

THE LIFE-CYCLE OF *POMERANTZIA PHILIPPINA* SP. N. (PROSTIGMATA: POMERANTZIIDAE) DESCRIBED FROM THE PHILIPPINES

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ABSTRACT: Herein we describe all active stages, including a prelarva with fully articulated legs, of the new species *Pomerantzia philippina* (Prostigmata: Eleutherengona: Pomerantziidae). This is the first description of a prelarva in the family and the first known representative of the family from the Philippines. Adult of the new species differs from 3 other species of the genus by the presence of 12 setae on both tarsi III and IV (vs. 11). Additionally, it differs from *P. charlesi* Baker, 1949 by the presence of 9 setae on tibiae IV (vs. 8), from *P. benhami* Price, 1974 by the absence of the reticulate pattern on the propodonal shield, and from *P. subterranea* Fan et Chen, 2005 by the presence of 19 setae on tarsi I (vs. 18).

KEY WORDS: Acari, soil, life-cycle, systematics, external morphology, Pomerantziidae

INTRODUCTION

Soil inhabiting mites of the family Pomerantziidae has been recently revised by Fan and Chen (2005). After this exemplary review the family includes five species of two genera: *Pomerantzia* Baker, 1949 with species *P. charlesi* Baker, 1949, *P. benhami* Price, 1974, and *P. subterranea* Fan et Chen, 2005 and *Apomerantzia* Fan et Chen, 2005 with species *A. prolata* (Price, 1971) and *A. kethleyi* (Price, 1975). Four pomerantziid species were described from the North America (Baker 1949; Price 1971, 1974, 1975, Price and Benham 1976) and one species, *P. subterranea* from China (Fan and Chen 2005).

In this paper we describe one more pomerantziid species, *Pomerantzia philippina* sp.n. from the Philippines based on all stages of the life-cycle, including the first known prelarva for the family. We also re-examined North American pomerantziids and made some minor corrections concerning numbers of their leg setae. The recent records of pomerantziids from China and the Philippines, along with record of the undescribed species from Malaysia (Kethley 1990), suggest that this family has a world-wide distribution.

MATERIAL AND METHODS

All specimens examined in this study are deposited in collection of the Field Museum Natural History, Chicago, USA (FMNH). In the descriptions below, the gnathosomal chaetotaxy follows Grandjean (1947); the idiosomal chaetotaxy follows Grandjean (1939) as adapted for Prostigmata by Kethley (1990); the leg chaetotaxy follows

Grandjean (1944) as applied to Raphignathidae by Atyeo (1963) with some modifications concerning notations of the additional setae. All measurements are given in micrometers (µm).

SYSTEMATICS

Family Pomerantziidae Baker, 1949

Genus *Pomerantzia* Baker, 1949

Pomerantzia philippina sp. n.

Figs 1–9

Description. Prelarva (Fig.1). *Gnathosoma*. Palpi with 4 free segments (palpal trochanter almost fused with palpal femur) bearing small scale-like setae. Palpal femora with 3 teeth arranged in dorso-basal row. Palpal coxae with ventral lobes. Chelicerae represented by two lumps without digits and setae. *Idiosoma*. Sejugal groove absent. Peritremes and podocephalic canals absent. Pair of lateral bands consisted of small tubercles bordering idiosoma laterally. Idiosomal dorsum bearing serrate setae *ve*, *sci*, *sce*, *cl*, and 2 pairs of opisthonotal scales. Urstigmae (Claparede's organ) present. Idiosomal venter bearing only setae *3a*. *Legs*. All 3 pairs of legs with 5 free segments, bearing teeth and scale-like setae. Coxae I and III each with tooth, coxae II without teeth. Trochanters I and II without teeth, trochanters III with tooth. Femora I, II, and III with 5, 3, and 4 setae, respectively. Additionally, femora I and III each with 3 teeth arranged in dorso-basal row (the same tooth row observable on palpal femora). Genua I–III each with 4 setae. Tibia I, II and IV with 7, 5, and 4 setae, respectively. All tarsi with well developed

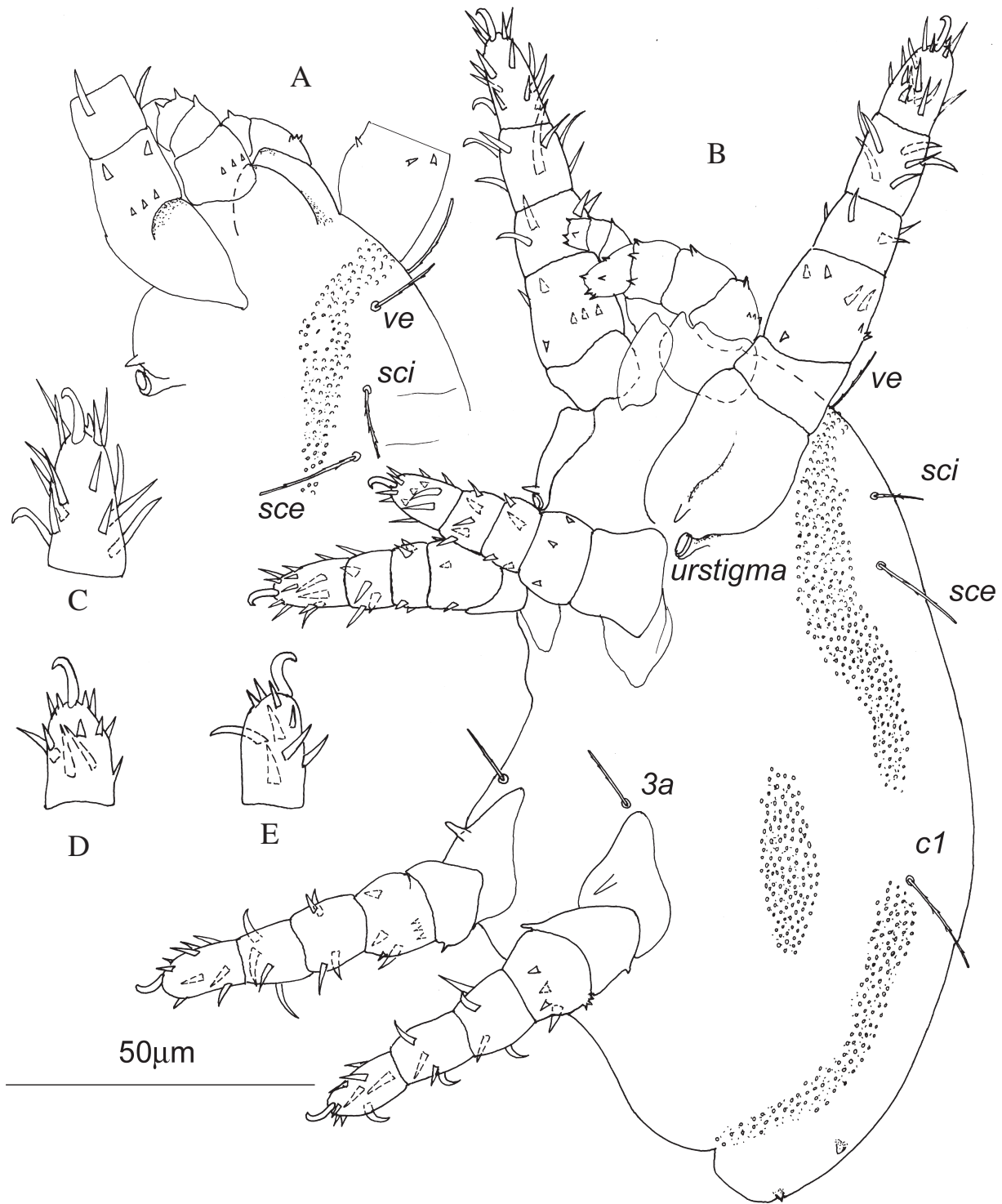


Fig. 1. *Pomerantzia philippina* sp.n., prelarva. A — body anterior part, dorsal view; B — body, lateral view; C–E — tarsi I–III, respectively, dorsal view.

smooth claw, tarsus I with small accessory claw. Pretarsi not developed. Tarsi I with 14 setae, tarsi II and III with 12 and 9 setae, respectively.

