and bear a few



Figs. 18-19. Forcellinia galleriella *WOMERSLEY. Holotype (and paratypes) female in dorsal view (18); spermatheca (19).*

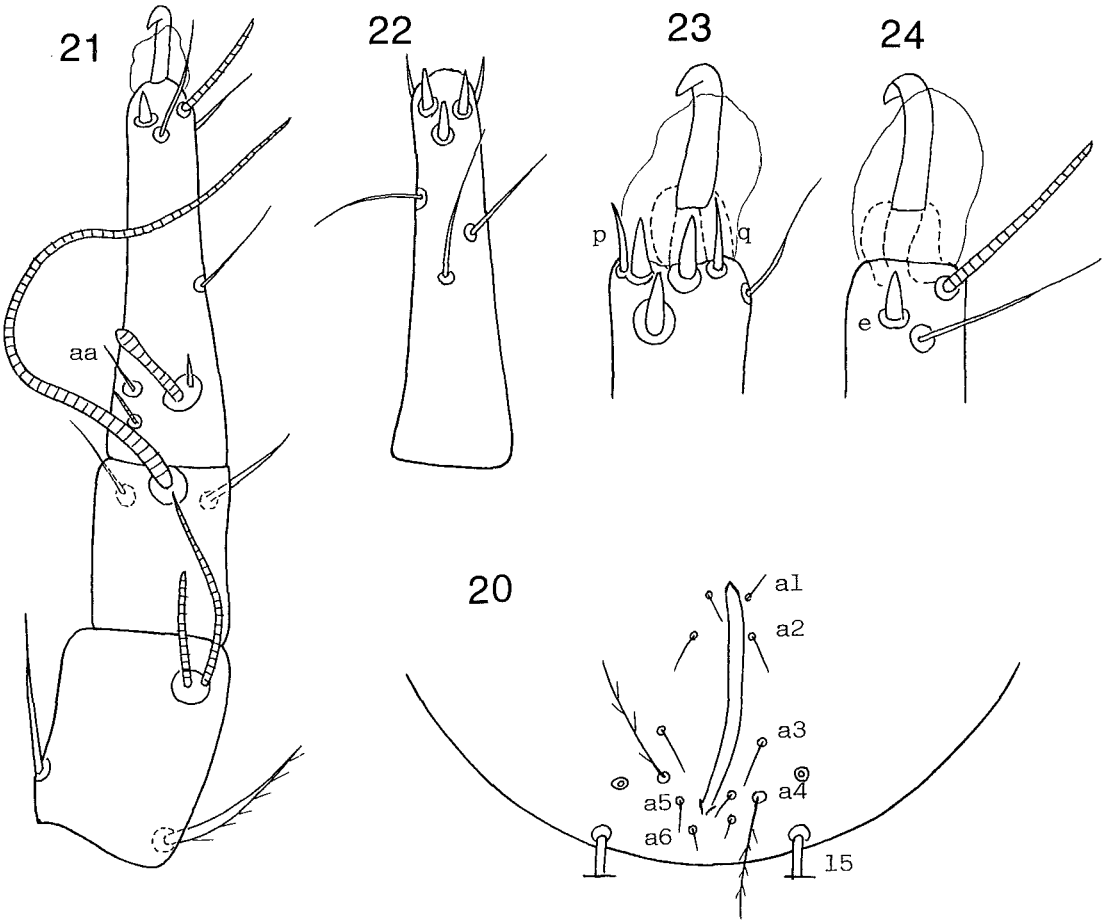
short barbs. *Legs:* Tarsi 55-55-59 and 67 long. Chaetotaxy (number of setae on tarsi): 13-12-10-10. Seta *e* is a spine, thick on tarsi I-II, narrower on tarsi III-IV; setae *p* and *q* are narrow spines; *aa* (tarsus I) is short and close to *ω2*.

HABITAT AND LOCALITY

The typical series (females and males) was found in a bee hive in Perth (see above). The hypopi (3 specimens in good condition) were fixed to the head of ants *Iridomyrmex humilis,* forming floating colonies on the lake Carabooda near Perth. Three adult mites were found among these ants. The material was collected by Mr. P.R. DAVIS and Mr. M.A. WIDMER.

REMARKS

These hypopi differ from all the other hypopi described so far in the genus *Forcellinia* by the following



Figs. 20-24. Forcellinia galleriella *WOMERSLEY. (Holotype and paratype female): opisthogaster (20); leg I in dorsal view (21); tarsus I in ventral view (22); apex of tarsus I in ventral (23) and dorsal view (24).*

characters: characteristic pattern of dorsal cuticle, reduction of the chaetotaxy on tarsi I-II (setae *p* and *q* lacking), absence of punctation on the greatest part of coxae I to III, absence of striation behind the suctorial plate.

Acknowledgements

We are grateful to Mr. K.T. RICHARDS, Western Australian Department of Agriculture, Perth who sent us material of *Forcellinia galleriella.*
We also thank Mr. D. MACFARLANE [British Museum (Nat. Hist.)] and Mr. D.C. LEE, South Australian Museum, Adelaide, for loan of material.

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