

GERDIA N. GEN. FROM EASTERN NORTH AMERICA, WITH REDESCRIPTION OF  
THE TYPE SPECIES, *POROBELBA PARKI* JACOT, 1937 (ACARI, ORIBATIDA,  
DAMAEIDAE)

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**ABSTRACT** — A new mite genus, *Gerdia* (Oribatida: Damaeidae), is proposed for the North-American species *Porobelba parki* described by Jacot (1937). It is distinguished from *Porobelba* Grandjean, 1936 based on differences in prodorsum morphology, the absence of an unpaired porose area on the notogaster and the development of notogastral setae. *Porobelba* and *Gerdia* may be sister genera in a group that also includes *Dameobelba* Sellnick, 1929. *Gerdia parki* n. comb. is redescribed in detail based on numerous adults and its ontogeny is described for the first time. Eleven states (USA) and provinces (Canada) are added to its known distribution, which now encompasses a region from Manitoba to New Brunswick in the north and Missouri to North Carolina in the south.

**KEYWORDS** — *Gerdia*; *Porobelba*; *Porobelba parki*; oribatid mites; taxonomy; chaetotaxy; ontogeny; type-species; North America

## INTRODUCTION

The inclusion of the North-American species *Porobelba parki* Jacot, 1937 within the oribatid mite genus *Porobelba* Grandjean, 1936 was recently rejected (Miko, 2008), based on the absence of several diagnostic characters of this otherwise European genus. The most apparent is the absence of an unpaired cuticular porose area that occurs posteriorly on the adult notogaster, between insertions of setae *ps*<sub>1</sub> and *h*<sub>1</sub>. This porose area represents a secretory organ (Alberti et al., 1997) that is unique within Damaeidae; while variable in size and shape it is always present in *Porobelba* (Grandjean, 1954). Other characters of the prodorsum and notogaster, considered

commonly as genus-level diagnostic traits within Damaeidae, support the proposal of a new genus for the North-American species.

Our aim is to propose such a new genus, to provide a modern redescription of adults of *Porobelba parki* and describe its ontogeny for the first time. We also include information about its known distribution and the relationship of the new genus to *Porobelba*.

We dedicate the new genus to our friend and good colleague, oribatologist Gerd Weigmann from Berlin, Germany.

The terminology and general approach of F. Grandjean, as modified by Norton (1977), and Miko

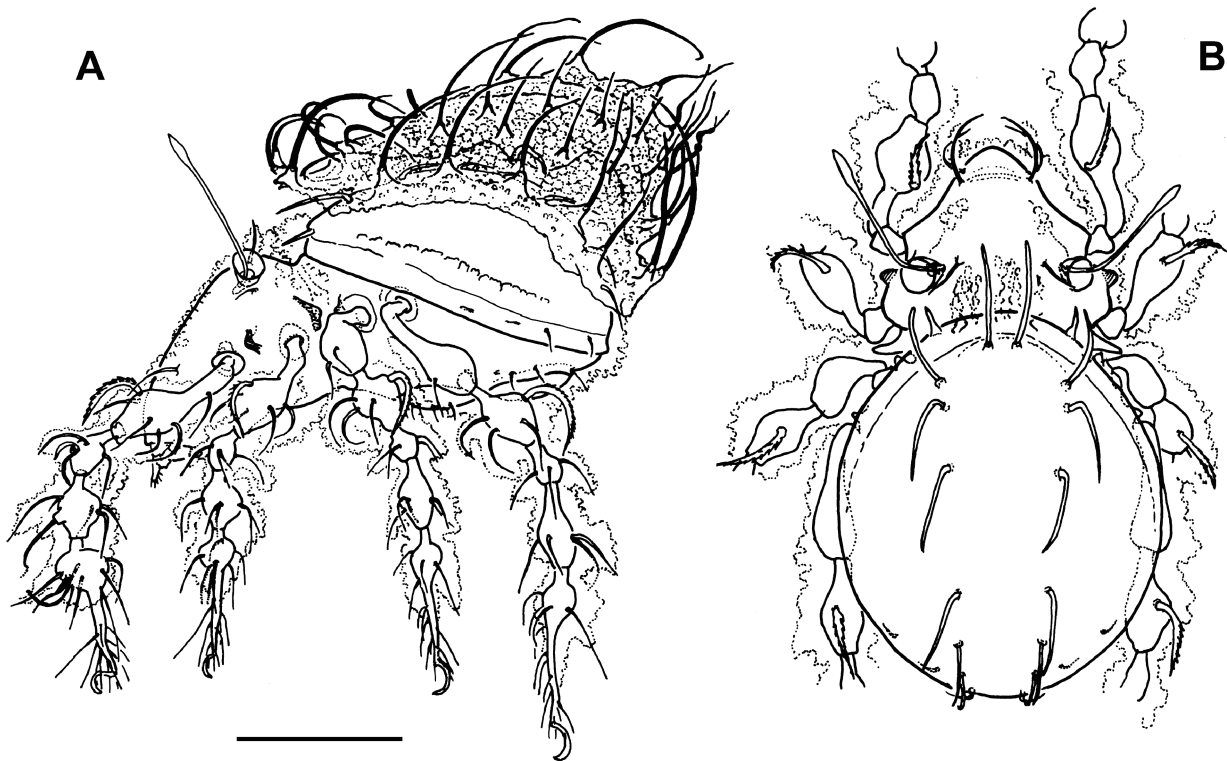


FIGURE 1: *Gerdia parki* (Jacot, 1937), habitus of adult: A – lateral view, with nymphal scalps (ventral setae and setae of legs only partly depicted); B – dorsal view (legs and their setation only partly depicted). Bar indicates 100  $\mu$ m.

and Travé (1996) were used. Van der Hammen (1980) and Hunt *et al.* (1998) provided glossaries of terms and an overview can be found in Norton and Behan-Pelletier (2009).

#### DIAGNOSIS OF *Gerdia* AND REDESCRIPTION OF TYPE SPECIES

##### *Gerdia* n.gen.

Body size about 305-380  $\mu$ m, yellowish brown, covered by thick layer of filamentous and granular cerotegument. Adult bears exuvial scalps. Prodorsum pentagonal or broadly triangular in dorsal view, laterally with well developed propodolateral apophysis (P). Bothridia comparatively large, funnel-like, positioned quite far from anterior border of notogaster, positioned well anteriad to tips of spinae adnatae. Body strongly narrowed in jugal area, as seen in anterodorsal view. Notogaster with 11 pairs of setae, *c-l-h* series of simi-

lar shape and size, positioned in two longitudinal rows, subparallel or slightly converging posteriad. Setae *ps*<sub>1-3</sub> shorter, aligned along posterior border of notogaster. Spinae adnatae present. Without porose area in posterior part of notogaster. Setation of trochanters 1-1-2-1, femora 7-6-4-4, genua 4-4-3-3, tibiae 5-5-4-4. Tibiae II - IV always bearing seta *d*, coupled with solenidion. Solenidion  $\varphi$  of tibia IV relatively short, usually of similar size to coupled seta *d* or slightly longer.

Type species: *Porobelba parki* Jacot, 1937.