Larva (Figs 2, 3). *Gnathosoma*. Palpi with 5 free segments. Palpal femur and genu each with filiform seta *d*. Palpal tibia bearing well developed claw in dorso-lateral position and 3 setae, 2 filiform

setae, *d*, *l''* and spur-like seta *l'*. Palpal tarsus in dorso-lateral position (thumb-claw complex) with full set of setae, eupathidia *ul'*, *ul''*, *sul*, and *acm*, filiform setae *ba*, *bp*, *va*, *lp*, and solenidion ω . Chelicerae distinctly developed and completely separated from each other and from subcapitulum, dorso-apically bearing scale-like setae *cha*. Mova-

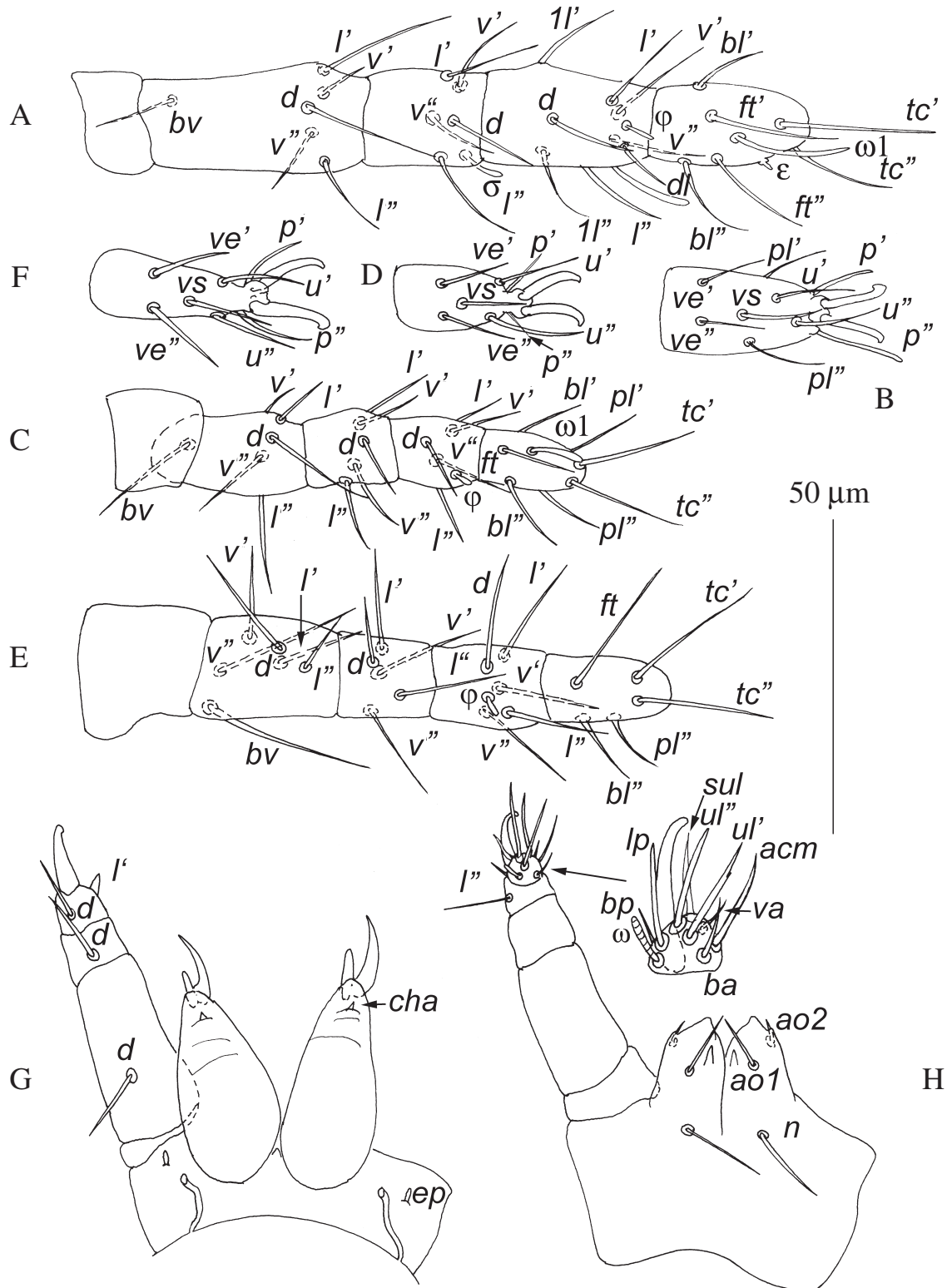


Fig. 2. *Pomerantzia philippina* sp.n., details of larva. A — leg I, dorsal view; B — tarsus I, ventral view; C — leg II, dorsal view; D — tarsus II, ventral view; E — leg III, dorsal view; F — tarsus III, ventral view; G — gnathosoma, dorsal view; H — same, ventral view.

ble digits of chelicerae distinctly developed, hook-like, fixed digits strongly reduced. Gnathobase with dorsal setae *ep* and 3 pairs of ventral setae *ao1*, *ao2*, and *n*. Peritremes absent. *Idiosoma*. Podoccephalic canals distinctly developed. Idiosomal

setae filiform and indistinctly serrate. Dorsum of idiosoma with 6 shield, propodonotal shield with 3 pairs of setae, *ve*, *sci*, and *sce*; shields C, D, and E each with one pair of setae, and shields F and H each with two pairs of setae. Setae *c2* situated of shield

