LIFE CYCLE OF *ALABIDOPUS ASIATICUS* SP. NOV. (ACARINA: ASTIGMATA: GLYCYPHAGIDAE) AND HYPOPUS OF *ALABIDOPUS MALAYSIENSIS* SP. NOV. EX. *RATTUS* SPP. FROM MALAYSIA

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----- ABSTRACT—The first example of a single glycyphagid species capable of suppression of the deutonymph as well as expression of two distinct hypopial stages is described. All developmental stages of *Alabidopus asiaticus* sp. nov. from *Rattus whiteheadi* Thomas, 1894, and the hypopus of *A. malaysiensis* sp. nov. from *Rattus rajah* (Thomas, 1894) are described. The genus *Alabidopus* Fain, 1967 is redefined based on adults, and the systematical affinities are discussed. A key for the six species of *Alabidopus* based on the hypopi is given.

INTRODUCTION

The basic developmental pattern for Glycyphagidae parasitic on mammals is well known. The adults, eggs, protonymphs and tritonymphs are free-living in the host nest, the specialized deutonymph is obligatory in formation and is an obligate parasite. The present work presents a systematic account of two new species of *Alabidopus* (Glycyphagidae) and reports the results of rearing experiments for one of these new species in which major deviations in hypopial development were observed that parallel developmental patterns seen in free-living Astigmata, i. e., deutonymphal expression by-passed, as well as the production of an inactive, non-feeding hypopus.

SYSTEMATIC ACCOUNT

Fain (1967) based the genus *Alabidopus* and the new subfamily Alabidopinae (Glycyphagidae Berlese, 1887) on hypopi found in the tail hair follicles of *Hydromys chrysogaster* Geoffroy, 1804, from Bloomburry in Queensland, Australia. Three additional species have been described based on hypopi: *A. microcebus* Fain & Lukoschus, 1977 from the tail hair follicles of *Microcebus pusillus* Geoffroy, 1795 (=*Microcebus murinus* Miller, 1777) from Madagascar; *A. muris* Lukoschus et al., 1979 from the hair follicles of the dorsum of *Rattus tunneyi* (Thomas, 1914) from the Kimberley region of Western Australia; Lukoschus et al. also described the tritonymph of *A. muris*; and *A. bipilifer* Fain & Uchikawa, 1980 from *Rattus sabanus* from Thailand.

Examination of two *Rattus* species collected in Malaysia has revealed the hypopi of two new species of *Alabidopus*, bringing the total of known species to 6. The two new species are described and illustrated below. One of these species was reared from hypopus to hypopus, thus making it possible to define the genus *Alabidopus* based on the adults. All measurements are given in micrometers (μm) in tabular form. A key to the known species of *Alabidopus* based on the hypopi is given.

Alabidopus asiaticus sp. nov.

HYPOPUS (holotype) (Figs. 2, 4, 9-12)—Sub-oval in shape, idiosoma pale yellow in color, legs brown, with the characteristics of the genus. Length 225 (for 10 paratypes $\bar{X}$ = 223, range 198-237); width 164 (for 10 paratypes $\bar{X}$ = 140, range 116-158).

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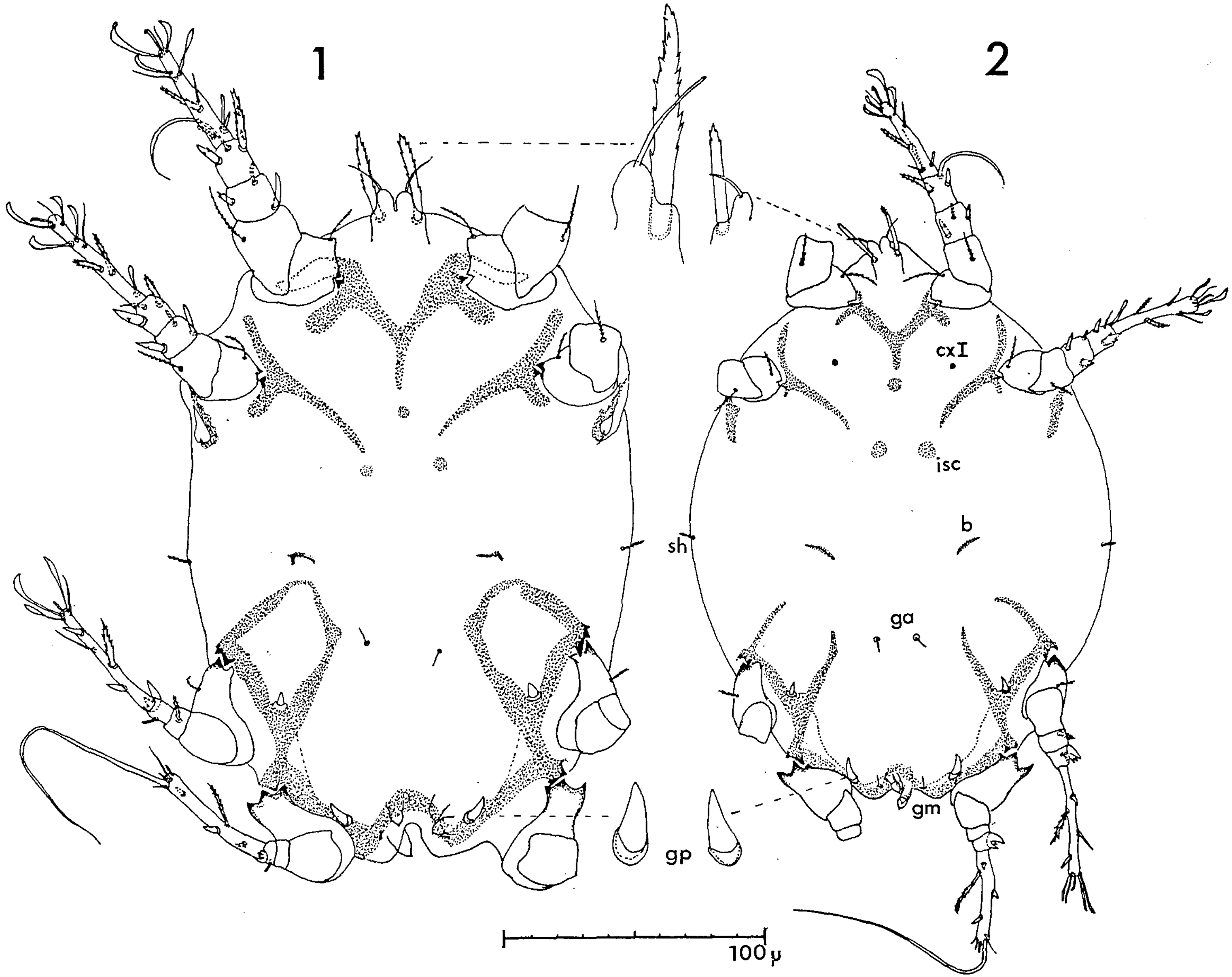
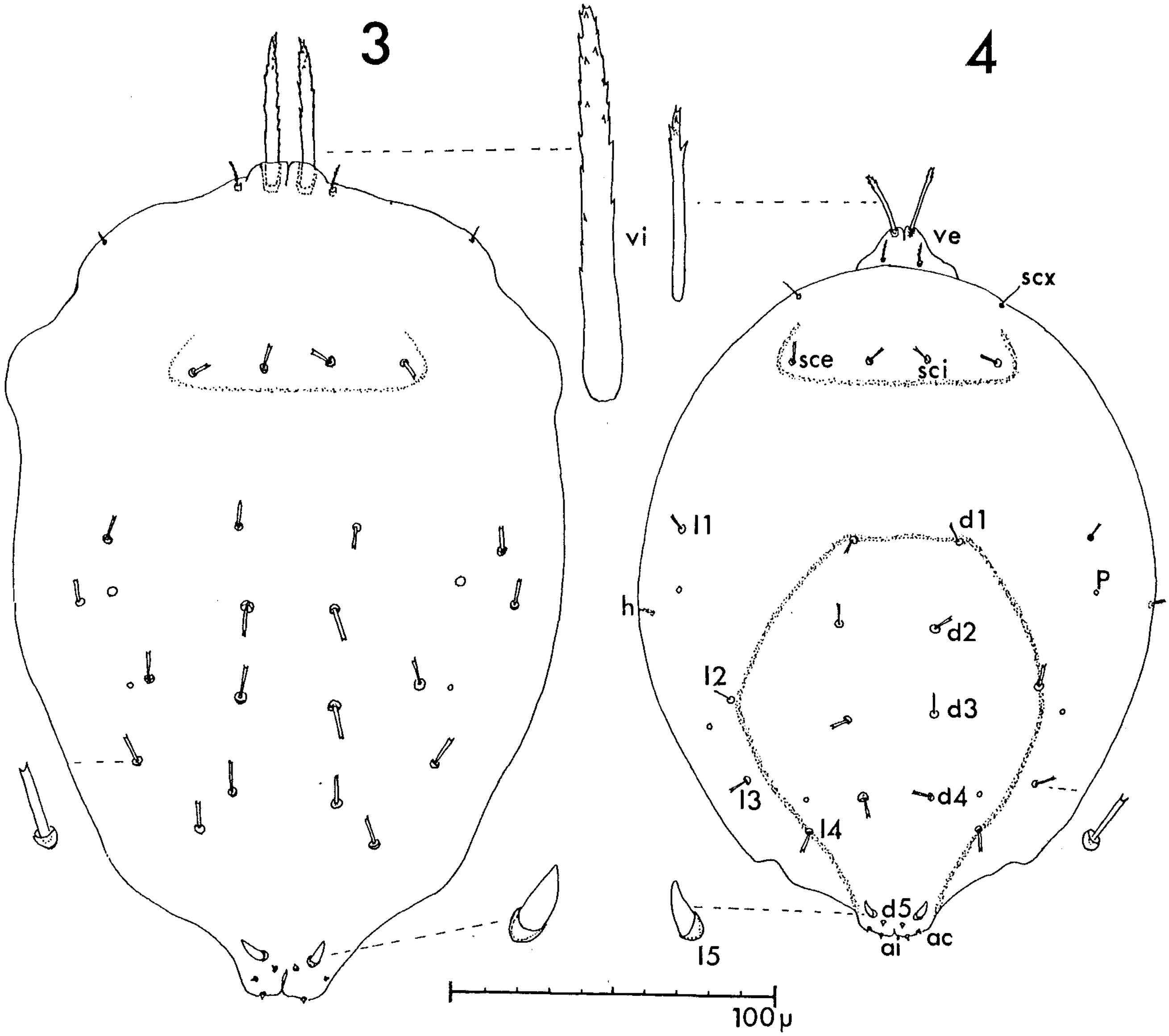