##### *Gerdia parki* (Jacot, 1937) n. comb.

##### Diagnosis

With characters of *Gerdia* as stated above. Prodorsum without distinct tubercles. Sensillus long, setiform, distally usually slightly thickened, lanceolate. Parastigmatic apophysis *Sa* very strong, distinct, pointed, slightly arched anteriad. Notogastral setae *c*<sub>1</sub> and *c*<sub>2</sub> pointing forward. Spinae adnatae acute,

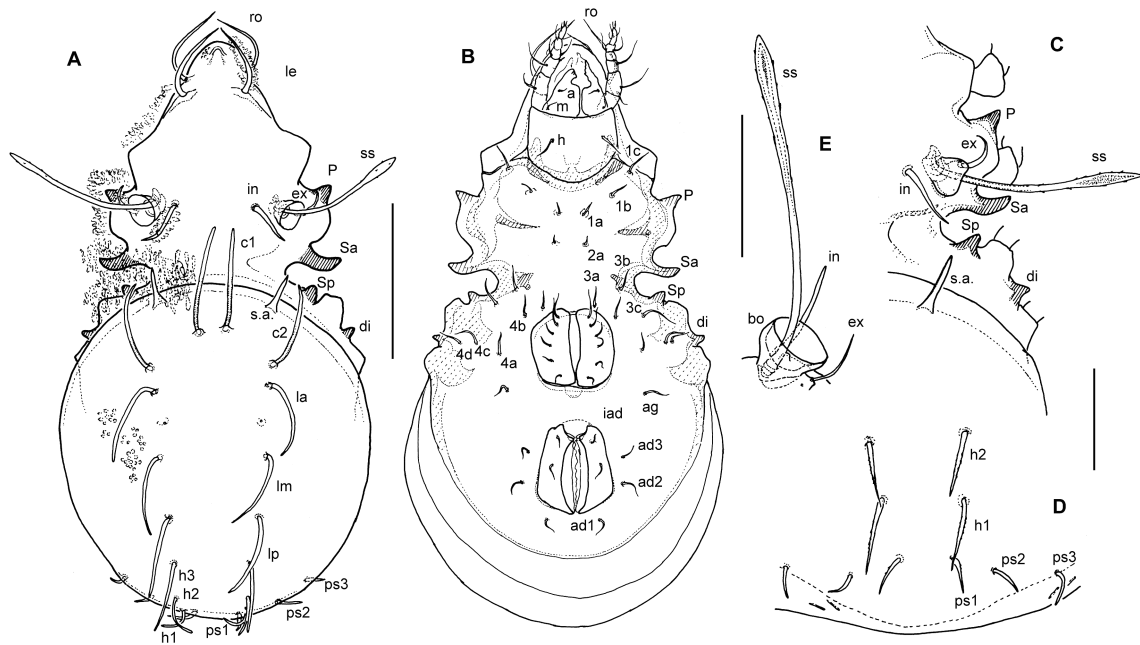


FIGURE 2: *Gerdia parki* (Jacot, 1937), adult: A – dorsal view without legs (slightly anterodorsal aspect showing dorsosejugal area); B – ventral view without legs, gnathosoma only partly depicted; C – right region of sejugal furrow, dorsal view; D – pygidial region of notogaster, posterior view; E – right bothridial area and sensillus, lateral view. Bars indicating 100  $\mu$ m (A+B), 50  $\mu$ m (C+D), and 50  $\mu$ m (E). Explanations in text and in Appendix 1.

thorn-like, slightly diverging anteriad. Dorsal setae of all femora hypertrophied, strong, arched, roughened with distinct, scale-like barbs.

#### Redescription of adult

**General characters.** Maximum body length 305 - 380  $\mu$ m (mean 347  $\mu$ m;  $n = 4$ ), ventral length 288-345  $\mu$ m (mean 321  $\mu$ m). Body covered by very thick layer of mostly filamentous (sejugal area, legs, ventral side etc.) but also glandular (notogaster, rostral part of prodorsum) cerotegument (Figs. 1; 2A; 4A). Body colour brown to yellowish brown. Adults bear reticulate exuvial scalps on notogaster (Figs. 1A; 6B; 8J).

**Prodorsum.** Pentagonal to broadly triangular, with well developed propodolateral apophysis (P; Fig. 2A, C). Rostrum broadly oval, with small longitudinal protuberance in central part between insertions of rostral setae (Fig. 2A). Bothridia quite distant from anterior notogastral margin (as in *Porobelba*), funnel-like. Sensillus (ss; Fig. 2E) relatively

long (about 105-115  $\mu$ m), setiform, distally usually broadened and lanceolate, with sparse, small and indistinct spines distally. Rostral (ro) and lamellar (le) setae of similar size (ro about 40  $\mu$ m, le about 45-48  $\mu$ m), bent, with attenuate tips; le longer and thicker than ro (Fig. 3B) and covered by cerotegument. Interlamellar seta (in; about 35  $\mu$ m), shorter than ro and le, straight or slightly curved, about one third of sensillus length, also covered by cerotegument. Exobothridial seta (ex) shorter (about 20  $\mu$ m) and finer than in, curved, hardly visible under cerotegument. No tubercles present on prodorsum, sejugal area strongly narrowed, best visible in slightly anterodorsal view. Anterior parastigmatic apophysis (Sa) strong and well developed, directed almost perpendicular to body, slightly bent anteriad. Posterior parastigmatic apophysis (Sp) much smaller, tubercular, oblique, sometimes hardly observable under thick layer of cerotegument.

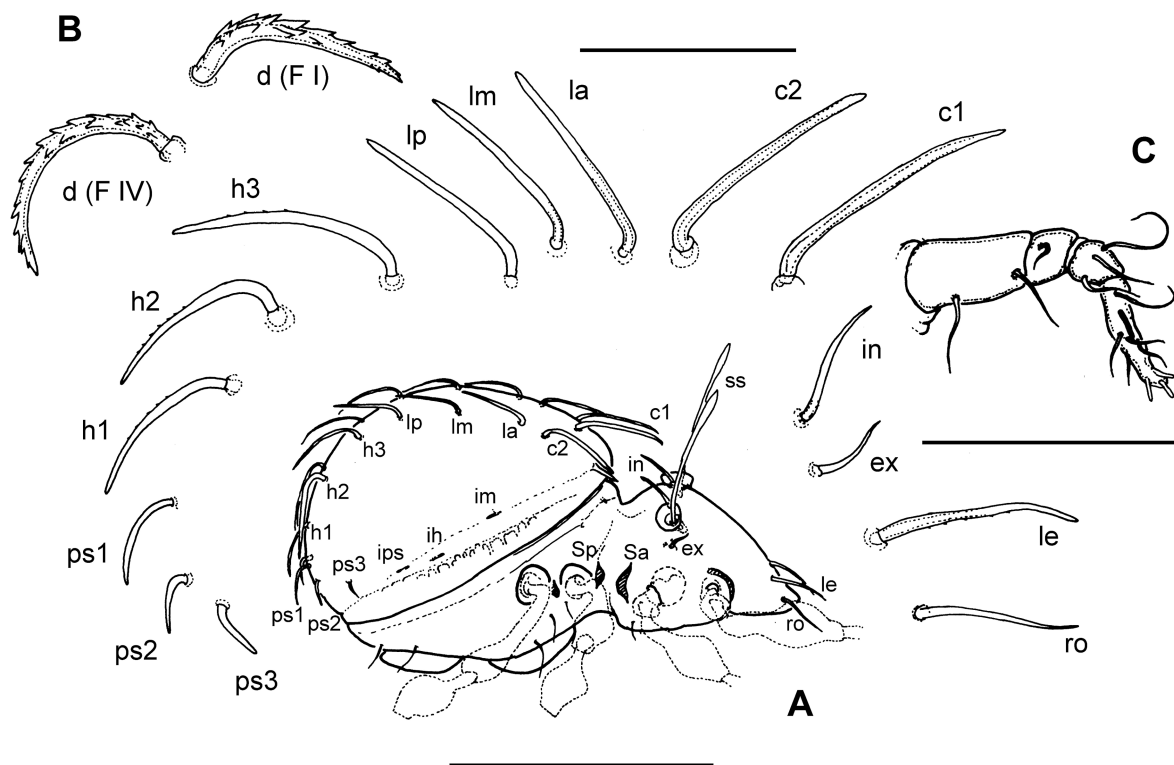


FIGURE 3: *Gerdia parki* (Jacot, 1937), adult: A – lateral view, ventral setae and legs not fully depicted; B – detailed views of prodorsal setae, notogastral setae and dorsal setae of femora I and IV; C – palp in lateral (antiaxial) view. Bars indicating 200  $\mu\text{m}$  (A), 50  $\mu\text{m}$  (B) and 50  $\mu\text{m}$  (C). Explanation in text and in Appendix 1.