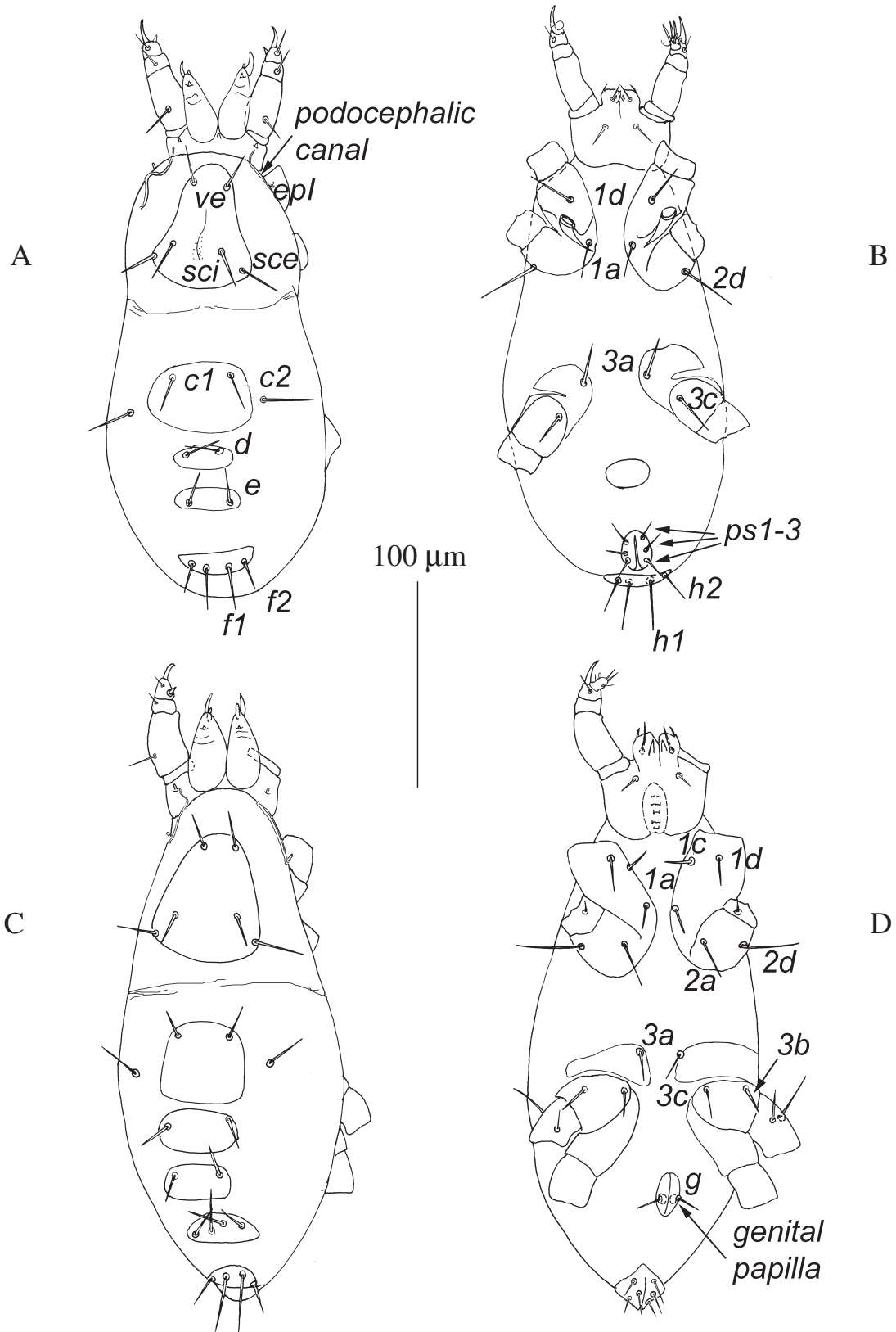


Fig. 3. *Pomerantzia philippina* sp.n., bodies of immature instars. A — larva, dorsal view; B — larva, ventral view; C — protonymph, dorsal view; D — same, ventral view

C, slightly below level of seta *c1* bases. Urstigmae present. Venter of idiosoma with small round opisthogastric shield. Anal orifice surrounded by 3 pairs of pseudoanal setae (*ps1-3*). *Legs*. All legs

with 5 free segments, femora not separated. All tarsi with paired smooth claws, pretarsi not developed, empodium absent. Coxisternal shields I-II separated medially. Coxae I-II and III situated far

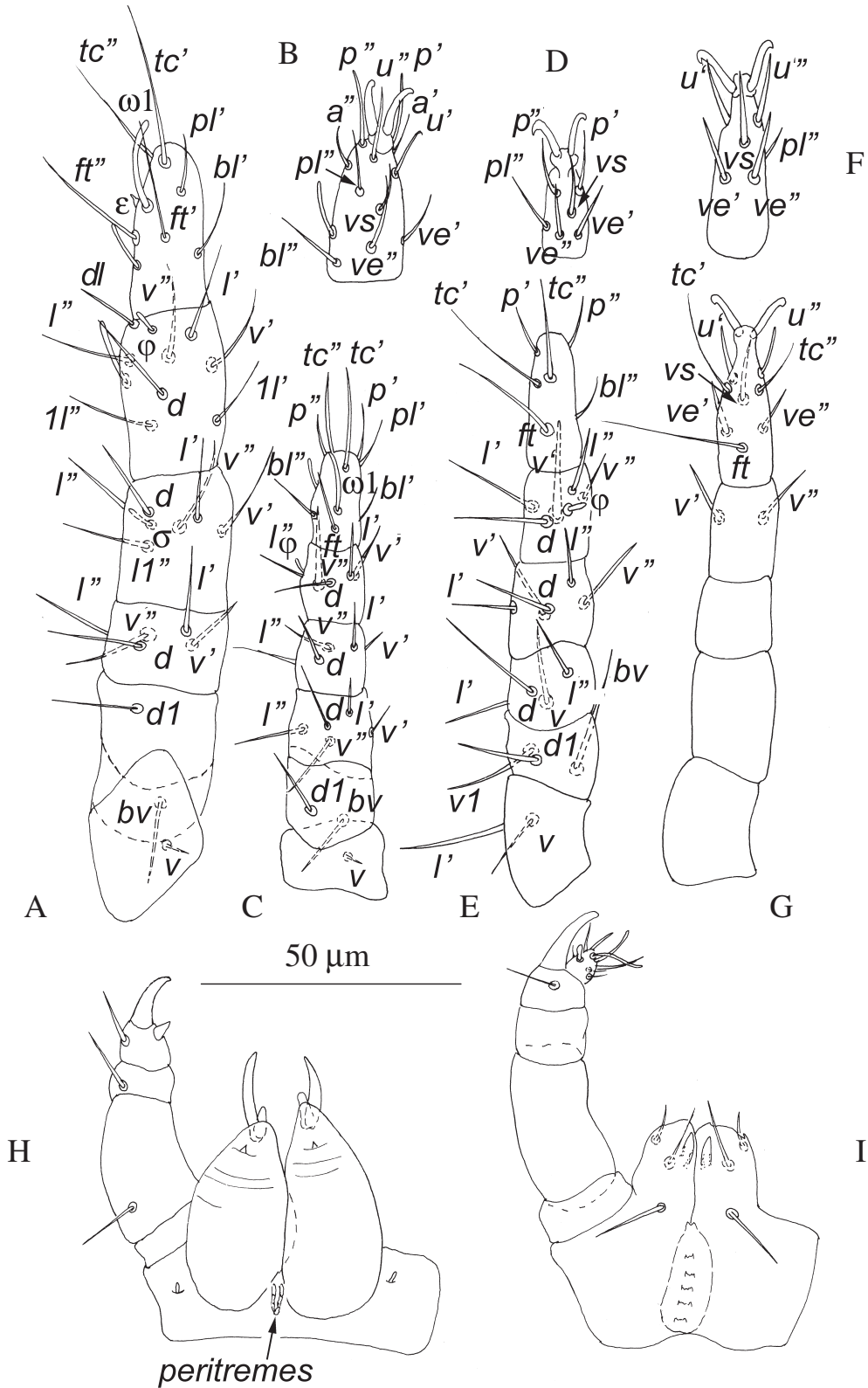


Fig. 4. *Pomerantzia philippina* sp.n., details of protonymph. A — leg I, dorsal view; B — tarsus I, ventral view; C — leg II, dorsal view; D — tarsus II, ventral view; E — leg III, dorsal view; F — tarsus III, ventral view; G — leg IV, dorsal view; H — gnathosoma, dorsal view; I — same, ventral view.

