

HUNGAROBELBIDAE N. FAM., WITH A DESCRIPTION OF *HUNGAROBELBA PYRENAICA* N. SP. (ACARINA, ORIBATIDA)

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ORIBATIDA
MORPHOLOGY
POSTEMBRYONIC
DEVELOPMENT
SYSTEMATICS
EUPHEREDERMS

SUMMARY : The study of the type-species *Hungarobelba visnyai* (Balogh, 1938) and of the new species *Hungarobelba pyrenaica*, leads us to create a new family, Hungarobelbidae. Among the eupheredermes, it belongs in the Eremuloidea and is closest to the Damaeolidae.

ORIBATES
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RÉSUMÉ : L'étude de l'espèce-type *Hungarobelba visnyai* (Balogh, 1938) et d'une nouvelle espèce, *Hungarobelba pyrenaica*, nous amène à créer une nouvelle famille, les Hungarobelbidae. Parmi les Euphérédermes, elle se situe dans les Eremuloidea et est proche des Damaeolidae.

INTRODUCTION

Hungarobelba visnyai, originally described as *Belba visnyai*, was implicitly placed in the family Damaeidae (= Belbidae) by its author (BALOGH, 1938). Recently, it has been placed in the newly created family Belbodamaeidae (BULANOVA-ZACHVATKINA, 1967, see also BALOGH, 1972 and GHILAROV and KRIVOLUTSKY, 1975). The erection of the Belbodamaeidae was questioned by NORTON (1979), who, on the other hand, mentioned that the genus *Hungarobelba* is poorly known and maybe does not share all of the synapomorphies of Damaeidae. Despite this, the position of *Hungarobelba* in the Damaeidae was repeated by BALOGH and BALOGH (1992).

TRAVÉ (1961) pointed out that there are similarities between *Hungarobelba* and *Veloppia* (Hammer, 1955), described from Alaska. NORTON (1978) described a new species of *Veloppia* — *V. kananas-*

kis — and stated that this genus is not a member of the Damaeidae. Most similarities were found with *Caleremaeus*, and the character states were given for both genera as a basis for the transfer of *Veloppia* into the Caleremaeidae (see NORTON, 1978).

Observations on material from eastern Slovakia, Hungary and Pyrénées Orientales showed that there are significant differences between *Hungarobelba* and other damaeid genera, which led us to the erection of a new family, Hungarobelbidae fam.n.

REMARKS ON *HUNGAROBELBA VISNYAI* (BALOGH, 1938)

All known descriptions, redescrptions or drawings of this species are, unfortunately, insufficient (BALOGH, 1938 and 1972; GHILAROV & KRIVOLUTSKY, 1975; MAHUNKA, 1977), but the main

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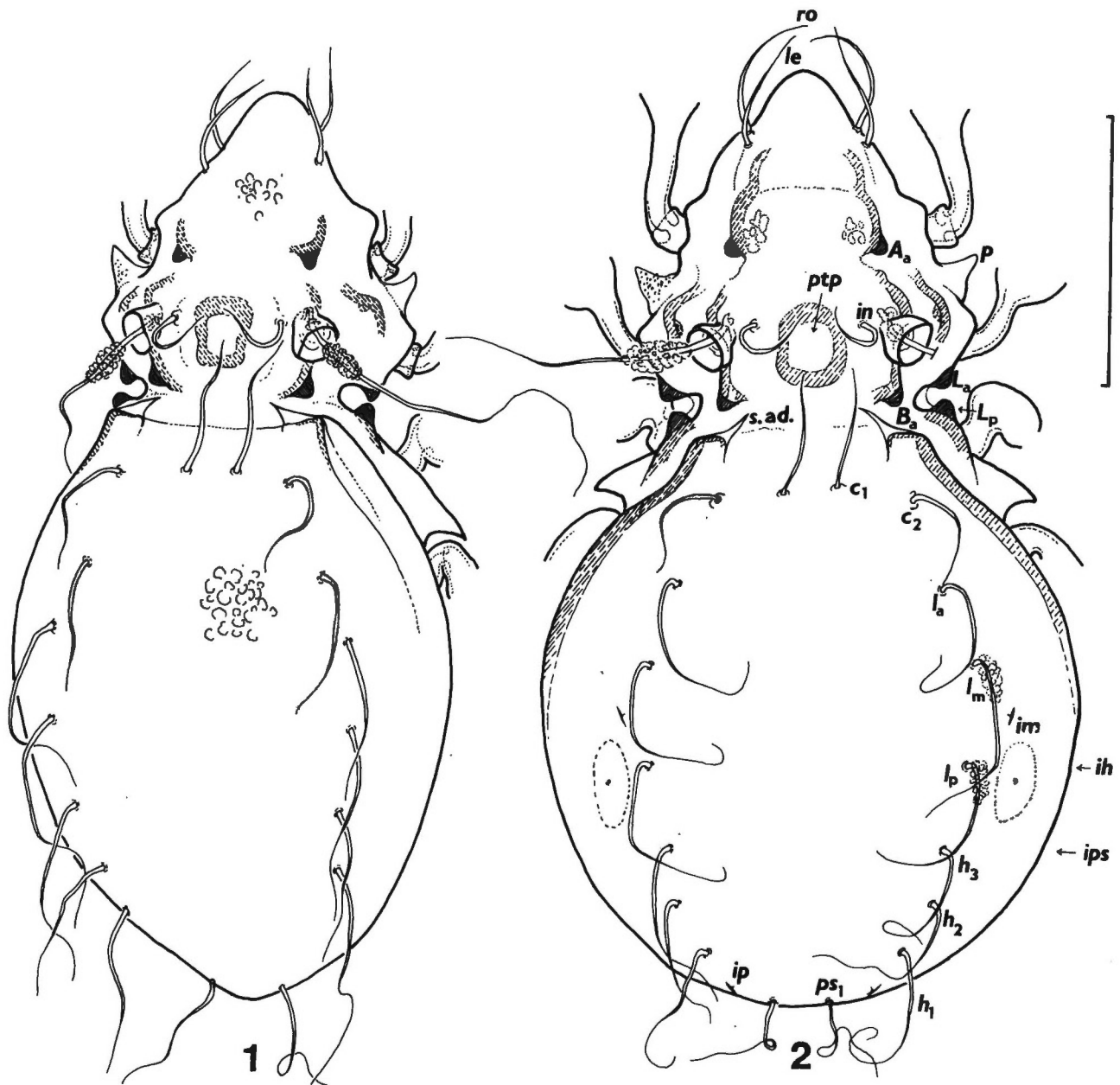