*Notogaster*. Circular to slightly oval in outline, hemispherical in lateral view. Spinae adnatae thin, thorn-like, with tips slightly diverging anteriad (length about 30  $\mu\text{m}$ ). Notogastral setae mostly long and distinct, series *c-l-h* in pair of subparallel to slightly posteriorly converging longitudinal rows; setal row *ps* aligned along posterior border of notogaster, with row *c-l-h* perpendicular to it when seen from posterior (Fig. 2D). First two pairs of setae (*c*<sub>1</sub>, *c*<sub>2</sub>) longest (55–65  $\mu\text{m}$ ), directed anteriad, strongly bent close to insertion, then almost straight, close to notogastral surface (Fig. 3A, B).

Dorsolateral setae *la-lp* of similar shape, usually slightly shorter (45–50  $\mu\text{m}$ ) and thinner, directed posteriad. Setae *h*<sub>1</sub>–*h*<sub>3</sub> slightly diminishing in succession (55–50–47  $\mu\text{m}$  in one measured indi-

vidual), with very indistinct, sparse spines unilaterally; less bent at base and more curved distally than *c* and *l* setae. Setae *ps*<sub>1–3</sub> diminishing in succession (23–18–15  $\mu\text{m}$ ), strong, slightly bent. Lyrifissures and opening of opisthonotal gland with positions typical of Damaeidae.

*Ventral characters* (Fig. 2B). Venter covered by layer of cerotegument. Discidium (*dis*) short, tubercular, but distinct, directed slightly forwards or perpendicular to body. Epimeral setation 3-1-3-4; setae relatively short, setiform, thin, lateral ones longer than others, seta *1c* longest. Epimeral setae insertions of first two epimeres on more or less distinct papillar protuberances, setae *4c* and *4d* inserted close together. With six genital, one aggenital, two anal and three adanal pairs of setae present,

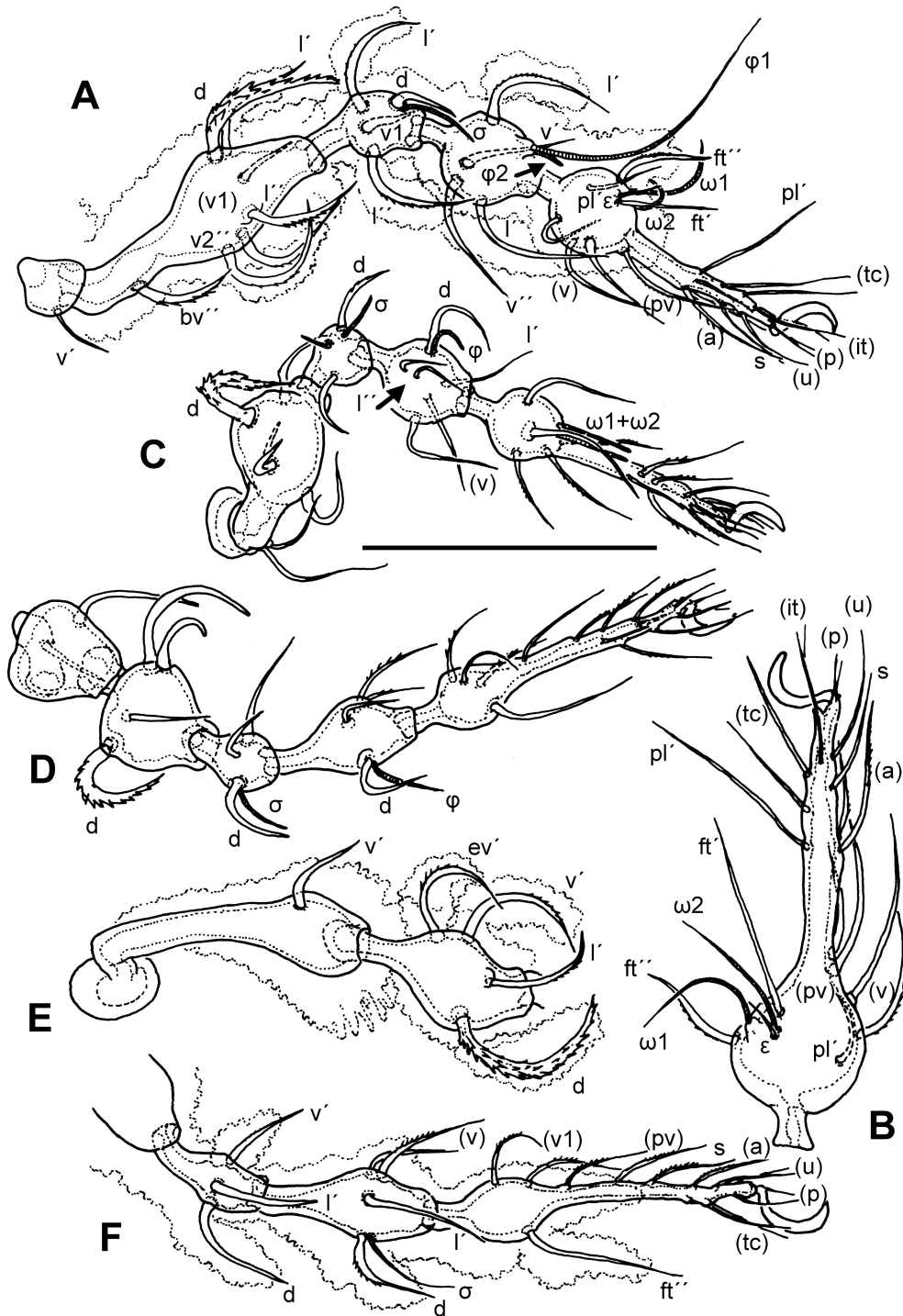


FIGURE 4: *Gerdia parki* (Jacot, 1937), legs of adult (antiaxial views): A – leg I; B – tarsus I in detail; C – leg II (arrow indicates anomalous doubling of lateral seta I''); D – leg III, E – trochanter and femur IV; F – genu, tibia and tarsus IV. Bar indicating 100  $\mu\text{m}$  (A,C-F). Light, irregular lines around A, E, F indicate extent of cerotegument covering. Designations of leg setae according to Grandjean, as reviewed by Norton (1977).