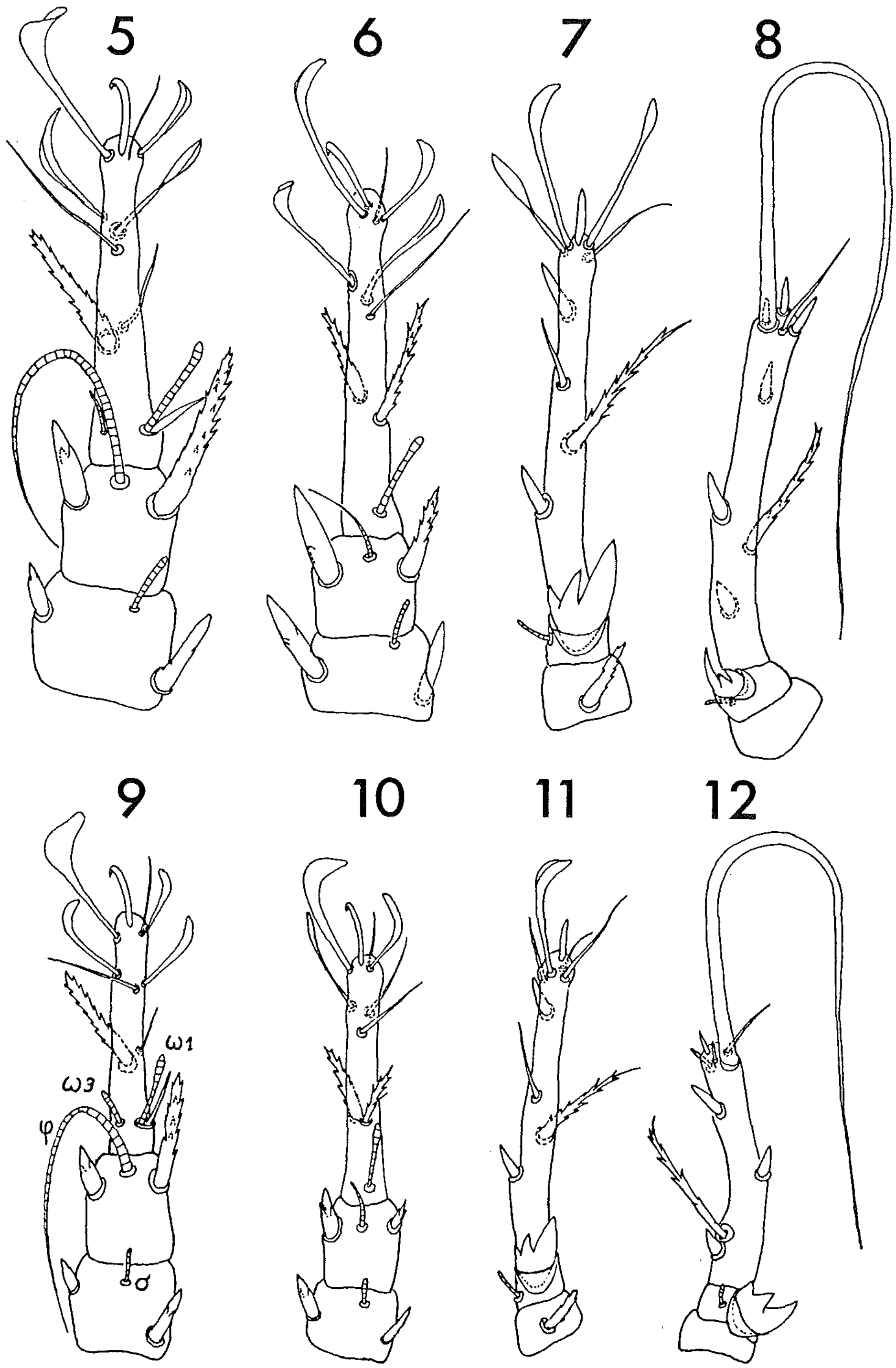
Figs. 1-2: *Alabidopus* hypopi, venter. 1, *A. malaysiensis* sp. nov., holotype; 2, *A. asiaticus* sp. nov., holotype.



Figs. 3-4: *Alabidopus* hypopi, dorsum. 3, *A. malaysiensis* sp. nov.—holotype; 4, *A. asiaticus* sp. nov.—holotype.