FIG. 1-2 : *Hungarobelba visnyai*

1. — Specimen from Hungarian Museum of Natural History (Hungary, Szakonyfalva, leg. S. MAHUNKA). Dorsal aspect. 2. — Specimen from Slovakia. Dorsal aspect (ptp : prodorsal protuberance). Scale : 100 μ m.

features can be distinguished. Material found in eastern Slovakia, while conducting an inventory of the soil fauna (MIKO, 1988, 1990), was determined as a *Hungarobelba* species. It was assumed to be *H. visnyai*, because of its flagelliform sensillus. These individuals were compared with specimens from Szakonyfalva (Hungary), preserved in the Hunga-

rian Museum of Natural History, Budapest. This comparison was kindly made possible by Dr MAHUNKA. The type of *H. visnyai* is presumed lost, but earlier mentioned material (sketched in Fig.1) is considered to be conspecific (MAHUNKA, 1977 and pers. comm.). The main character states shared by both Slovakian and Hungarian specimens are :

general shape of prodorsum; type of cerotegument; presence of prodorsal enantiophyses and apophyses; type and shape of bothridium and sensillus; presence and development of sejugal enantiophyses; shape of discidium; truncate notogaster; presence and position of spinae adnatae; shape and position of notogastral setae; number of setae in epimeral and anogenital regions.

The following differences were observed in Slovakian material: smaller size; shorter and more circular form of notogaster; dorsosejugal scissure between the spinae adnatae not developed; spinae adnatae more spiniform and orientated medially; notogastral setae somewhat shorter.

Despite these differences, the Slovakian material was determined as conspecific with the type-species, *H. visnyai*.

Hungarobelba visnyai (Balogh, 1938)

Only adults are described, because of absence of immatures in our material.

General characteristics

Length 335-360 μm , colour light-brown to brown. Adults rarely carrying the reticulate nymphal exuviae. Whole body covered by layer of cerotegument, which can be removed after heating with lactic acid. Cerotegument of prodorsum and notogaster irregularly granular, with two types of sculpture: large, semiglobular or globular tubercles; and small granuli (Fig. 4E).

Prodorsum

Prodorsum roughly triangular in shape. Prodorsal surface smooth (except for the cerotegument), punctate, with small and indistinct maculae in central part.

Rostrum conical, rounded. Rostral and lamellar setae subequal in length, inserted near to each other on lateral side of rostrum. Acetabulum I partly covered from the anterolateral side by small tectum (external wall of acetabulum, "paroi extérieure" *sensu* GRANDJEAN, 1965), projecting posteriorly from rostral area. A similar, but much more developed, lateral tectum covers acetabulum II

from anterior side (Fig. 4A). Pedotecta I and II absent. Prodorsal and sejugal grooves distinct and deep. Prodorsum convex between grooves, except rostral area. A high, protruding, prodorsal protuberance is present between the bothridia (Fig. 4A, *ptp*). In dorsal view this protuberance is visible as a rounded, quadrangular structure with more or less visible and well sclerotized borders (Fig. 2). Similarly, borders of inter-groove convexities of prodorsum are seen from dorsal view as more or less visible ridges, localized between lateral and central part of prodorsum and surrounding the bothridia. Enantiophyses present in both prodorsal and dorsosejugal grooves. Only distinct tubercles in prodorsal groove are in anterior position (A_a). Second half of prodorsal enantiophysis (A_b) absent. Similarly, no (or only very slightly developed) posterior tubercles were found opposite the well developed anterior tubercles of postbothridial enantiophysis (B_a) (Fig. 4A). Apophyses of the laterosejugal enantiophysis (L_a , L_p) are both well developed, tubercular, without tips.