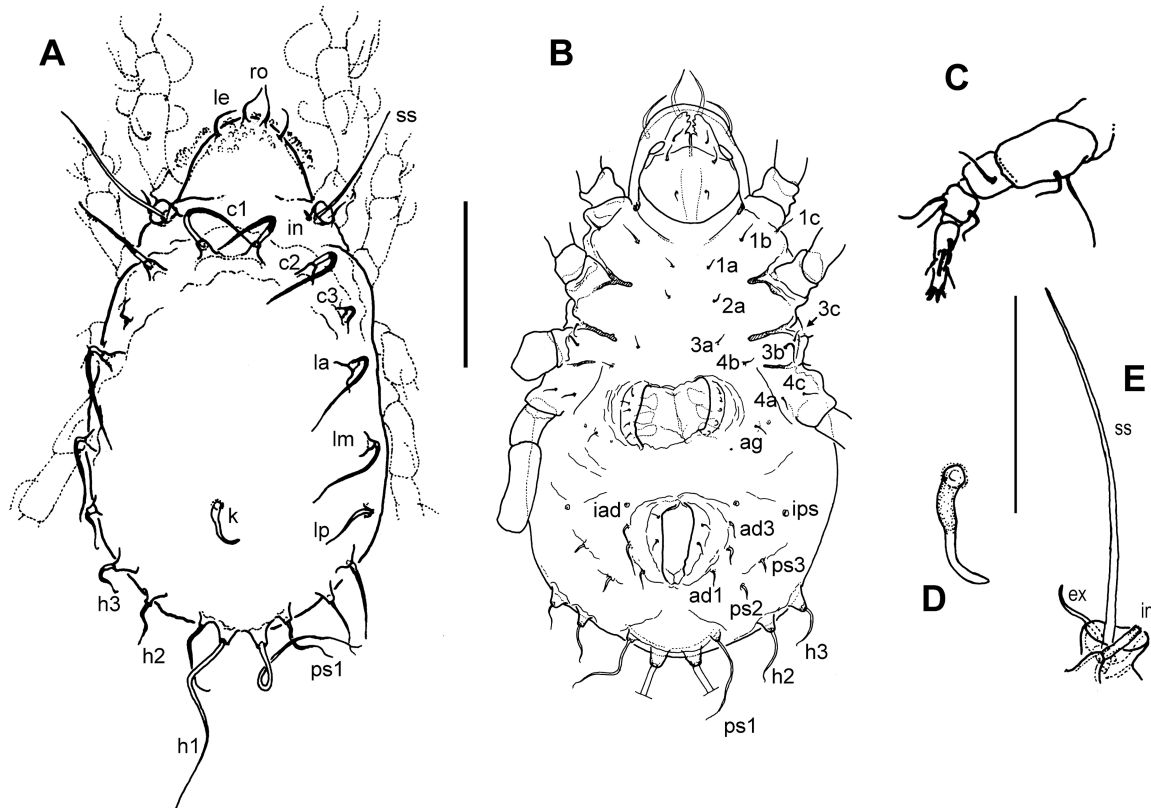


FIGURE 5: *Gerdia parki* (Jacot, 1937), tritonymph: A – dorsal view; B – ventral view; C – palp; D – cornicle k, dorsal view; E – bothridial area and sensillus. Legs and gnathosoma only partly depicted. Bars indicating 100 µm (A+B) and 50 µm (C+D+E). Explanations in text and in Appendix 1.

as usual in Damaeidae; all similar in shape and size. Genital aperture well separated and quite distant from anal opening; longer and broader than anal.

*Gnathosoma* (Characters were studied only on non-dissected individuals, and therefore are not described in full detail). Type and form of subcapitulum typical of Damaeidae. Palps relatively long, with elongated tarsus; setation (tarsal solenidion not included) 0-2-1-3-8, three distal setae on tarsus eupathidial (Fig. 3C). Setae of rutella and mentum similar in shape to other ventral setae. Chelicerae without unusual characters.

*Legs*. Moniliform (Figs. 4, 1A), covered by thick layer of mostly filamentous and columnar cerotegument, making setation difficult to study. Setal formula of legs as follows (famulus included, soleni-

dia not included): I, 1-7-4-4-20; II, 1-6-4-4-17; III, 2-4-3-3-16; IV, 1-4-3-4-13. Solenidia quite short, except  $\phi_1$  long, flagellate, tactile. Solenidia of tibiae II-IV coupled with seta *d*; latter about as long as, or longer than, respective solenidion (Fig. 4C,D,F). Solenidia of tarsus II inserted as if paired (Fig. 4C), parallel, straight and relatively long. Famulus emergent, shorter than other setae, simple, setiform (Fig. 4B). Dorsal setae of all femora of very characteristic shape (Figs. 3B, 4), hypertrophied (55-68 µm), with distinct, thorn- and scale-like spines. Anomalous doubling of lateral seta on tarsus II observed on one specimen (Fig. 4C).

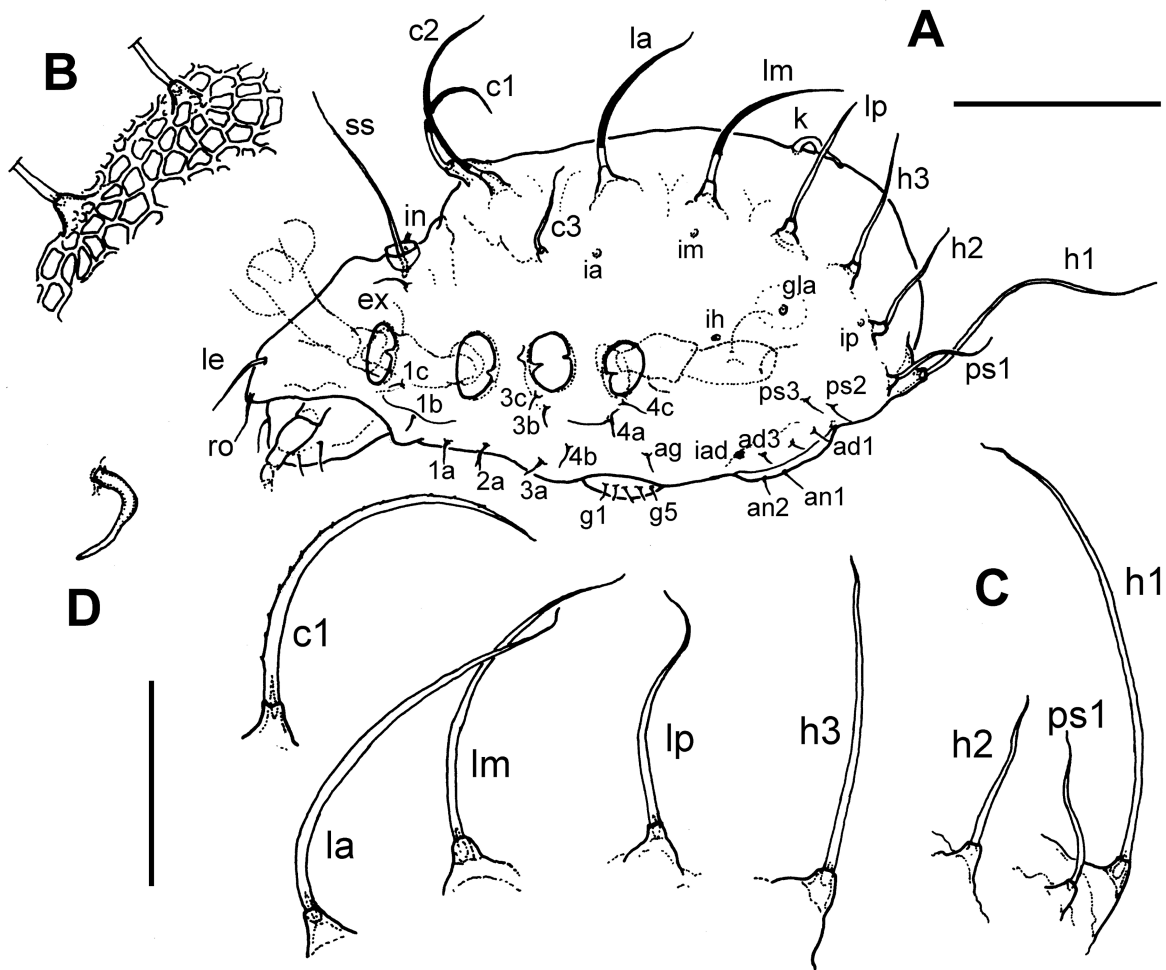


FIGURE 6: *Gerdia parki* (Jacot, 1937), tritonymph: A – lateral view (black distal parts of setae *c1*, *c2*, *la* and *lm* reconstructed on basis of nymphal scalp); B – detail of net-like structure of nymphal scalps; C – notogastral setae from tritonymphal scalp in detail; D – notogastral cornicle in lateral view. Bars indicating 100 µm (A) and 50 µm (B+C+D). Explanations in text and in Appendix 1.