from each other. Leg setation: *ta* I with 15 setae, (*tc*), (*ft*), (*pl*), (*bl*), (*p*), (*u*), *vs*, (*ve*), solenidion ω and famulus ϵ ; *ta* II with 14 setae, (*tc*), (*ft*), (*pl*), (*bl*), (*p*),

(*u*), *vs*, (*ve*), and solenidion ω ; *ta* III with 12 setae, (*tc*), *pl*"', *ft*, *bl*"', (*p*), (*u*), *vs*, (*ve*); *ti* I with 8 setae, *d*, *d1*, (*l*), (*v*), (*ll*) and 2 solenidia ϕ ; *ti* II–III with 5

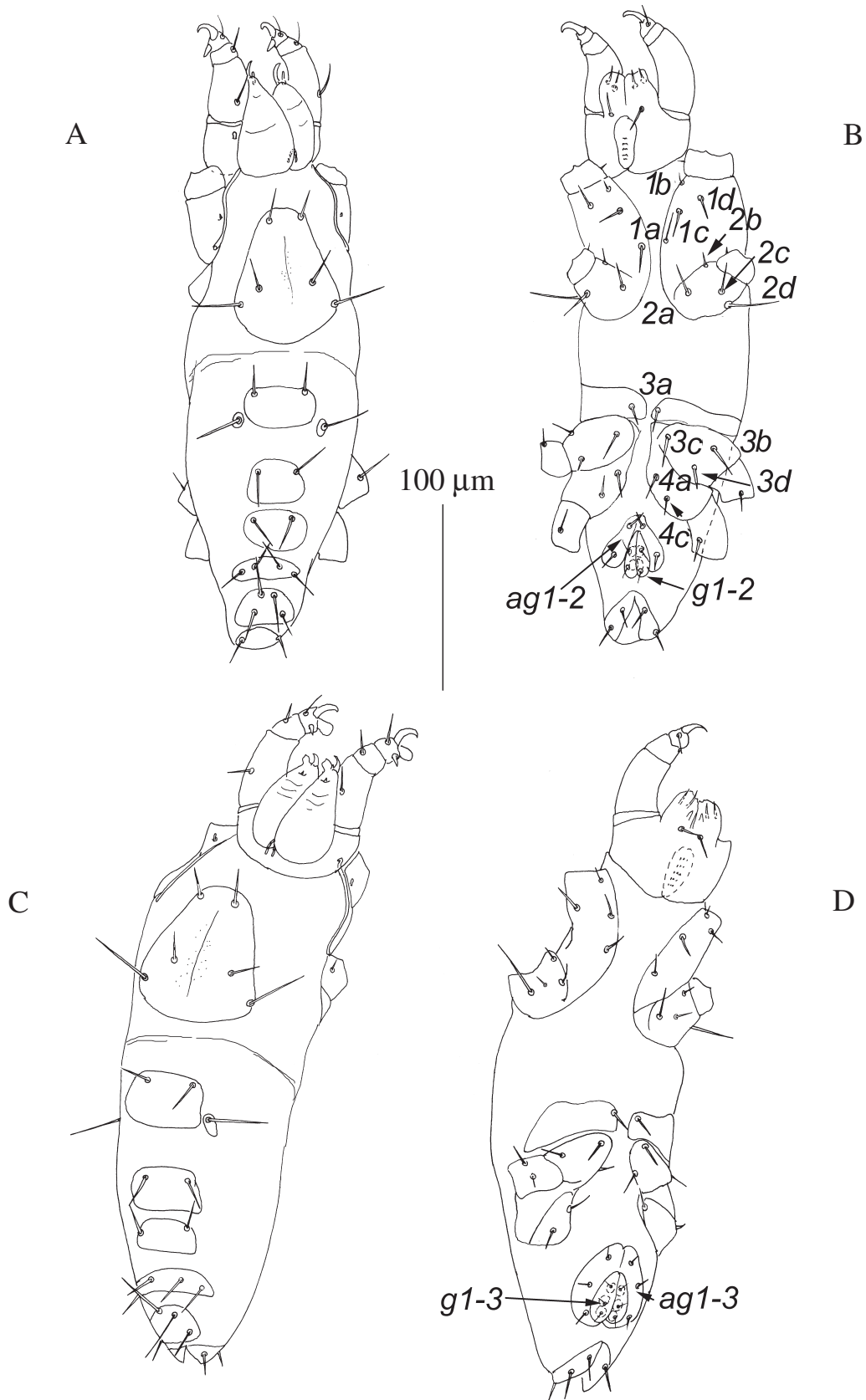


Fig. 5. *Pomerantzia philippina* sp.n., bodies of immature instars. A — deutonymph, dorsal view; B — deutonymph, ventral view; C — tritonymph, dorsal view; D — same, ventral view.

setae, *d*, (*l*), (*v*), and solenidion ϕ ; *ge* I with 5 setae, *d*, (*l*), (*v*), and solenidion σ ; *ge* II–III with 5 setae, *d*, (*l*), (*v*); *fe* I–III with 5 setae, *d*, (*l*), (*v*), *bv*; *tr* I–III

without setae; *cx*I with 2 setae, *1a*, *1d* and solenidion *ep*I situated dorsally; *cx*II with 1 seta, *2d*; *cx*III with 2 setae, *3a*, *3c*.