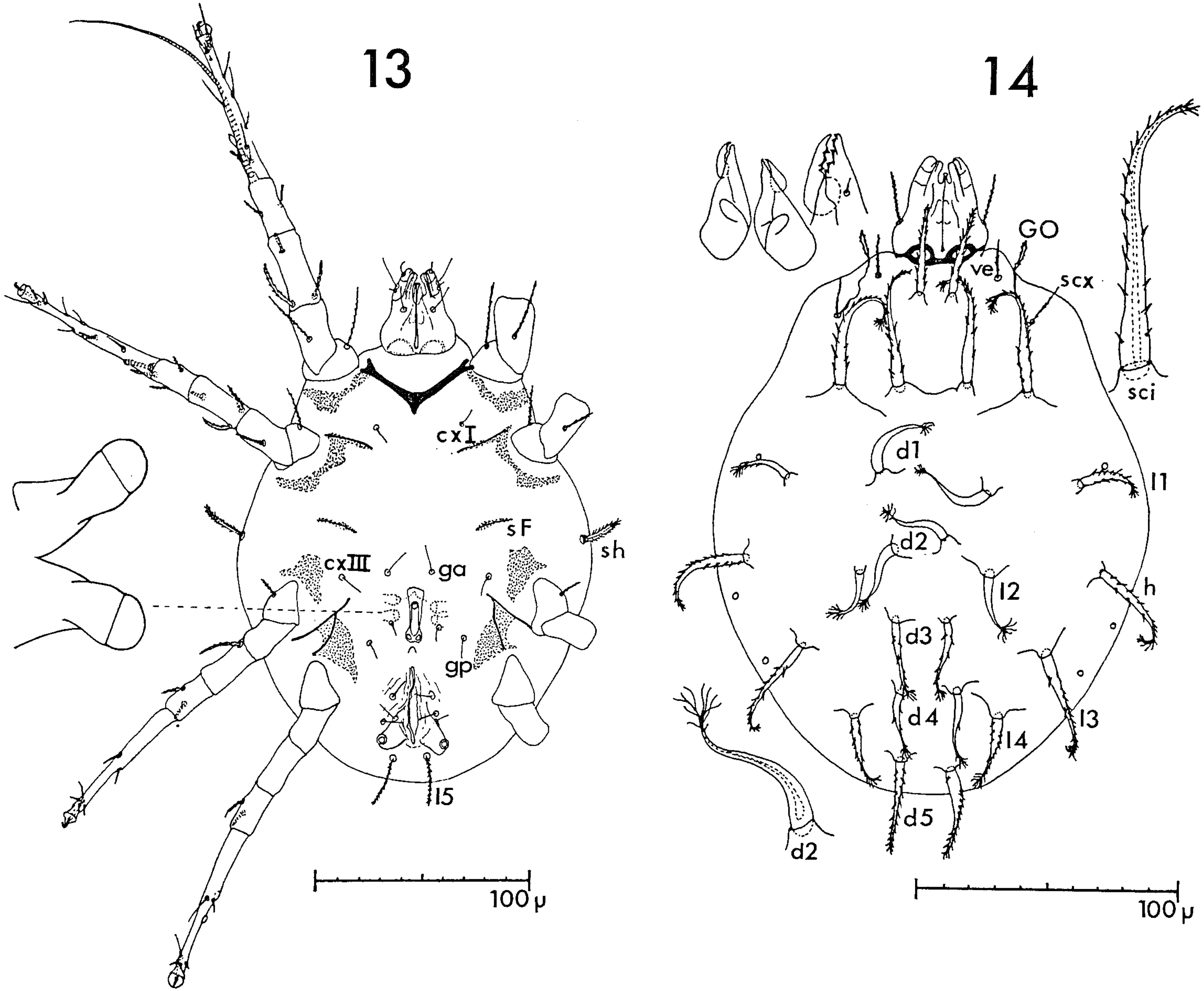
VENTER (Fig. 2)—Cuticle smooth, without cuticular patterning. Epimera I fused in Y-shape, epimera II-IV free. Small curved, pigmented sclerites (b) present anterior to coxal fields III. (These sclerites are present in all paratypes examined). Palposoma with one pair of strong setae and *alpha* on cylindrical tubercles. Coxal setae I acuminate, coxals III in the shape of conical spines, subhumerals serrate. Genital region terminal, surrounded ventrally by epimerites IV fused with a small pregenital sclerite. Three pairs of genital setae present: *g a*, *g m* setaform, *g p* spinose. Three conspicuous, subcuticular yellow to brown sclerites are present in the mesal region of epimera II. Sclerites *is c* are homologous with those seen in hypoderid species parasitizing birds (Fain, 1967).

DORSUM (Fig. 4)—Cuticle smooth, without cuticular patterning. Sejugal furrow indistinct. Presence of sejugal region and very weakly sclerotized prodorsal and hysterosomal shields observable only in crushed specimens. The following setae are present: *v i*, *v e*, *h*, serrate; *sc e*, *sc i*, dorsals 1-4, laterals 1-4 bifid; laterals 5 spinose; *d 5*, two pairs of anals micro-spinose.



Figs. 5-12: Tarsus-genu of legs I-IV of hypopi. 5-8, *Alabidopus malaysiensis* sp. nov.; 9-12, *Alabidopus asiaticus* sp. nov.

LEGS (Figs. 9-12)—Typical for the genus. Legs III and IV distinctly inserted laterally, trochanters bearing anteriorly directed sclerotized spurs. All tarsi relatively long, claws sub-sessile. Tarsus IV with a long, whip-like terminal seta. Setae of tibiae III-IV tridentate, dentitions subequal, setal insertions recessed.



Figs. 13-14: *Alabidopus asiaticus* sp. nov.—13, male venter; 14, male dorsum.

TABLE 1.—Measurements of *Alabidopus* hypopi.

	Alabidopus asiaticus tissue hypopi holotype	*Alabidopus asiaticus* tissue hypopi paratypes (n=10)	*Alabidopus asiaticus* free hypopi paratypes (n=10)	*Alabidopus malaysiensis* tissue hypopi holotype	*Alabidopus malaysiensis* tissue hypopi paratypes (n=10)
length	225	223 (198-237)	196 (161-210)	258	258 (249-271)
width	164	140 (116-158)	119 (97-137)	173	162 (143-179)
v e	7	7 (7-9)	7 (7-8)	10	10 (10-10)
v i	24	27 (24-29)	26 (22-29)	49	51 (48-52)
sc e, sc i	6-7	6-7 (6-7)	6 (5-6)	7	7 (7-9)
d 1-4	6-7	6-7 (6-7)	6 (6-7)	7-10	7-9-9-9 (7-10)
l 1-4	6-7	6-7 (6-7)	6 (6-7)	6-9-9-10	7-8-9-9 (6-10)
d 5	4	4 (4-4)	4 (4-4)	4	4 (4-5)
l 5	7	9 (7-10)	8 (7-9)	10	11 (10-12)
h	6	6 (5-6)	6 (5-6)	7	7 (7-7)
sh	6	6 (6-7)	6 (6-7)	10	10 (9-10)
palposoma seta	23	23 (22-23)	22 (20-24)	34	36 (34-38)
alpha	10	9 (9-10)	10 (9-11)	21	19 (18-21)
tarsus I	34	32 (31-34)	33 (32-34)	44	42 (38-46)
tarsus II	35	33 (32-35)	34 (31-36)	49	45 (42-49)
tarsus III	45	43 (40-45)	42 (41-44)	52	50 (46-54)
tarsus IV	35	33 (31-34)	33 (32-35)	45	43 (38-45)
claw I	10	10 (9-10)	9 (9-10)	12	11 (10-11)
claw II	10	9 (9-10)	9 (9-9)	11	10 (9-11)
claw III	6	7 (6-7)	7 (6-7)	7	7 (7-7)
claw IV	6	5 (5-6)	5 (4-5)	6	6 (6-7)
omega 1	11	11 (11-12)	11 (10-12)	15	13 (13-15)
omega 3	6	6 (6-6)	6 (6-6)	7	7 (6-7)
omega II	11	10 (10-11)	10 (10-11)	12	11 (11-12)
phi I	56	56 (54-57)	54 (50-60)	62	63 (62-65)
phi II	7	7 (6-7)	7 (7-8)	9	10 (9-12)
phi III	4	4 (4-5)	4 (4-4)	6	6 (5-6)
phi IV	4	4 (4-5)	4 (4-5)	5	5 (5-5)
sigma I	6	5 (5-6)	5 (5-6)	9	8 (7-9)
sigma II	5	5 (4-5)	5 (5-6)	7	7 (7-7)
famulus	9	9 (7-10)	10 (9-10)	9	9 (9-10)
seta tarsus IV	96	91 (89-94)	90 (88-93)	120	116 (111-121)

CHAETOTAXY OF LEGS I-IV—Tarsi 8-8-8-8; tibiae 2-2-1-1; genua 2-2-1-0; femora 1-1-0-0; trochanters 1-1-1-0. Solenidia—*omega* 1, *omega* 3 in basal position on tarsus, *omega* II, *phi* I-IV, *sigma* I, II present. Famulus subequal to *omega* 1. The above description is based on specimens expressed from hair follicles of the dorsum in the region of the pelvis. Measurements of material collected directly from the host, as well as additional material reared from adult mites, are given in Table 1.