#### Ontogeny: (Figs. 5-8)

*Facies and Dimensions* (all from slide-mounted specimens, complemented by measurements of one tritonymph used for drawings — Figs. 5-7). General characters of larva and eupheredermous nymphs typical of family (Grandjean, 1954) (Figs. 5A,B; 6A); exuvial scalps strongly reticulate (Figs. 6B; 8J). Total length of: larva (La, *n* = 2) 192-201 (mean 197) µm; protonymph (Pn; *n* = 3) 225-245 (mean 235) µm; deutonymph (Dn; *n* = 4) 255-294 (mean 278) µm; tritonymph (Tn; *n* = 2) 320-334 (mean 327) µm. Measurements of structural details (below) approxi-

mate, taken from average-sized specimen of respective instar (separate structures not measurable in single slide-mounted Tn).

*Integument, setae.* Cuticle colorless, covered with cerotegument in all instars, except under exuvial scalps of nymphs. Excrescences of cerotegument densely packed, touching or nearly so; those on body, legs and setae columnar to bottle-shaped (Fig. 8K), ≈1 µm diameter or less, smallest distally on leg tarsi; those on solenidia minute, very fine, making solenidia appear fuzzy (Fig. 8K). Setae of dorsum and legs light to dark brown, except for hya-

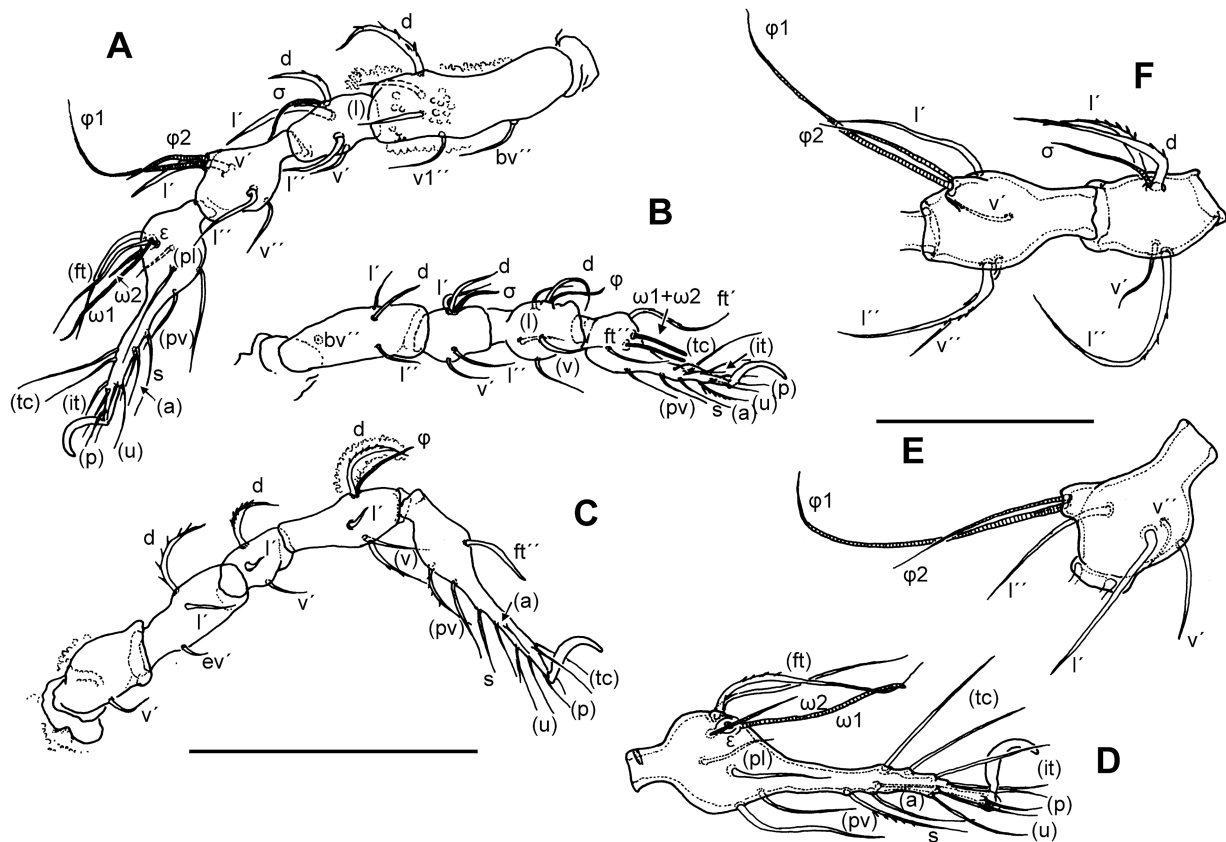


FIGURE 7: *Gerardia parki* (Jacot, 1937), tritonymph: A – leg I, antiaxial view; B – leg II, antiaxial view; C – leg IV, antiaxial view; D – tarsus I, antiaxial view; E – tibia I, paraxial view; F – genu and tibia I, antiaxial view. Bar indicating 100  $\mu\text{m}$  (A,B,C) and 50  $\mu\text{m}$  (D,E,F). Designations of leg setae accordingly to Grandjean, as reviewed by Norton (1977).

line birefringent base (Figs. 6; 8F,G); pigmentation increasing with seta size, ventral setae with little or no pigment. Most setae flagellate when intact; flexible, undulating, threadlike distal region can comprise 1/3 setal length, which when broken makes measurements highly variable and imprecise.

*Prodorsum.* Setae *le*, *ro*  $\approx 30$   $\mu\text{m}$  in La, anteriorly directed, curved in basal third, with 1-2 conspicuous barbs; 35-40 in Dn, with several inconspicuous barbs; pairs *ro* and *le* arranged in shallow arch; mutual distance of *ro* 1/4 (La) to 1/3 (nymphs) that of *le*. Seta *ex* relatively straight, smooth ( $\approx 20$   $\mu\text{m}$  in La, 25-30 in Dn and Tn). Seta *in* subflagellate ( $\approx 45$   $\mu\text{m}$ ), with 1-2 barbs in La (Fig. 8C; short in nymphs ( $\approx 15$   $\mu\text{m}$  in Dn and Tn), posterodorsally directed, only slightly tapered to tip with terminal brush of

small spines (Figs. 5E; 8D,E). Sensillus ( $\approx 70 \mu\text{m}$  in La, 130 in Dn; 98–110  $\mu\text{m}$  in drawn Tn), with similar form in all immatures: smooth or with sparse small barbs, flagellate; proximal 3/4 stiff, nearly straight and tapered, distal 1/4 threadlike, flexible, strongly undulating; cerotegument thickness and size of excrescences increase along length (Fig. 8A,B).

*Gastronotic region.* Body elliptical to almost rectangular in larva, oval in nymphs. Exuvial attachment cornicle *k* of nymphs (15 µm in Pn, 20 in Dn; ≈33 µm in Tn) straight, smooth and tubular in basal half, slightly constricted, flame-shaped in distal half with thinner walls and irregular longitudinal wrinkles (Figs. 5D; 6D; 8H,I). Opisthonotal gland and all normal cupules in positions typical of family. Gastronotic setae inserted on prominent, sclerotized,