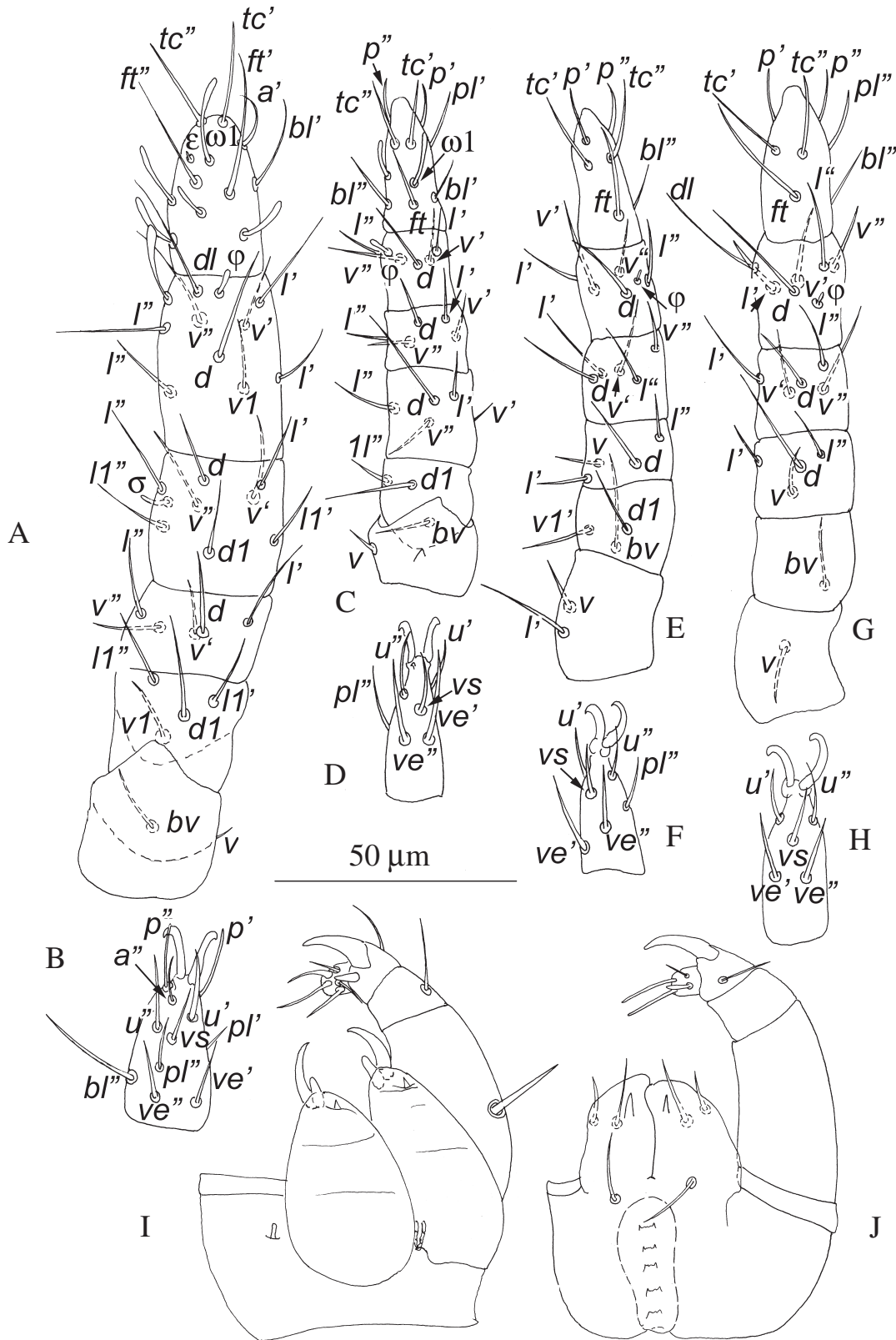


Fig. 6. *Pomerantzia philippina* sp.n., details of deutonymph. A — leg I, dorsal view; B — tarsus I, ventral view; C — leg II, dorsal view; D — tarsus II, ventral view; E — leg III, dorsal view; F — tarsus III, ventral view; G — leg IV, dorsal view; H — tarsus IV, ventral view; I — gnathosoma, dorsal view; J — same, ventral view.

Protonymph (Figs 3, 4). *Gnathosoma*. Small, 3 segmented peritremes situated between cheliceral bases added. *Idiosoma*. Genital and anal orifices

distinctly separated. Setae *gl* and pair of genital papillae added. Opistogastric shield absent. *Legs*. Legs IV added. Femora I–III subdivided onto tel-

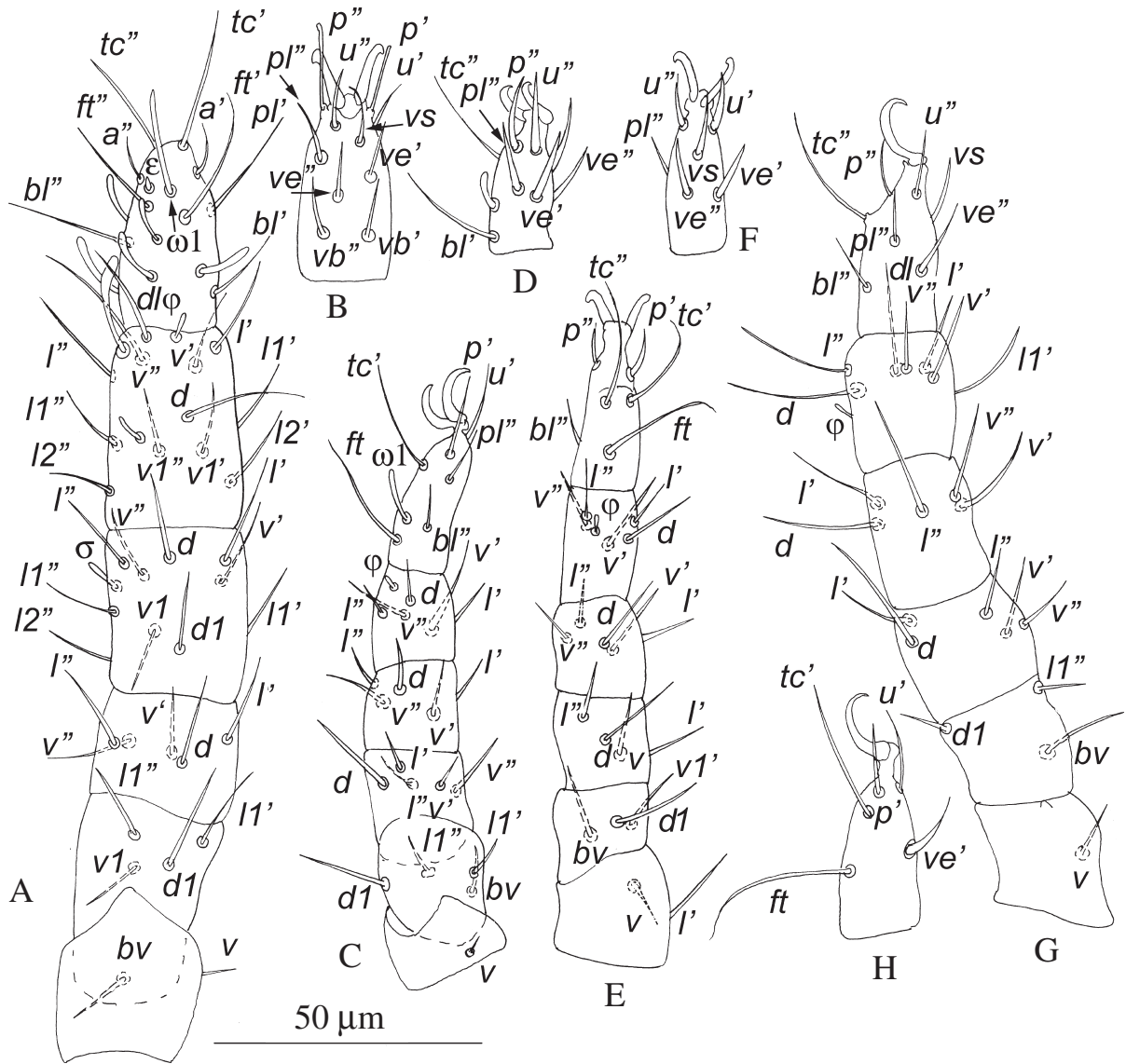


Fig. 7. *Pomerantzia philippina* sp.n., legs of tritonymph. A — leg I, dorsal view; B — tarsus I, ventral view; C — leg II, dorsal view; D — tarsus II, ventral view; E — leg III, dorsal view; F — tarsus III, ventral view; G — leg IV, lateral view; H — tarsus IV, lateral view.