MALE (Figs. 13-14, 19-22)--Oval in shape, off-white in color. Length 201 (for 2 paratypes $\bar{X}$= 181, range 179-182); width 158 (for 2 paratypes $\bar{X}$= 134, range 131-137). Cuticle smooth, shields and patterning.

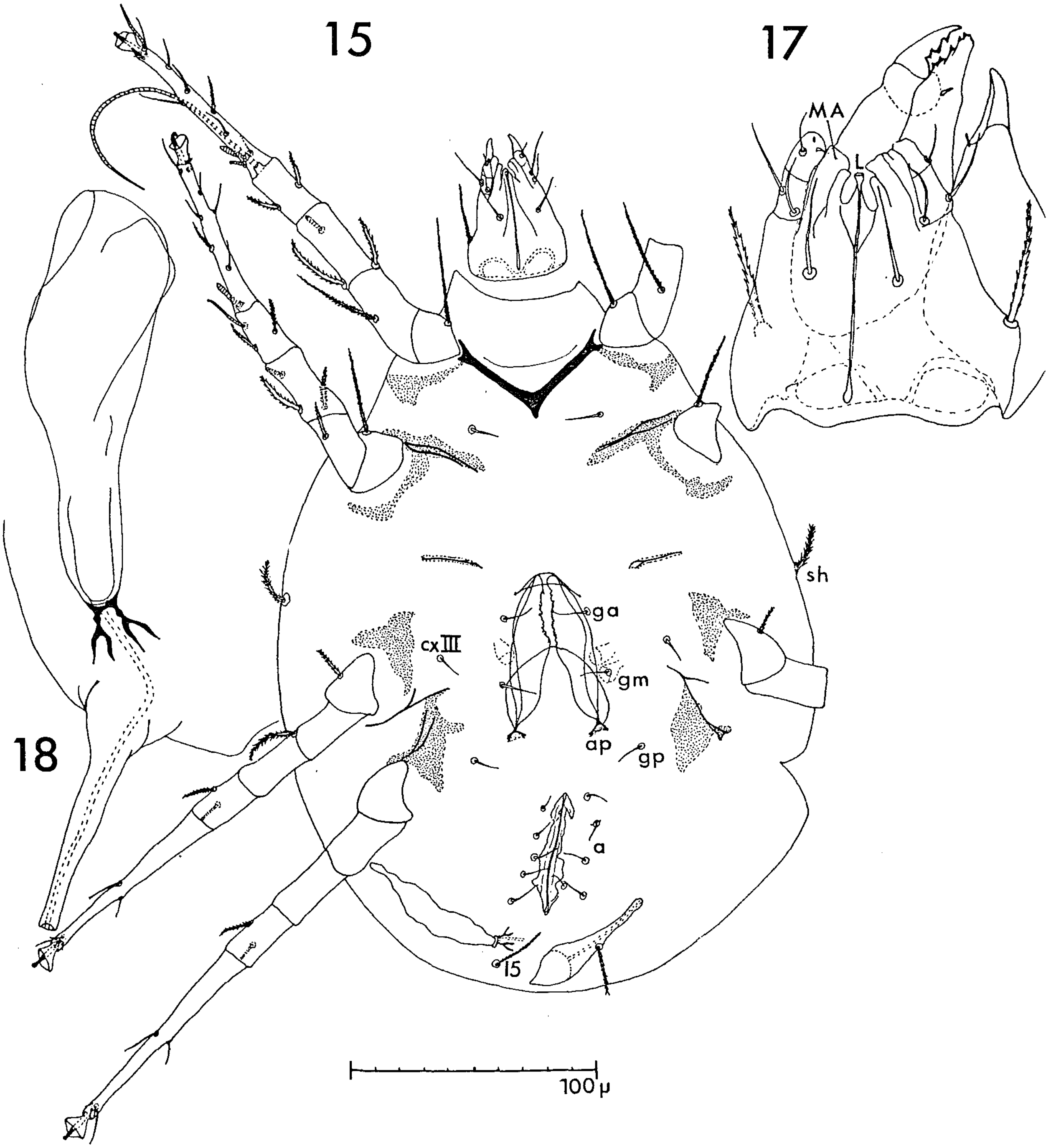
VENTER (Fig. 13)—Epimera I well sclerotized fused mesally in V-shape, II-IV separate mesally and more weakly sclerotized. Epimerites III present and fused with epimera III. Genital region between legs III and IV, without sclerite on ventral surface, opening to genital atrium long, rectangular, aedeagus short (18), two pairs of two-segmented genital suckers present, genital setae *g a, g m* and *g p* present. Sejugal furrow (sf) present as a short linear subcuticular sclerotization. Anal opening (34 long) with three pairs of anal setae, and a pair of small (5) adanal suckers. Subhumerals (*sh*) relatively distant from epimera III. Gnathosoma with well-developed malae; palps two-segmented; chelicerae chelate dentate; mouth parts functional as feeding on yeast and skin debris was observed.

DORSUM (Fig. 14)—Sejugal region indistinct. The following serrate setae are present: *v i, v e, sc i, sc e, l 1-5, d 1-5, h*. With the exception of the propodosomal setae and *l 5*, all setae have a central core and whip-like ends. Supracoxal setae thin, pectinate. Grandjean's organ (G.O.) in the shape of a small, multiple-tined band.

LEGS (Figs. 19-22)—Subequal, tarsi elongate. Pretarsi with distinct condylophores, pulvillus short, stalked, and rounded; empodial claw present. Legs IV with two tarsal suckers.

TABLE 2.—Measurement of free living stages of *Alabidopus asiaticus* sp. nov.

	male	female	TrN (♂)	TrN (♀)	PrN (♂)	PrN (♀)	larva
length	201	285	210	237	164	204	182
width	158	212	161	170	122	149	131
v e	15	17	12	15	9	11	7
v i	34	48	33	34	27	31	20
sc e	48	60	34	74	27	37	23
sc i	45	66	34	66	31	39	24
sc x	16	21	15	19	10	13	7
d 1	34	48	31	54	27	28	23
d 2	29	168	28	92	22	43	23
d 3	29	156	31	79	24	43	20
d 4	34	46	24	50	15	24	--
d 5	34	66	24	40	15	20	13
l 1	34	39	24	39	20	41	16
l 2	24	41	24	39	21	26	18
l 3	41	63	32	56	23	27	15
l 4	28	52	21	38	13	20	--
l 5	34	23	15	31	12	15	16
h	37	57	31	59	23	29	16
sh	21	21	21	27	11	16	10
g a	15	17	7	13	--	--	--
g m	10	15	5	11	5	10	--
g p	12	15	7	10	--	--	--
tarsus I	63	72	42	56	34	43	30
tarsus II	62	68	43	51	38	45	32
tarsus III	61	74	45	61	43	50	35
tarsus IV	67	89	50	56	40	50	--
omega 1	12	12	10	12	10	9	7
omega 2	7	7	6	6	5	4	--
omega 3	21	20	12	16	--	--	--
omega II	11	12	9	12	9	9	7
phi I	115	122	71	106	66	74	33 ?
phi II	16	17	11	16	10	12	9
phi III	10	10	5	11	7	7	5
phi IV	7	9	5	9	--	--	--
sigma I	10	10	6	12	6	7	6
sigma II	6	6	4	7	5	5	4



Figs. 15, 17-18: *Alabidopus asiaticus* sp. nov. (female)—15, venter; 17, gnathosoma ventrali; 18, bursa copulatrix and seminal receptacle.