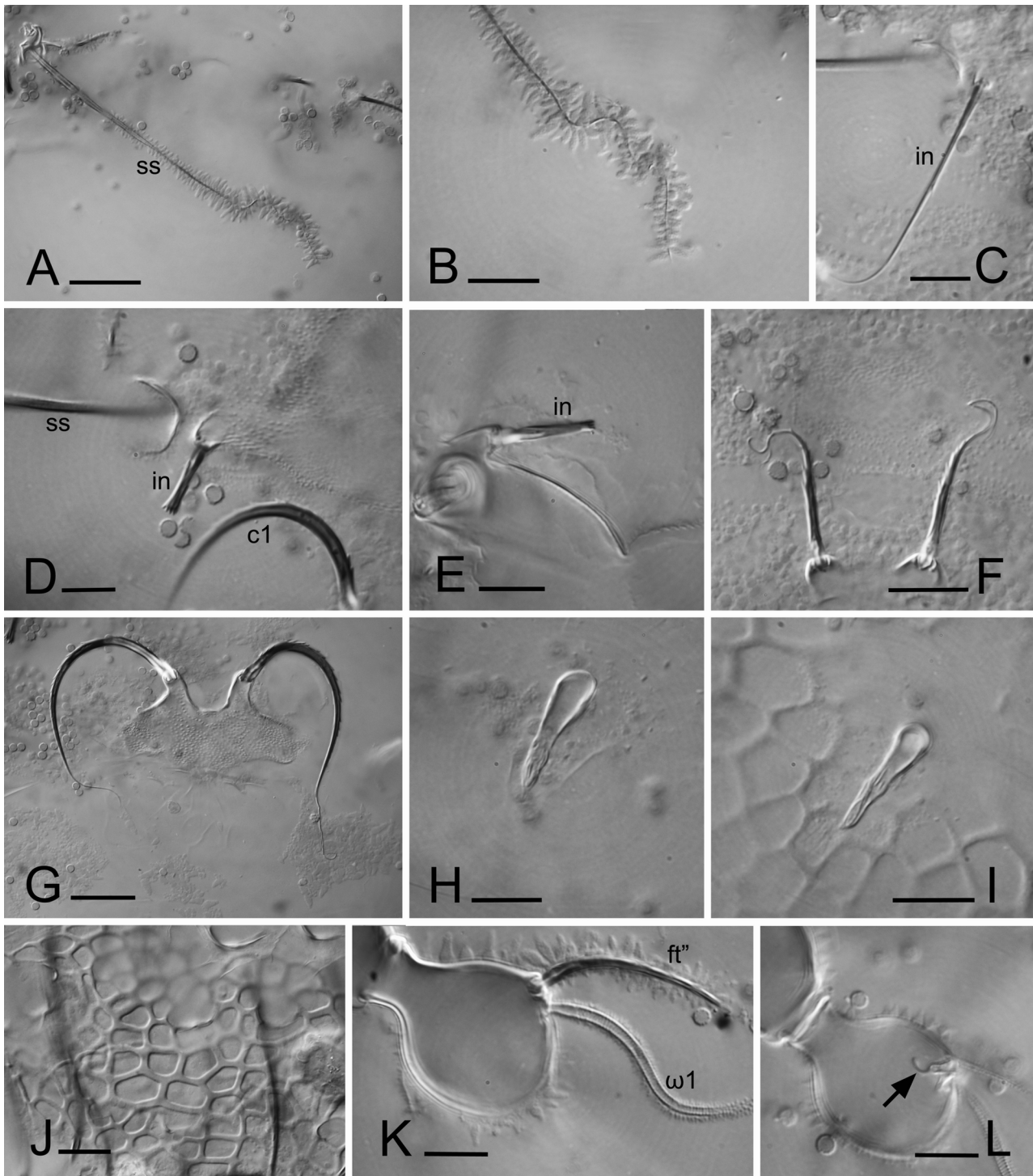


FIGURE 8: *Gerdia parki* (Jacot, 1937) immatures: A – sensillus of deutonymph; B – same, enlargement of distal half; C – interlamellar seta of larva; D – bothridial area of protonymph; E – interlamellar seta of deutonymph; F – setae *c1* of larva; G – setae *c1* of deutonymph; H – cornicle *k* from protonymph; I – same, from protonymphal scalp on deutonymph; J – portion of exuvial scalp from larva; K – deutonymphal tibia I, focused on seta *ft''* and solenidion  $\omega 1$ ; L – same, focused on sunken famulus, arrow on "root". All photomicrographs, from slide-mounted, slightly flattened specimens; all except J-L layered from 2-4 images.

conical to cylindrical tubercles; tubercles independent, except as noted below. Larva with great range of setal size and form: darkest and most heavily barbed include  $c_1$  (30  $\mu\text{m}$ ),  $c_2$  (90  $\mu\text{m}$ ),  $da$  (100  $\mu\text{m}$ ),  $dm$  (100  $\mu\text{m}$ ),  $dp$  (75  $\mu\text{m}$ ), and  $lp$  (100  $\mu\text{m}$ ); thinner, less pigmented and less strongly barbed setae include  $c_3$  (30  $\mu\text{m}$ ),  $la$  and  $lm$  (50  $\mu\text{m}$ ), and  $h_3$  (90  $\mu\text{m}$ );  $h_2$  (25  $\mu\text{m}$ ) and  $h_3$  (15  $\mu\text{m}$ ) with little pigment, 1-2 minute barbs. Setal pair  $dp$  on common medial sclerite;  $c_1$  directed anterodorsally (Fig. 8F),  $c_2$  dorsolaterally, about equidistant from  $c_1$  and  $c_3$ .

Nymphal setae well pigmented except as noted, also with wide range of size (measured in deutonymph but proportionally similar in other nymphs); coarseness and density of barbs greatest in anterior setae, gradually decreasing in more posterior setae. Seta  $c_1$  (100  $\mu\text{m}$ ; Fig. 8G) strongly curved posterodorsad;  $c_2$ ,  $la$ ,  $lm$ ,  $lp$ ,  $h_3$  (all ca 130  $\mu\text{m}$ ) weakly curved posterolaterally;  $h_1$  (ca 130  $\mu\text{m}$ ) thinner, almost straight, posteriorly directed, with few, minute barbs; ventrally positioned  $h_2$  (40  $\mu\text{m}$ ) and  $ps_{1-3}$  (40, 35, 20  $\mu\text{m}$  respectively) smooth, lightly pigmented. Setal pairs  $c_1$  and  $h_1$  each on shared microtuberculate median sclerite. Length of setae on tritonymph as follows (Fig. 6):  $c_1$  205  $\mu\text{m}$ ,  $la$  210  $\mu\text{m}$ ,  $h_1$  240  $\mu\text{m}$ ,  $h_2$  80  $\mu\text{m}$ ,  $h_3$  165  $\mu\text{m}$ ,  $ps_1$  72  $\mu\text{m}$ . Seta  $c_3$  absent unilaterally from one observed tritonymph.

**Ventral region.** Setation typical for family. Setal formulae for epimeres (I-IV): La 3-1-2, Pn 3-1-2-1, Dn 3-1-2-2 (Tn not studied). Seta  $3c$  (included in formula) of larva with typical scale-form, closely covering Claparède's organ. Genital setation (Pn-Tn): 1-3-5. Aggenital seta first appearing in Dn.

**Gnathosoma.** Typical of family. Second palp-femur seta formed in Pn (Fig. 5C).

**Legs** (Figs. 7, 8 K-L). Overall form typical of family. Ontogeny of setae and solenidia given in Table 1; no variation observed. Most setae with several small barbs. Seta  $d$  of all tibiae and all genera (except IV which lacks solenidion) closely coupled with respective thin, isodiametric solenidion. In most cases,  $d$  1.5 to 2 times longer than respective solenidion, with following exceptions. Seta  $d$  on larval genera regressed, much shorter ( $\approx 2$ , 4, 5  $\mu\text{m}$  on I-III, respectively) than solenidion; latter curves ventrodorsad around posterior face of seg-

ment (both becoming normal in nymphs). Also, tibia I seta  $d$  in all immature instars about half length of flagellate (tactile)  $\phi_1$  (but, seta  $d$  absent on both tibia I of observed tritonymph, Fig. 7 E,F);  $\phi_2$  similar to other tibial solenidia but slightly thinner. Tarsal solenidion  $\omega_1$  of leg I ceratiform (Fig. 8K), 2-3 times as thick and half-again as long as  $\omega_2$ ; both solenidia of tarsus II thin, similar to  $\omega_2$  of tarsus I. Famulus minute, sunk in deep sclerotized cup in all immature instars, not noticeably projecting beyond edge; with straight or slightly curved root-like internal extension from cup, about equal to cup in length (Figs. 8L; 7D). Proral setae ( $p$ ) of tarsus I appear eupathidial in all instars; subunginal seta of tarsus I normal and proximal to antelateral setae ( $a$ ) in immatures, becoming eupathidial and distal to pair ( $a$ ) only in adult; no other setae eupathidial.