of femur and basifemur. Leg setation: *ta* I with 17 setae, (*a*) added, 2 solenidia ω and famulus ϵ ; *ta* II with 14 setae, and solenidium ω ; *ta* III with 12 setae; *ta* IV with 8 setae, (*tc*), *ft*, (*u*), *vs*, (*ve*); *ti* I with 8 setae and 2 solenidia ϕ ; *ti* II–III with 5 setae and solenidium ϕ ; *ti* IV with 2 setae, (*v*); *ge* I with 6 setae, *ll*'' added, and solenidium σ ; *ge* II–III with 5 setae; *ge* IV without setae; *fe* I–II with 5+2 setae, *d*, (*l*), (*v*) + *d1*, *bv*; *fe* III with 4+3 setae, *d*, (*l*), *v* + *d1*, *v*, *bv*; *tr* I–II with one seta, *v*; *tr* III with 2 setae, *v*, *l*; *tr* IV without setae; *cxI* with 3 setae, *1c* added, and solenidium *epl*; *cxII* with 2 setae (*2a* added); *cxIII* with 3 setae (*3b* added); *cxIV* without setae.

Deutonymph (Figs 5, 6). *Gnathosoma*. Same as in protonymph. *Idiosoma*. Second pair of genital setae (*g2*) and genital papillae added; setae *ag1*–2

added, situated on separate aggenital shield. *Legs*. Femora of all legs separated onto telofemur and basifemur. Leg setation: *ta* I with 17 setae, 5 solenidia ω , and famulus ϵ ; *ta* II with 14 setae and 2 solenidia ω ; *ta* III–IV with 12 setae, (*p*), *pl*'', *bl*'' added on tarsus IV; *ti* I with 9 setae, *v1* added, and 2 solenidia ϕ ; *ti* II–III with 5 setae and solenidium ϕ ; *ti* IV with 6 setae, *d*, *d1*, (*l*) added, and solenidium ϕ ; *ge* I with 8 setae, *d1* and *l*'' added, and solenidium σ ; *ge* II–IV with 5 setae, *d*, (*v*), (*l*) added on genu IV; *fe* I with 5+5 setae, (*l*), *v1* added; *fe* II with 5+3 setae, *ll*'' added; *fe* III with 4+3 setae; *fe* IV with 4+1 setae, *d*, (*l*), (*v*) + *bv*; *tr* I–III with one seta, *v* added on *tr* IV; *tr* III with 2 setae; *cxI* with 4 setae, *1b* added, and solenidium *epl*; *cxII* with 4 setae, *2c*, *2b* added; *cxIII* with 4 setae, *3d* added; *cxIV* with 2 setae, *4a*, *4c* added.

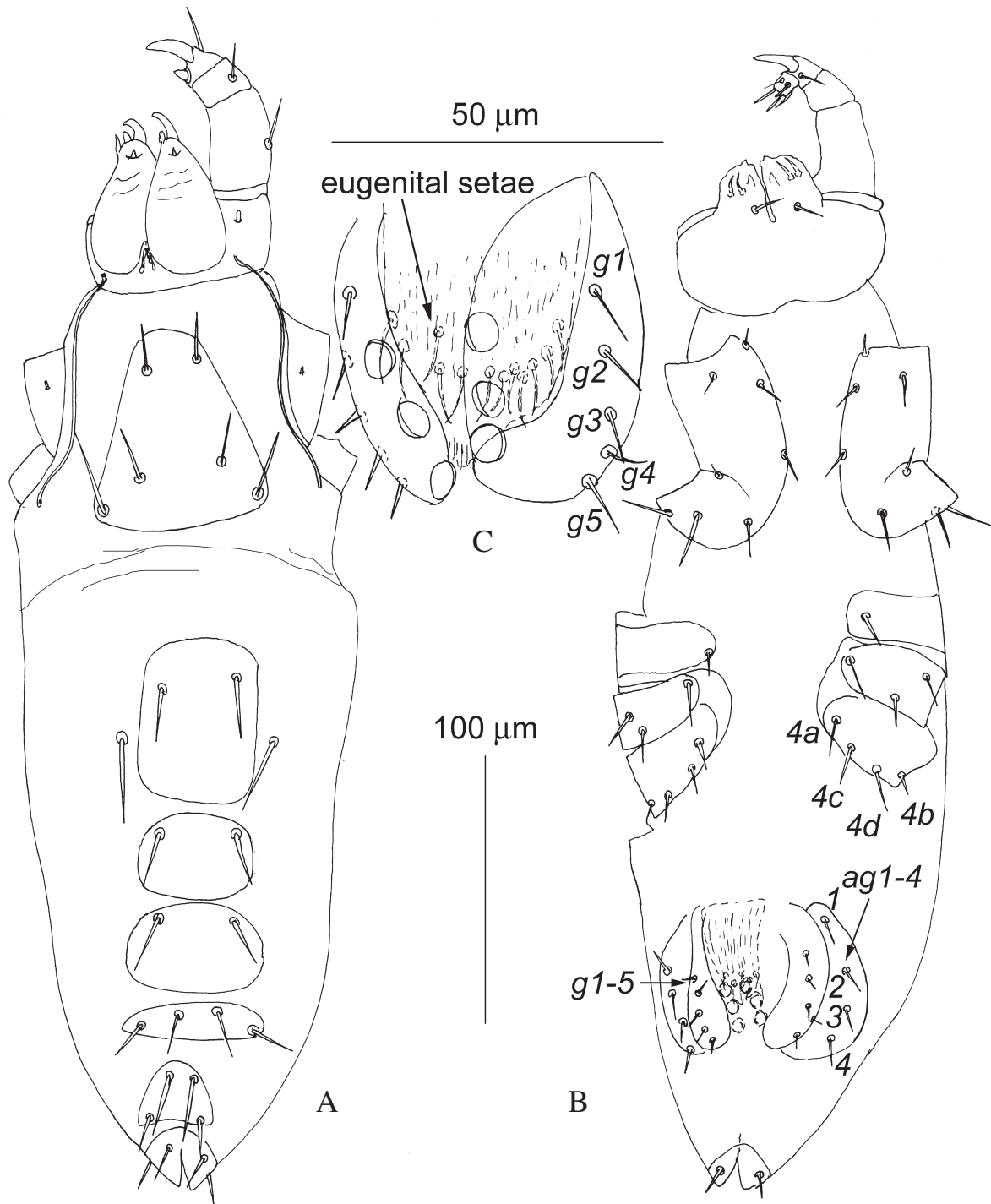


Fig. 8. *Pomerantzia philippina* sp.n., holotype female. A — body, dorsal view; B — same, ventral view; C — ovipositor. Scale bars: 100 µm (A, B), 50 µm (C).