CHAETOTAXY OF LEGS I-IV—Tarsi 9-8-6-6+2 suckers; tibiae 2-2-1-1; genua 2-2-1-0; femora 1-1-0-0; trochanters 1-1-1-0. Solenidia—*omega* 2 more basal than *omega* 1 with a slightly expanded tip, *omega* 3 terminal, *phi* I borne on a tubercle, extending beyond the tibial margin (Fig. 19); only one solenidion *sigma* on genua I and II. Measurements as in Table 2.

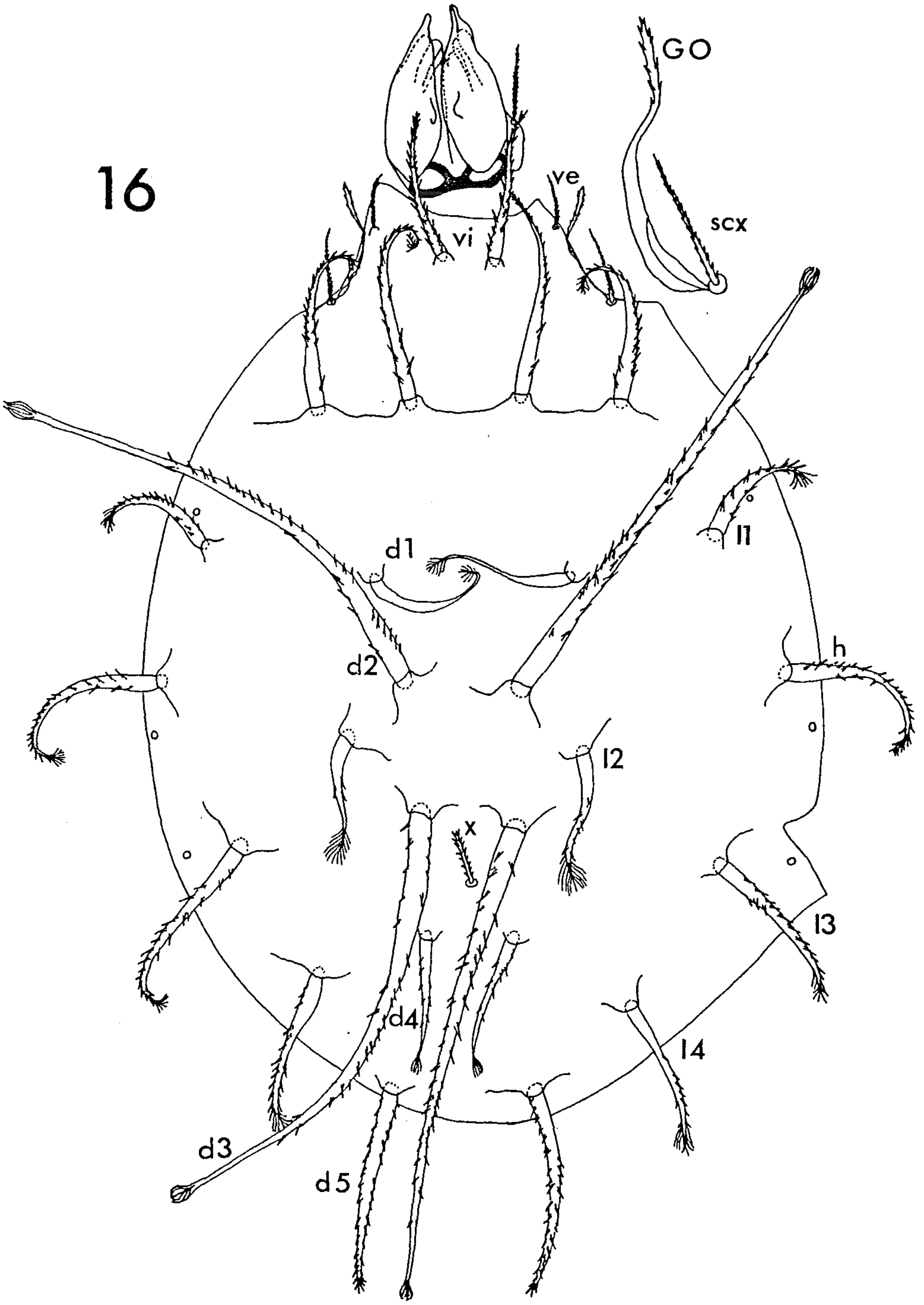
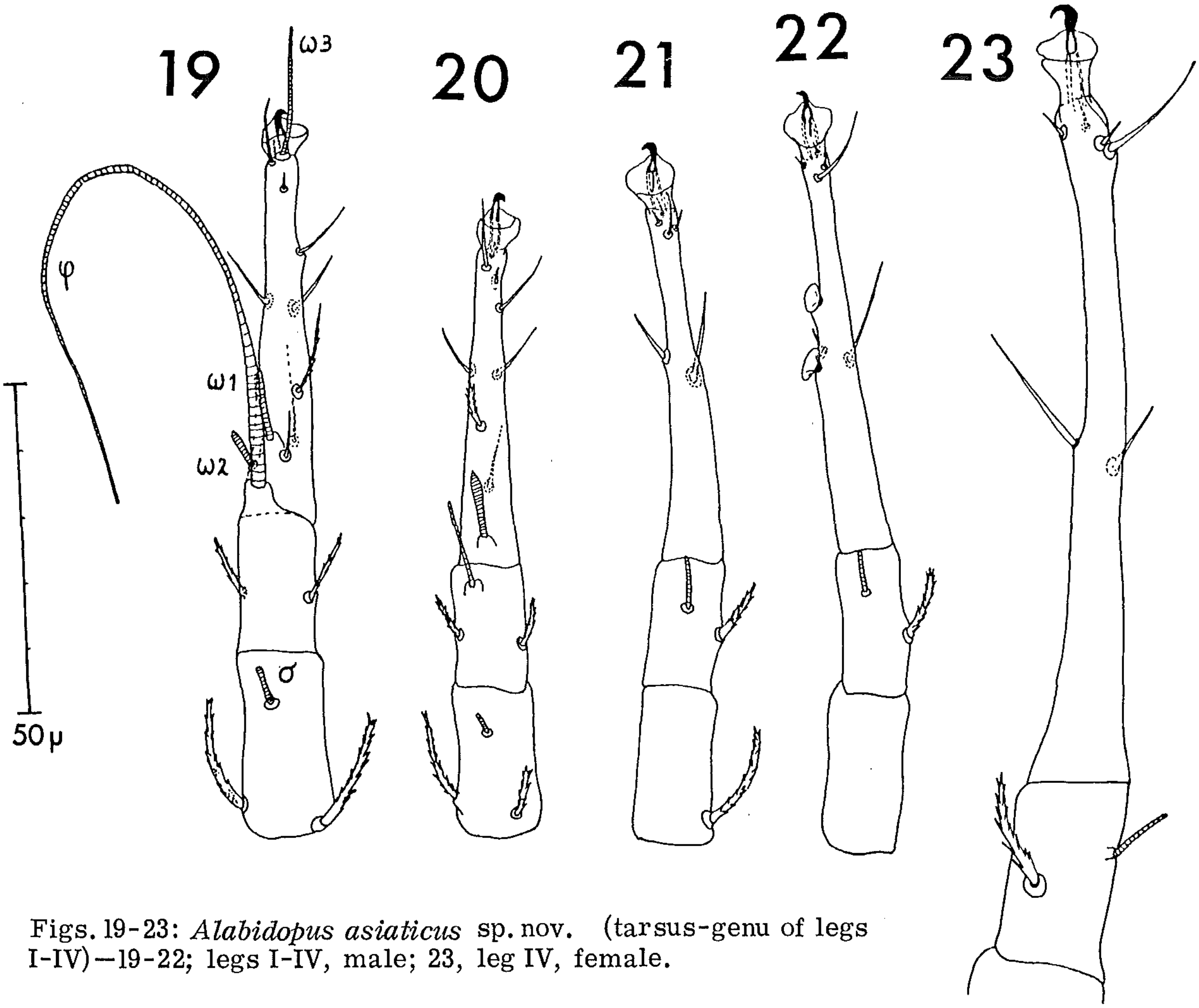


Fig. 16: *Alabidopus asiaticus* sp. nov. (female)—dorsum.