### Material examined

From the records indicated below, the known distribution of *Gerdia parki* encompasses a region from Manitoba to New Brunswick in the north and Missouri to North Carolina in the south. Most collections are from forests, but these vary widely in composition, from rather pure coniferous or deciduous woodlands to mixed forests. The species seems to have an affinity for decaying woody substrates, including stumps, logs and rot-holes in standing trees, since the larger samples of adults and the few immature specimens were collected from such microhabitats. Specimens obtained from leaf litter in low numbers might have been dispersing adults.

**Original specimens.** The type series is in the Field Museum, Chicago, Illinois, mounted in Canada balsam). We studied the following: holotype, Illinois, Champaign Co., Urbana, 14-IV-1934 (slide number 41-S1859); paratypes, 3 with same data (slide numbers 35-S1860, 47-S1861, 58-S1862). In the original description, Jacot (1937) recorded this mite from Mammoth Cave, Kentucky and Turkey Run, Indiana, but we did not locate these specimens.

**Other studied material from the USA.** The following records relate to specimens in the collection of R.A.N. or in the Field Museum; they are adults unless noted otherwise. Data are presented in their original form. Individuals used for drawings in this

TABLE 1: Ontogeny of leg setae and solenidia in *Gerdia parki* (Jacot). Structures are indicated where they are first added and are assumed present through the rest of ontogeny, unless noted otherwise; setae in parentheses represent pairs; dash indicates no additions.

	Trochanter	Femur	Genu	Tibia	Tarsus
<b>Leg I</b>					
Larva	-	d, bv''	d, (l), $\sigma$	d, (l), v', $\phi$ 1	(ft), (pl), (pv), (tc), (a), (u), (p), s, e, $\omega$ 1
Protonymph	-	-	-	-	$\omega$ 2
Deutonymph	v'	(l)	v'	v'', $\phi$ 2	-
Tritonymph	-	v1''	-	-	(it)
Adult	-	v1', v2''	-	d lost	(v)
<b>Leg II</b>					
Larva	-	d, bv''	d, (l), $\sigma$	d, l', v', $\phi$	(ft), (pv), (tc), (a), (u), (p), s, $\omega$ 1
Protonymph	-	-	-	-	-
Deutonymph	v'	(l)	v'	l''	$\omega$ 2
Tritonymph	-	-	-	v''	(it)
Adult	-	(v)	-	-	(v)
<b>Leg III</b>					
Larva	-	d, ev'	d, l', $\sigma$	d, l', v', $\phi$	(ft), (pv), (tc), (a), (u), (p), s
Protonymph	v'	-	-	-	-
Deutonymph	l'	l'	v'	v''	-
Tritonymph	-	-	-	-	(it)
Adult	-	v'	-	-	v'
<b>Leg IV</b>					
Protonymph	-	-	-	-	ft'', (pv), (u), (p)
Deutonymph	-	d, ev'	d, l'	d, l', v', $\phi$	(tc), (a), s
Tritonymph	v'	l'	v'	v''	-
Adult	-	v'	-	-	v'

redescription were from Indiana and New York, in the following overview they are in bold. *Illinois*. Cook Co., Carle Woods, (unknown col.), 18-IV-1936, 1 from log mold. *Indiana*. Jefferson Co., Cliffly Falls St. Pk., J.A. McBride, col., 26-VIII-1973, 1 from unknown substrate. **Wells Co. Bluffton, 4H Park, R.F. Wilkey col., 26-V-1973, 8 adults, 1 nymph from rotten tree stump.** *Kentucky*. Edmonton Co., Mammoth Cave Nat. Pk., Little Beauty Cave, W.C. Welbourn, col., 31-VIII-1987, 1 from rat feces. *Maryland*. Fairfax Co., Great Falls, M. Delfinado and E.W. Baker, cols, 6-VII-1973, 10 from tree hole. *Maine*. Piscataquis Co. Katahdin-Greenville road at Caribou Lake, R.A. Norton col., 28-VII-1975, 5 from litter in second growth beech, maple forest (RAN 75-072). *Michigan*. Schoolcraft Co., Blaney Park (Ford Lake Area), W.R. Suter, 24-VIII-1971, 1 from birch, fir duff. (FM (HD) 71-36). *Missouri*. Boone Co.,

Columbia, Hinkson Creek Recreation Area, R.A. Norton and J.B. Kethley cols, 29-IV-1985, 5 from litter in crotch of maple tree (FM (HD) 85-161). *New York*. St. Lawrence Co., Cranberry Lake Biological Station, Barber Island, G. Terzi col., 13 IX 1980, 3 from basal rot hole in red maple tree containing mammal nest remains. (RAN 80 130). **Onondaga Co.:** Syracuse, Burnett Park, J.R. Philips, col., 10-IV-1975, 1 from remains of gray squirrel at base of nest-tree of Great Horned owl; Highland Forest, R.A. Norton, col., 18-X-1969, 35 from humified wood in basal tree hole; **Beaver Lake Nature Center, R.A. Norton col., 10 VII 2009, 5 adults, 1 nymph from rotten cherry log (RAN 81-9);** Cicero Game Management Area, R.A. Norton col., 9-IX-1972, 1 from litter and rootlets of maple hummock in hardwood swamp. Cortland Co., Heiberg Forest, Tully, R.A. Norton, col., 15-V-1971, 1 from decaying maple log.

*North Carolina.* Buncombe Co., Bent Creek Experimental Forest, L.J. Metz, col., IV-1974, 1 from litter in mixed oak-pine forest. Macon Co., Otto, Coweeta Hydrologic Laboratory, D.L. Dindal, col., 25-V-1973, 1 from bark, moss and bracket fungi. *Ohio.* Fairfield Co., Barneby Center, R.A. Norton, col., 29-VI-1972, 1 from rotting log. Wayne Co., Wooster, Secrest Arboretum, D.E. Johnston, coll., 18-I-1970, 1 from *Pinus radiata* stand. *Virginia.* Sussex Co., Wakefield, M. Delfinado and E.W. Baker, cols, 14 July 1973, 6 from rot hole in sweetgum tree. Page Co., Skyline Drive, ca 200m South of Big Meadows, R.A. Norton col., 18-V-1974, 4 adults from litter and organic soil under ash (*Fraxinus*) tree (RAN 74-12).

One mounted individual from the Karl Strenzke Collection in Senckenberg Museum, Frankfurt, Germany, was also studied, with an original label "SMF 16926: *Porobelba*, 350, *Belbidae*. Old Tawney's Cave, Twilight zone; Thulss - Mt. Lake; Hoyer-H.G.S" (see Miko, 2008 for details).

*Records from Canada.* We examined specimens from three Canadian provinces (all in the Canadian National Collection, Ottawa), with the following collection data. *Manitoba.* Ninette, 29.v.1958 (J.F. McAlpine) ex nest of *Microtus* sp. New Brunswick. Kouchibouguac National Park, 28.vii.1978 (I.M. Smith), ex litter and soil in basal hole in red oak; 31.vii.1978 (I.M. Smith) ex litter in basal hole in maple; 10-16.vii.1978 (I.M. Smith) ex decaying spruce log at La Source picnic area. *Ontario.* Lake Superior, Granite Island, 15.vii.1973 (R. Freitag) ex Ringed bill gull nest. Thunder Bay area, 1973 (R. Freitag) ex Ringed bill gull nest. Point Pelee National Park, 14.viii.1974 (E.E. Lindquist) ex fine debris of rotten stump. Saint Lawrence Islands National Park, 9.ix.1976 (E.E. Lindquist and I.M. Smith) ex rotting wood in hemlock log.

*Culture.* A temporary culture was established from eggs of several adults derived from the Virginia sample indicated above (RAN 74-12). One tritonymph, 4 deutonymphs, 3 protonymphs and 2 larvae were reared in small jars with plaster-of-Paris substrate, using mycelium of an unknown fungus as food.