Tritonymph (Figs 6, 7). *Gnathosoma*. Same as in deutonymph. *Idiosoma*. Third pair of aggenital (*ag3*) and genital (*g3*) setae, and genital papillae added. *Legs*. Leg setation: *ta* I with 19 setae, (*vb*) added, 6 solenidia ω , and famulus ϵ ; *ta* II with 14 setae and 2 solenidia ω ; *ta* III–IV with 12 setae; *ti* I with 12 setae, *v1'*, (*l2*) added and 3 solenidia ϕ ; *ti* II–III with 5 setae and solenidium ϕ ; *ti* IV with 7 setae, *l1'* added, and solenidium ϕ ; *ge* I with 10 setae,

l2'', *v1* added, and solenidium σ ; *ge* II–IV with 5 setae; *fe* I with 5+5 setae; *fe* II with 5+4 setae, *l1'* added; *fe* III with 4+3 setae; *fe* IV with 5+3 setae, (*v*)+*d1*, *l1''* added; *tr* I–III with one seta, *v* added on *tr* IV; *tr* III with 2 setae; *cxI* with 4 setae and solenidium *epl*; *cxII* with 3 setae; *cxIII* with 4 setae; *cxIV* with 2 setae.

Female, holotype (Figs 8, 9). *Gnathosoma*. Same as in tritonymph. *Idiosoma*. Weakly sclero-

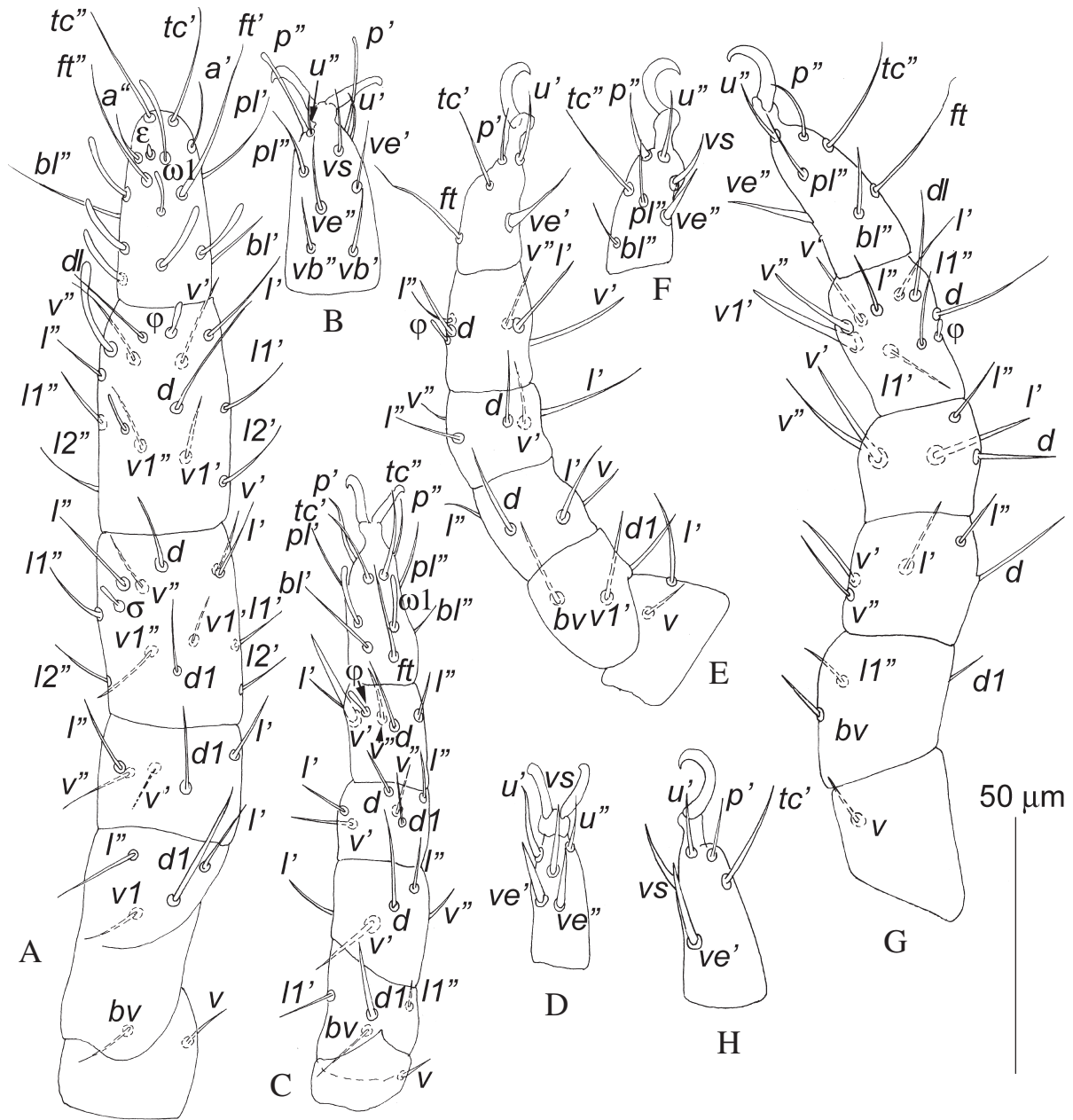


Fig. 9. *Pomerantzia philippina* sp.n., legs of female holotype. A — leg I, dorsal view; B — tarsus I, ventral view; C — leg II, dorsal view; D — tarsus II, ventral view; E — leg III, dorsal view; F — tarsus III, ventral view; G — leg IV, lateral view; H — tarsus IV, lateral view.

tized. Shields without ornamentation. Sejugal groove present. Fourth pair of aggenital setae (*ag4*) added. Two pairs of genital setae added (*g4–5*). Totally, 4 pairs of aggenital and 5 pairs of genital setae present. Ovipositor well developed, bearing 12 filiform eugenital setae. *Legs*. Shields bearing setae *3a* separated from coxae III. Leg setation: *ta* I with 19 setae, 7 solenidia ω , and famulus ϵ ; *ta* II with 14 setae and 2 solenidia ω ; *ta* III–IV with 12 setae; *ti* I with 12 setae and 3 solenidia ϕ ; *ti* II–III with 5 setae and solenidium ϕ ; *ti* IV with 9 setae, *l1''*, *v1* added, and solenidium ϕ ; *ge* I with 12 setae, *l2'*, *v1'*

added, and solenidium σ ; *ge* II with 6 setae, *d1* added, and solenidium σ ; *ge* II–IV with 5 setae; *fe* I with 5+5 setae; *fe* II with 5+4 setae, *l1'* added; *fe* III with 4+3 setae; *fe* IV with 5+3 setae; *tr* I–III with one seta, *v* added on *tr* IV; *tr* III with 2 setae; *cxI* with 4 setae and solenidium *epl*; *cxII* with 4 setae; *cxIII* with 4 setae; *cxIV* with 4 setae, *4b*, *4d* added.