FEMALE (Figs. 15-18, 23)—Similar to male but distinctly larger. Length 285 (for 8 paratypes $\overline{X}$=286, range 248-303), width 212 (for 8 paratypes $\overline{X}$= 226, range 182-242).

VENTER (Fig. 15)—Genital region located between epimera III and IV, genital sclerites absent, three genital valves present, genital apodemes (ap) small, indistinct, two pairs of two-segmented genital suckers present in the genital vestibule. Anal region ventral, flanked by five pairs of anal setae. Duct of bursa copulatrix long (39); a pair of gobulet-shaped sclerites present



Figs. 19-23: *Alabidopus asiaticus* sp. nov. (tarsus-genu of legs I-IV)—19-22; legs I-IV, male; 23, leg IV, female.

at the base of the seminal receptacle. Gnathosoma (Fig. 17) with broad malae (ma), a narrow labrum (L), chelicerae chelate dentate, 3-4 evenly distributed teeth per digit. Palps two-segmented, palpal tarsus with two setae and one solenidion, palpal tibia with two simple setae. Subcapitulum with one serrate and one nude seta.

DORSUM (Fig. 6)—Similar to male, but longer setae, especially dorsals 2 and 3. Figured specimen and some paratypes possess an unpaired supernummerary seta ($\overline{X}$) between dorsals 3 and 4. Two pairs of lateral pores are present between the humeral seta and lateral 3, and one pair of pores near lateral 1. Sacculus of opisthonotal glands located near laterals 3, but very weakly sclerotized, indistinct.

LEGS—Similar to male but longer. Tarsus IV (Fig. 23) without suckers. Measurements as in Table 2.

TRITONYMPH—General shape, structure of the cuticle, gnathosoma, chaetotaxy of idiosoma and legs, and solenidiotaxy similar to that in adults. Genital region between legs IV. Three pairs of anal setae present. Male and female forming tritonymphs differ in body size and setal lengths, especially the humerals and dorsals 2 and 3; measurements as in Table 2.

EGG—White, oval, cuticular patterns absent, of a uniform size: length 114-118, width 70-73.

LARVA—Generally similar to male forming tritonymph. The following setae are absent: *d4, l4*, genital setae, and two pairs of anal setae. Coxal roots broad, two-segmented, 15 long. Chelicerae functionable, feeding was observed. Sexual dimorphism not apparent. Chaetotaxy of legs I-III: tarsi 7-6-3; tibiae 2-2-1; genua 2-2-1; femora 1-1-0; trochanters 0-0-0. Solenidiotaxy I-III: tarsi 1-1-0; tibiae 1-1-1; genua 1-1-0. Measurements as in Table 2.

PROTONYMPH—As in tritonymph except only one pair of genital setae, one pair of genital suckers, and three pairs of anal setae are present. Sexual dimorphism evident in size and length of setae but less pronounced than in tritonymphs and adults. Male forming protonymphs 187 long (158-201), 128 (100-155) wide, female forming protonymphs 192 long (182-207), 141 (119-158) wide.
C

CHAETOTAXY OF LEGS I-IV—Tarsi 7-6-4-3; tibiae 2-2-1-0; genua 2-2-1-0; femora 1-1-0-0; trochanters 0-0-0-0.

SOLENIDIOTAXY I-IV—Tarsi 2-1-0-0; tibiae 1-1-1-1; genua 1-1-0-0. Measurements as in Table 2.

The protonymph may develop into one of three different morphs: inert hypopus, active hypopus, or tritonymph.

INERT HYPOPUS (Fig. 24)—Length 175 (158-182), width 155 (149-170). Almost spherical cuticle strongly sclerotized, yellow-brown in color, with many irregular grooves. Legs greatly reduced, only I-II show an indication of two segments with club-shaped solenidia (8 long), and one short seta on legs I. Genital valves with two pairs of two-segmented suckers in ventro-caudal position. Palposomal and idiosomal setation absent.

ACTIVE HYPOPUS —Hypopi reared from protonymphs exhibit the same characteristics of subcutaneous hypopi removed from the host. However, reared hypopi are considerably smaller: average 196 long and 119 wide compared to 223 long x 140 wide in subcutaneous hypopi. Reared hypopi exhibit a distinct sejugal furrow dorsally and lack internal sclerotizations. The dorsal cuticle is pleated posterior to the scapular setae and between the rows of the dorsals and laterals. The differences between reared hypopi and subcutaneous hypopi suggests "feeding" during presence in the host tissue, although the "feeding" mechanism is unknown.

HOST DATA—*Rattus whiteheadi* Thomas, 1894 Subang Forest Reserve, Selangor, Malaysia, three hosts examined, trapped 8 and 9 May, 1979 by Institute for Medical Research, Division of Acarology.

DEPOSITION OF TYPES—Holotype and illustrated specimens with the British Museum (Natural History), London; Institute for Medical Research, Kuala Lumpur ; Institut de Médecine Tropical "Prince Léopold", Antwerp ; Department of Aquatic Ecology, Catholic University, Nijmegen.

Alabidopus malaysiensis sp. nov.

HYPOPUS (holotype) (Figs. 1, 3, 5-8)—Very similar to *A. asiaticus* but differs by having coxal fields III closed; palposomal setae and *v i* remarkably longer than in *A. asiaticus*. Length 258 (for 10 paratypes, $\bar{X}$=258, range 249-271), 173 wide, (for 10 paratypes, $\bar{X}$=162, range 143-179). Cuticle smooth and white.

VENTER (Fig. 1)—With closed coxal fields III, narrow cuticular bows present anteriorly; epimerites II with a sack-like lateral formation; coxal setae I absent; solenidia *alpha* relatively long. Setae of the dorsum (Fig. 3) and legs (Figs. 5-8) generally more strongly developed than in *A. asiaticus*. Measurement as in Table 1.