## DISCUSSION AND REMARKS

Jacot (1937) included his North-American species in the otherwise European genus *Porobelba*, perhaps based on similarity of characters such as body form and size, cerotegument, weak ceratiform spinae adnatae, setae  $c_1$  quite long and directed anteriad, moniliform legs etc. But as stated in a previous work on *Porobelba* (Miko, 2008), it lacks the most important diagnostic character of this genus — the single, unpaired porose area on the posterior part of notogaster. Already Norton (1979) had remarked that *parki* cannot be considered to be a member of *Porobelba*, as the genus was originally defined. Grandjean (1954) observed high variability in development of the porose area in *Porobelba*, which in some cases may be replaced by a small group of individual pores; but always the porose area is manifested in some form. In *G. parki* the area has never been observed, even as a group of pores (Fig. 2D). Moreover, *G. parki* differs from species of *Porobelba* by other characters, which are often used within Damaeidae as generic characters. The presence of the propodolateral apophysis, absent from all known species of *Porobelba*, is most notable. The positions of notogastral setae also differ: setae  $c_1$ - $h_3$  of *Porobelba* species are directed more or less radially, and somewhat ventrad in lateral view. Setae  $p_1$ - $p_3$ , displaced along posterior border of notogaster, are therefore almost parallel to row  $h_1$ - $h_3$  in posterior view. In *G. parki*, setae  $c_2$ - $h_1$  are in subparallel rows, converging posteriad and almost perpendicular to row  $p_1$ - $p_3$  (Fig. 2D). Other characters — i.e. the form of the sensillus, the form and size of parastigmatic apophyses and discidium, the hypertrophied dorsal setae ( $d$ ) of all femora — are also quite different in *parki* and could be considered as having genus-level significance.

Differences were found also in immatures, although ontogeny is in general very similar between *Porobelba* and *Gerdia*. Compared to immatures of *P. spinosa* (Ermilov and Lochynska, 2009), nymphs differ in the form and length of cornicle  $k$ , which attaches exuvial scalps to each other; this cornicle is shorter and much less curved in all immature instars of *G. parki*. Also notable is the form and length of interlamellar seta in deuto- and tritonymphs of

*G. parki*; they are short, only slightly tapered, with a terminal brush of small spines, compared to their normal, setiform shape in *P. spinosa*. The hypertrophied dorsal setae of leg femora is apparent even in nymphs of *G. parki*. The ontogeny of leg setation is almost identical, with differences only in tibial dorsal setae. In *G. parki*, setae *d* of tibia II and III are always retained in adults. In *P. spinosa*, these setae are normally lost in the adult (Ermilov and Łochyńska, 2009). Nevertheless, some races of *P. spinosa* from southwest and west Europe may lose setae *d* of tibia II and III as in *G. parki* (Grandjean, 1954). In observed tritonymphs of *G. parki*, setae *d* of tibia I were missing from both legs. Perhaps they were broken, but this also may represent variability of development of tibial *d* setae, in which case it would further indicate independence of tibia I and tibia II-III development. This is supported also by an observation of Grandjean (1954), who reported a rare presence of seta *d* on tibia I even in adults of *P. spinosa*.

In our view, these differences are sufficient to recognize *Gerdia* as a separate genus. In particular, the unusual pattern of notogastral setae and hypertrophied femoral setae *d* are considered apomorphies of *Gerdia*, while the unique porose area is an apomorphy of *Porobelba*. These genera seem close enough to be sister-taxa, or at least part of a well defined group together with *Dameobelba minutissima* (Sellnick, 1920), as suggested by Miko (2006). A formal cladistic analysis remains to be done.

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#### REFERENCES

Alberti G., Norton R. A., Adis J., Fernandez N. A., Franklin E., Kratzmann M., Moreno A. I., Weigmann G., Woas S. 1997 — Porose integumental organs of oribatid mites (Acari, Oribatida). 2. Fine structure — Zoologica 48,146: 33-114.

- Ermilov, S.G., Łochyńska, M. 2009 — Morphology of juvenile stages of *Epidamaeus kamaensis* (Sellnick, 1925) and *Porobelba spinosa* (Sellnick, 1920) (Acari: Oribatida: Damaeidae) — Annales Zoologici 59 (4), 527-544
- Grandjean, F. 1954 — Observations sur les Oribates (30e série). — Bulletin du Museum D'Histoire Naturelle, 2e série, 26 (4), 482-490
- Hammen, L. van der 1980 — Glossary of acarological terminology, vol. I. General terminology — Dr. W. Junk Publ., The Hague, 244 pp.
- Hunt, G. S., Norton, R. A., Kelley J. P. H., Colloff, M. J., Lindsay, S. M. 1998 — An Interactive Glossary of Oribatid Mites, CD-ROM — CSIRO Publishing, Melbourne
- Jacot, A.P. 1937 — New Moss-Mites, Chiefly Midwestern II. — American Midland Naturalist, Vol. 18, No. 2 (Mar., 1937), pp. 237-250
- Miko, L. 2006 — Damaeidae — In: Weigmann, G.: *Hornmilben (Oribatida)*, Die Tierwelt Deutschlands 76, Goecke & Evers Publ., 179-207.
- Miko, L. 2008 — Taxonomy of European Damaeidae (Acari: Oribatida) II. *Porobelba weigmanni* n.sp. (Oribatida, Damaeidae), from East Slovakia, with comments on other known species of the genus — Zootaxa 1844: 55-62
- Miko, L., Travé, J. 1996 — Hungarobelbidae n.fam., with a description of *Hungarobelba pyrenaica* n.sp. (Arachnida, Oribatida) — Acarologia, 37, 133-155.
- Norton, R. A. 1977 — A review of J. Grandjean's system of leg chaetotaxy in the Oribatei and its application to Damaeidae — In: Dindal, D. L. (Ed.), *Biology of Oribatid Mites*, 33, SUNY College of Environmental Science and Forestry, Syracuse, New York, 33-62.
- Norton, R. A. 1979 — Aspects of the biogeography of Damaeidae, sensu latu (Oribatei), with emphasis on North America — In: Rodriguez, J.G. (Ed.): *Recent Advances in Acarology* vol. 2: 535-540.
- Norton, R. A., Behan-Pelletier, V. M. 2009 — Oribatida. Chapter 15 (pp. 430-564) — In: *A Manual of Acarology* (G.W. Krantz and D.E. Walter, eds). Texas Tech Univ. Press, Lubbock.
- Sellnick, M. 1920 — Neue und seltene Oribatiden aus Deutschland — Schriften Physikalisch-ökonomische Gesellschaft, Königsberg, Bd 61-62: 35-42.

#### APPENDIX

##### Designations of setae and other morphological characters in Figures 1-8


P — propodolateral apophysis;  
 Sa — anterior parastigmatic apophysis;  
 Sp — posterior parastigmatic apophysis;  
 ss — sensillus;

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ro — rostral seta;  
le — lamellar seta;  
in — interlamellar seta;  
ex — exobothridial seta;  
s.a. — spina adnatum (plur. spinae adnatae);  
bo — bothridium;  
di — discidium;  
c1, c2, c3, la, lm, lp, h1, h2, h3, ps1, ps2, ps3 — notogastral setae;  
ad1, ad2, ad3 — adanal setae;  
an1, an2 — anal setae;  
g1, g5 — genital setae;  
ag — aggenital seta;  
1a, 1b, 1c — setae of epimere I;  
2a — seta of epimere II;  
3a, 3b, 3c — setae of epimere III;

4a, 4b, 4c, 4d — setae of epimere IV;  
h, m, a — setae of gnathosoma;  
iad — adanal lyrifissure;  
ia, im, ip, ih, ips — lyrifissures;  
gla — opisthonotal gland opening;  
k — cornicle.

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