Measurements: Gnathosoma 65 long and 80 wide. Palp 65 long. Palpal femur 55 long and 25 wide. Length of palpal setae: *dF* and *dG* about 15, *dTi* and *l'Ti* about 9. Length of gnathosomal setae *n* 15, *ao1* and *ao2* about 17. Idiosoma 350 long and

Table
Leg I–IV setation of Pomerantziidae

Species	Tarsi	Tibiae	Genua	Telo+ Basifemora	Trochanters	Coxae
<i>P. charlesi</i> Baker, 1949	19(8) 14(2) 11 ¹ 11 ¹	12(3) 5(1) 5(1) 8 ² (1)	12(1) 5 5 5 ⁴	5+5 5+4 4+3 5+3	1 1 2 1	4(1) 4 4 4
<i>P. benhami</i> Price, 1974	19(8) 14(2) 11 ¹ 11 ¹	12(3) 5(1) 5(1) 9(1)	12(1) 5 5 5 ⁴	5+5 5+4 4+3 5+3	1 1 2 1	4(1) 4 4 4
<i>P. subterranea</i> Fan et Chen, 2005	18 ¹ (8) 14(2) 11 ¹ 11 ¹	12(3) 5(1) 5(1) 9(1)	12(1) 5 5 5 ⁴	5+5 5+4 4+3 5+3	1 1 2 1	4(1) 4 4 4
<i>P. philippina</i> sp.n.	19(8) 14(2) 12 12	12(3) 5(1) 5(1) 9(1)	12(1) 5 5 5 ⁴	5+5 5+4 4+3 5+3	1 1 2 1	4(1) 4 4 4
<i>A. prolata</i> (Price, 1971)	19(6) 14(2) 11 ¹ 11 ¹	12(3) 5(1) 5(1) 9(1)	10 ³ (1) 5 5 6	5+5 5+4 4+3 5+3	1 1 2 1	4(2) 4 4 3
<i>A. kethley</i> (Price, 1975)	19(8) 14(5) 11 ¹ 12	12(3) 5(1) 5(1) 9(1)	10 ³ (1) 5 5 6	5+5 5+4 4+3 5+3	1 1 2 1	4(2) 4 4 3

() — number of solenidia, including famulus ϵ are in brackets. Absent setae: ¹ — pl'' ; ² — νI ; ³ — (12); ⁴ — $11''$

125 wide. Length of idiosomal setae: *ve*, *sci*, *c1*, *d*, *e*, *f1*, *h1* about 22; *f2*, *h2*, *ps1–3* about 17; *sce*, *c2* about 30; *g1–5* about 9; *ag 1–4* about 12. Legs I, II, III, IV about 200, 120, 170, and 190, respectively.

Type material. Female holotype, one prelarva, 6 larva, 5 protonymph, 3 deutonymph, and one tritonymph paratypes. PHILIPPINES: Romblon Prov., Sibuyan Isl, Magdiwang, beach near of Puto Point, 12°26'N, 122°41'E, soil [0–30cm, 31–60 cm, and 61–90 cm deft, flotation], May 1989, collector unknown.

Type depositories. Holotype and most paratypes are deposited in FMNH, one protonymph paratype in the Zoological Institute, Russian Academy of Sciences, Saint-Petersburg, Russia (ZISP).

Etymology. The species name refers the country of the type localization.

Comparative material. *Pomerantzia charlesi*: one female (FMNH), USA: [0–30 cm deft], other data unknown; one tritonymph (FMNH), USA: California, Jasper Co., peach orchard soil, 25 July 1936, coll. W.F. Turner.

Apomerantzia kethleyi: one deutonymph (FMNH), USA: Illinois, [Will Co., Goode now woods], soil [20–30 cm deft, Berlese funnel], 2 February 1974, coll. Suter.

Apomerantzia prolata: one female and one tritonymph (FMNH), USA: California, Grass Valley, pine soil, 28 March 1973, coll. D.W. Price.

Differential diagnosis. Female of the new species differs from females of the other species of the genus by the presence of setae pl'' on tarsi III and IV (see Table 1). Additionally, it differs from *P. charlesi* by the presence of setae νI on tibiae IV, from *P. benhami* by the absence of the reticulate pattern on the propodonal shield, and from *P.*

subterranea by the presence of 19 setae on tarsi I. The last species has 18 setae on tarsi I. We did not examine the type series of *P. subterranea* and based on figures from the original description (Fan and Chen 2005: fig. 3, p. 11, fig. 6, p. 15) suggest that the missing seta is pl'' , which presents in tritonymphs but disappears in females.

Remarks. (i) In *A. prolata* and *A. kethleyi*, seta pl'' of tarsus II is short, tooth-like. Therefore, this seta was misinterpreted by Price (1974, 1975) as a solenidion.

(ii) Price (1974) re-described *P. charlesi* based on the type series. In his re-description, some leg setae were overlooked due to poor condition of the type specimens. The correct number of leg setae for this species is given in Table.

DISCUSSION

In their review of the family, Fan and Chen (2005) applied a variant of Grandjean's leg chaetotaxy developed for anystoid mites (Prostigmata: Anystina) (Grandjean 1943). Since, pomerantziids belong to another infraorder, Eleutherengona, we prefer to use the nomenclature of leg setae which was developed by Grandjean (1944) for stigmatid mites (Eleutherengona: Stigmatidae). Later on, this nomenclature (with some modifications) was successfully applied to different eleutherengone families (Atyeo 1963; Lindquist 1986; Swift 2001; Fan and Zhang 2005). It should be noted that notations of the tarsal setae were not provided by Fan and Chen (2005) and there are some discordances in application of the Grandjean's nomenclature (Grandjean 1944) to tarsal setae among different authors. Among these discordances, the two primary variations should be noted to avoid proba-

ble confusion. The tarsal setae *a*, *pl*, and *pv sensu* Lindquist (1986; see also Norton 1977) correspond to setae *pl*, *bl*, and *ve sensu* Atyeo (1963) as applied in this paper. Another point of disagreement concerns the presence or absence of setae *k* on genua I in pomerantziids. Fan and Chen (2005) named the genual solenidion, which is homologous to solenidion *sigma* of all other Eleutherengona, as sensillum *k*. In our opinion, the true sensillum *k*, which characterises many eleutherengone taxa (Fan and Zhang 2005) and probably, functionally substitutes for solenidion *sigma*, is absent in pomerantziids and according to Swift (2001) in some raphignathoids (Eleutherengona: Raphignathoidea). At the same time, seta *dl* (dorso-lateral) of tibia I is likely homologous to seta *k sensu* Lindquist (1986). We, however, name this seta as *dl* to avoid confusion with sensillum *k* of genu I in other eleutherengones.

We compared our data about pomerantziid life-cycle with those of *A. prolata* (excluding prelarva) by Price (1974), and *P. subterranea* (starting from deutonymph) by Fan and Chen (2005). In these species, the character pattern in ontogeny is the same, except for some characters of the species/generic level (see Table). It is interesting that males of the family Pomerantziidae are still unknown. They were not found even among 122 individuals collected by Price (1974) in several localities in California. We believe, therefore, that pomerantziids are parthenogenetic.

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