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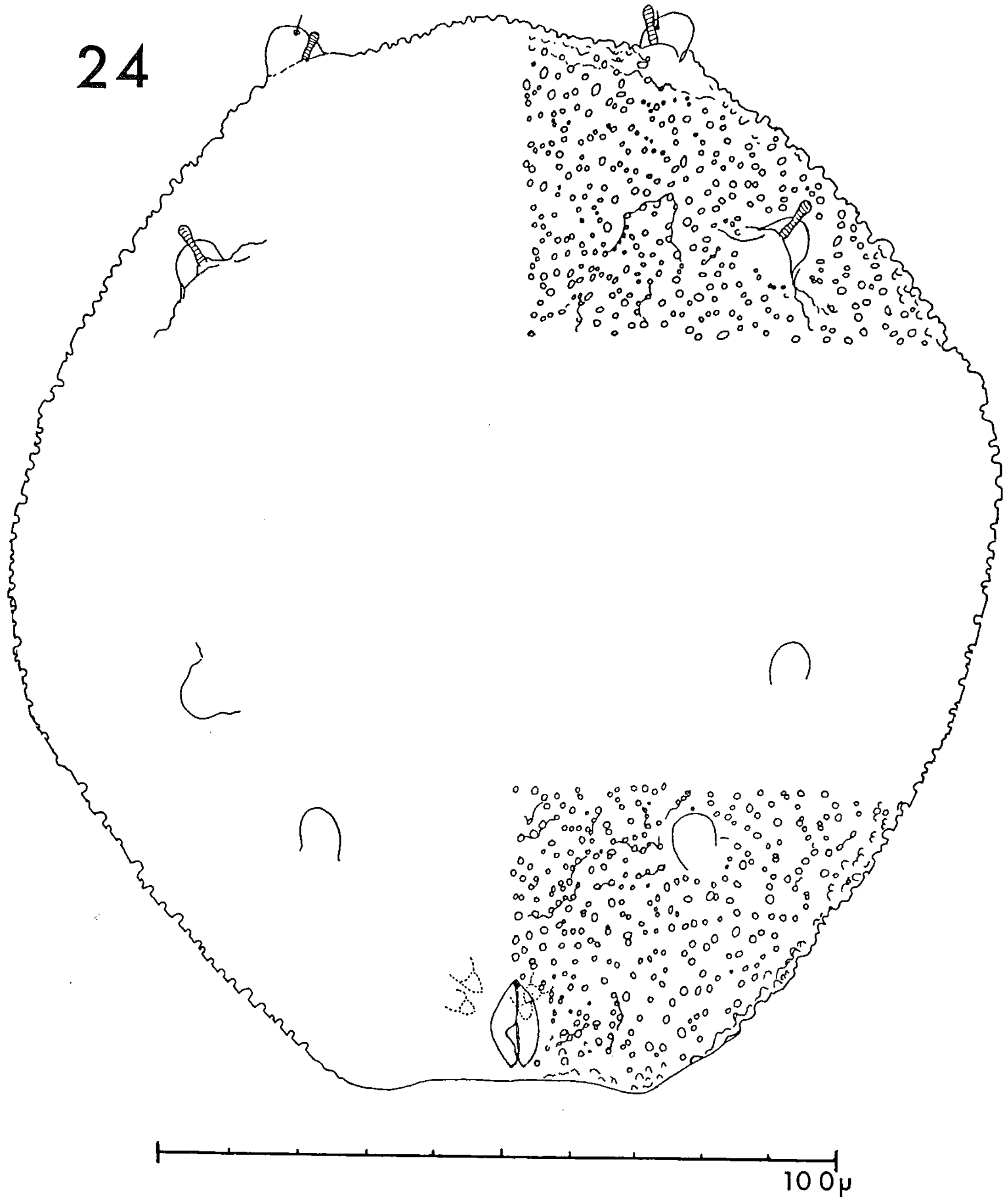

Fig. 24: *Alabidopus asiaticus* sp. nov.—inert hypopus.

HOST AND DATA—*Rattus rajah* (Thomas, 1894), Subang Forest Reserve, Selangor, 7 May, 1979, trapped by technicians of the Institute for Medical Research, Kuala Lumpur. Hypopi were found in the dorsal hair follicles at the level of the pelvic region.

Holotype deposited in the British Museum, London; paratypes with the Institute for Medical Research, Kuala Lumpur; the Institut de Médecine Tropical, "Prince Leopold", Antwerp; and the Department of Aquatic Ecology, Catholic University, Nijmegen.

Key to the species of *Alabidopus* Fain, 1967, based on hypopi

1. All dorsal hysterosomal setae in the shape of conical spines 2
- Most dorsal setae bifid 3

2. Coxal fields III open; genu III seta spinose; idiosomal width 190 ..... *A. hydromys* Fain, 1967
- Coxal fields III closed; genu III seta barbed; idiosomal width 145 .... *A. muris* Lukoschus et al., 1979

3. Genu I with two solenidia; medio-ventral setae of tarsi without barbs; *omega* 1 and 3 on common basal plate; scapular setae spinose with rounded tips .... *A. microcebus* Fain & Lukoschus, 1977
- Genu I with one solenidion; medio-ventral setae of tarsi barbed; *omega* 1 and 3 separate; scapular bifid 4

4. Solenidia *alpha* longer than palposoma setae, *v i* 18 only, basally slightly thickened .... *A. bipilifer* Fain & Uchikawa, 1980
- Solenidia *alpha* shorter than palposoma setae, *v i* longer than 20, thickened 5

5. Seta *v i* ca. 49 long, palposomal seta ca. 34 long, *alpha* 21 long, body length ca. 258, body width ca. 162 .... *A. malaysiensis* sp. nov.
- Seta *v i* ca. 24 long, palposomal seta 23 long, *alpha* 10 long, body length ca. 223, body width ca. 140 .... *A. asiaticus* sp. nov.

SYSTEMATICAL POSITION

Genus *Alabidopus* Fain, 1967

In a previous paper (Lukoschus et al., 1979) we have described for the first time the tritonymph of a species of genus *Alabidopus* (e.g. *A. muris* from Australia). The present work allows us to give figures of the adults, male and female of another species found in Malaysia.

According to the general characters of the adults the genus *Alabidopus* (at least for the species whose adults are known) belongs to the family Glycyphagidae. It differs however clearly from all the genera included in the Glycyphagidae by the following characters: smooth aspect of the cuticle, the complete absence of propodonotal punctate plates, the shape of the legs, with tarsi moderately elongate and ending in a well-formed claw, in the male by the presence of two copulatory suckers on tarsi IV and the presence of adanal suckers. By these characters, especially the tarsal and adanal suckers in the male, the genus *Alabidopus* cannot be included in any of the known subfamilies of Glycyphagidae. We think therefore that the subfamily Alabidopinae Fain, 1967, created for the genus *Alabidopus* should be retained.

NOTES AND RESULTS OF REARING EXPERIMENTS ON *ALABIDOPUS ASIATICUS*

PROCEDURAL NOTES—Glass vials (10 ml capacity) were filled to a height of 1cm with a mixture of plaster and activated charcoal. Hosts were captured in live traps and sacrificed by direct cardiac injection, using ethyl alcohol, and then refrigerated for one day at about 4°C. Hypopi were extracted from the skin of the dorsum in the region of the pelvis, using jeweler's forceps, and placed inside the vials with skin scrapings which contained skin scales, hairs, sebum, and unidentified debris from the skin surface. A small amount of active baker's yeast in a pasty form was added to the vial. Vials were closed with cotton wool stoppers and kept in darkness in an incubator at 30°C. Vials were observed with a dissecting microscope. Cultures were ventilated by blowing on the vial. Humidity in the vials was maintained by the addition of droplets of water to the plaster.

NOTES ON THE MOST SUCCESSFUL REARING (Beginning 10 May 1979)

Day 0—50 hypopi were removed from a non-gravid, non-lactating female *Rattus whiteheadi* after one day of refrigeration.
Day 1—22 hypopi seen running on the glass and plaster.
Day 2—Some hypopi became quiescent.
Day 3—First tritonymph appeared and was observed feeding on skin scrapings and yeast.
Day 5—First adults appeared and were observed in copulation.
Day 6—First eggs appeared and were located in grooves of plaster.
Day 8—First larvae observed, all initially immobile.
Day 11—First protonymphs observed, all initial hypopi and adults immobile.
Day 15—First active reared, hypopi observed, most protonymphs immobile.
Day 18—Some swollen, partially egg-shaped protonymphs were observed changing to a yellow color.
Day 22—Rearing terminated, specimens sacrificed for preparation.

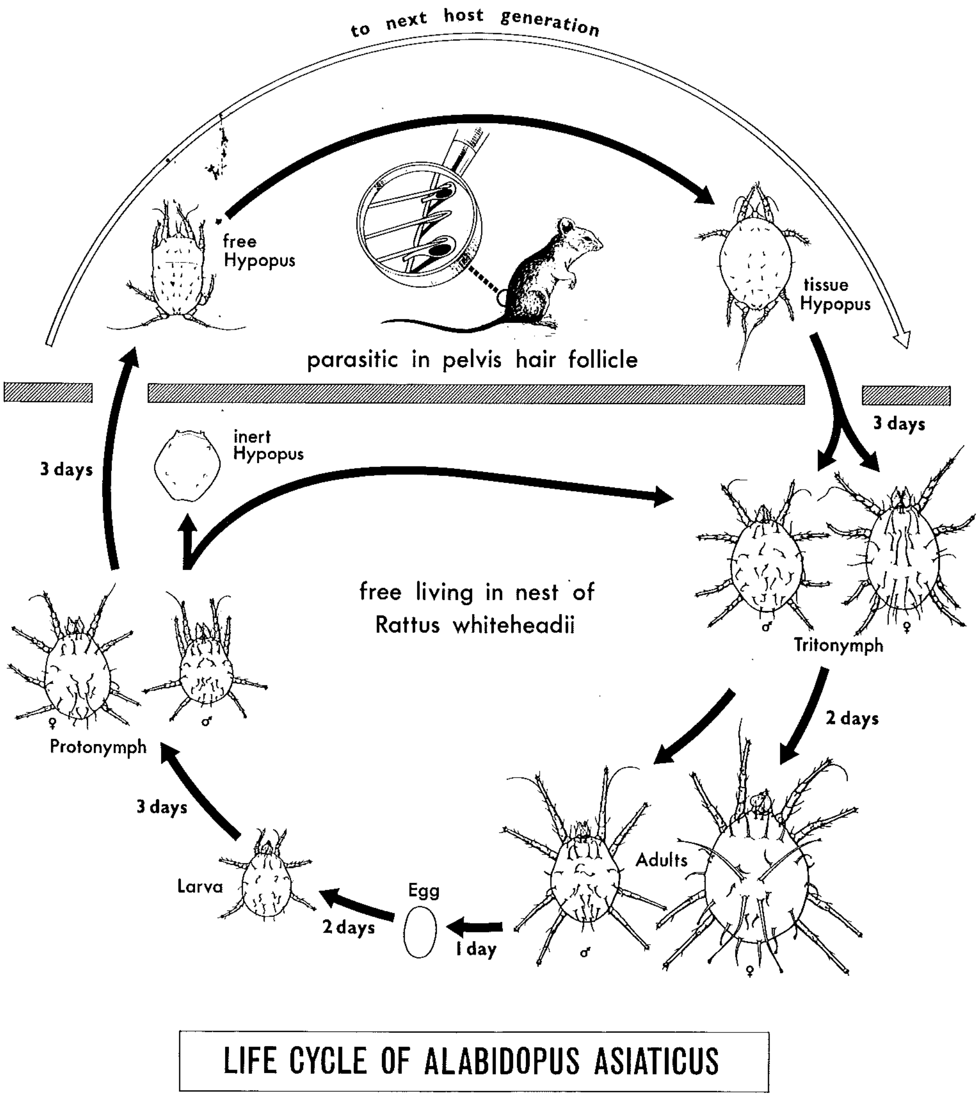

Fig. 25: *Alabidopus asiaticus* sp. nov. —life cycle.

It is strongly suspected that the rearing conditions were suboptimal, and certainly not comparable to their natural habitat. A large number of dead specimens had fungi growing within the body. Hypopi stuck in the sebum or stuck by their dorsum to the vial wall did not start development. These dates are given in graphic form in Fig. 25.

DISCUSSION

ALTERNATIVE POST-PROTONYMPHAL DEVELOPMENT—*Alabidopus asiaticus* is most remarkable because the protonymph may give rise to one of three stages: an inert hypopus, an active hypopus, or a tritonymph. This phenomenon was previously unknown for glycyphagids "phoretic" on mammals. Indeed, the only other known instance, for all of Astigmata, of an active and an inactive hypopus within one species is that of *Chaetodactylus* species associated with Hymenoptera. Active and inactive hypopi of *Chaetodactylus* were described by Trouessart (1904) for *C. ludwigi* (Trouessart, 1897), by Popovici-Baznosanu (1913) and Fain (1966) for *C. osmiae* (DuFour, 1839), and by Baker (1962) for *C. krombeini* (Baker, 1962). Facultative hypopial production is well known for Astigmata associated with stored products.

Although the mechanism to initiate hypopus formation of either stages, or to by-pass the deutonymph is unknown, the general conditions associated with each alternative have been characterized (Zakhvatkin, 1941). Under "favorable" environmental conditions the deutonymph is by-passed. "Unfavorable" conditions lead to the production of the hypopus. An active hypopus would serve as a dispersal agent, and an inactive hypopus may function to survive unfavorable conditions in the immediate vicinity.

The discovery of facultative hypopial production for a mammal associated species, as well as active and inactive hypopi for both a mammal and insect associated species, raises several questions. It is quite possible that facultative hypopial production may be a common pattern for mammal-associated glycyphagidae. The biologically disperate nature of the phoriants associated with both active and inactive hypopi is similarly suggestive. Additional rearing studies are badly needed to clarify these questions.

DEVELOPMENT PERIOD—It is now quite clear that only a short period of time is required to complete the life cycle (excluding the deutonymph) of mammal associated Glycyphagidae. Where species have been reared from the initial hypopus to the hypopus of the next generation, as few as 15 days may be required, as for *Alabidopus asiaticus* in the present work. Fain & Lukoschus (1974) have reported on rearing other species of Glycyphagidae that fall into two groups: a complete cycle of hypopus to hypopus, or hypopus to the next generation protonymph.

In the first group *Lophioglyphus liciosus* Volgin, 1964 (=*Apodemopus apodemi* Fain, 1965) required 17 days. In the second group, *Baloghella melis* Mahunka, 1963 (=*Melesodectes auricularis* Fain & Lukoschus, 1968) required 18 days; *Marsupialichus marsupialis* Fain et al., 1972 required 20 days; *Xenoryctes krameri* (Mchael, 1886) required 27 days; *Dermacarus sciurinus* (Koch, 1841) required 32 days. Although other rearings were successfull only to the tritonymph or adult stage, the time required was always very short, usually less than 7 days.

Although the developmental period for the deutonymphal stage is unknown, it is strongly suspected to coincide with the period between host reproductive events. During this prolonged period on the host, it is unclear to what extent, if any, that "growth" takes place. However, active hypopi that have been reared are smaller than the hypopi that are taken from the host.

SEXUAL DIMORPHISM—Most glycyphagid species that are phoretic or parasitic on mammals as deutonymphs exhibit sexual dimorphism as adults. Generally males are much smaller than females. Males may have special clasping structures for copulation such as hypertrophied, pincer-like legs II, as in *Baloghella melis* (Lukoschus et al., 1971), specializations of tibial setae I and II as in *Myacarus* species (Fain & Lukoschus, 1974), or additional specialized setae on femur and genu II as in *Xenoryctes krameri*. There may also be remarkable differences in the lengths of dorsal setae as in *Lophioglyphus liciosus*, *I. japonicus* (Lukoschus et al.,1977), *Orycteroxenus dispar* and *O. galemys* (Lukoschus et al., 1979). However, sexual dimorphism in each of these species, except for differences in size, is seen only in the adults.

Males and females of *Alabidopus asiaticus* exhibit parallel differences in the lengths of dorsal setae, especially in the length of dorsals 2 and 3 (Table 2). More importantly, these differences are also present in the tritonymphs and to a lesser degree in the protonymphs. Differences in the lengths of dorsal setae are correlated with differences in body size. Moulting tritonymphs with long setae contain females. Moulting tritonymphs with short setae contain males. Protonymphs with long setae were observed to moult into either inert or active hypopi as was the case for protonymphs with short setae. Inert hypopi do not exhibit morphological differences, nor do active hypopi.

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