Another sclerotized ridge occurs in area between the bothridium and acetabulum II, ventral to insertion of exobothridial seta. This ridge covers the small, but distinct propodolateral cavity (*cpl*) containing a small microsculptured area (probably porose area, Fig. 4A). Bothridia funnel-like, with membranous rim, situated above acetabulum II or somewhat anteriorly, not fused with postbothridial apophyses. Propodolateral apophyses (P) well developed, triangular, pointed and granulose.

Sensillus long, setiform, with filiform or flagelliform distal part. Proximally, close to bothridia, a club-shaped conglomerate of cerotegument is present on the sensillus, consisting of small tubercular or sphaerical granules (Fig. 4B). The sensillus can be slightly thickened in this area. Interlamellar setae setiform, somewhat shorter than rostral and lamellar setae, usually curved towards prodorsal protuberance. Exobothridial setae small, setiform, not (or hardly) visible in dorsal aspect, inserted on a small tubercle.

Notogaster

Notogaster oval or broadly oval, and truncate anteriorly (Fig. 1). Dorsosejugal scissure very indis-

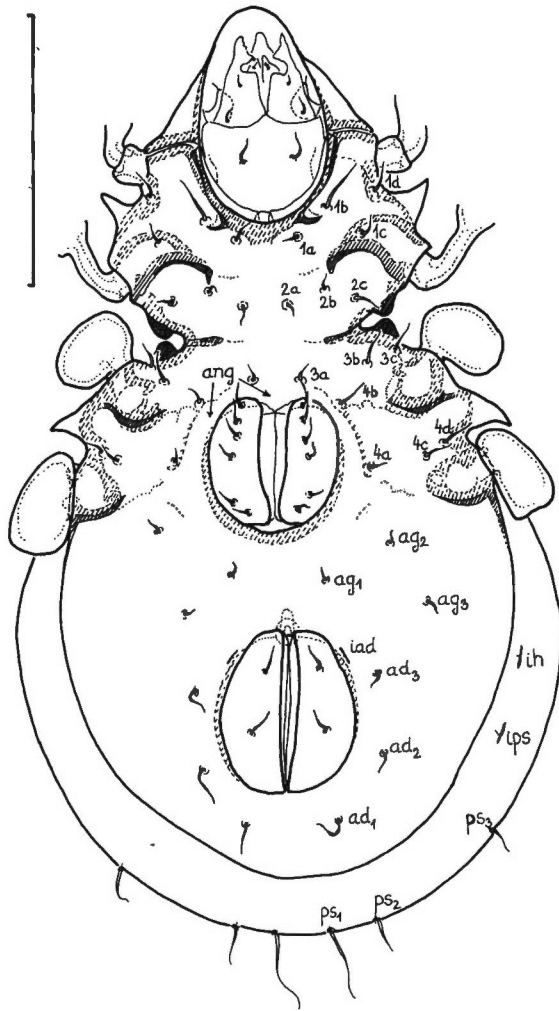


FIG. 3 : *H. visnyai*

Specimen from Slovakia. Ventral aspect (ang : anterogenital area).
Scale : 100 μ m.

tinct, usually formed only by ridges of cerotegument. Humeral ridges present in anterolateral part of notogaster, with anterior end of typical angular form. Spiniform or broadly triangular, sharply pointed spinae adnatae (*s.a.*) are positioned here. Tips of *s.a.* orientated medially, more or less pointing to posterior border of prodorsal protuberance.

Notogastral setae generally in 2 longitudinal rows, 9 pairs of setae always visible (including ps_1). Setae flagelliform distally, c_1 directed anteriorly, other setae posteriorly and curved mediad. Proximally the setae have similar conglomerate of cerotegument as on the sensillus. Setae ps_1 - ps_3 situated

on posterior border of notogaster. ps_1 much longer than ps_2 and ps_3 , distance ps_2 - ps_3 more than twice that of ps_2 - ps_1 . Lyrifissures in usual positions.

Lateral characteristics (Fig. 4A)

Acetabula I-IV placed roughly in a line. Sejugal groove deep. Laterosejugal enantiophysis (L) situated dorsad of acetabulum II, between the anterior tubercle of postbothridial enantiophysis (B_a) and parastigmatic enantiophysis (S). Tracheal opening situated on the base of anterior apophyse of laterosejugal enantiophysis. Tracheal system modified, trachea I only developed as a short brachytrachea.

A distinct carina is present between acetabulum I and the insertion of the rostral hairs. Another, less distinct ridge is visible close to the genital plates, between the epimeral setae 4a and 4b.

Ventral region

Epimeral surface with micro-granulate microsculpture, covered by granular cerotegument. Epimeres I, II and III separated by epimeral groove II and deep sejugal groove, epimeres III and IV practically fused into one plate, only indistinctly separated from anogenital plate, surrounding the genital aperture anteriorly and anterolaterally as an arch without microsculpture. This is called the anterogenital area (*ang*, Figs. 3, 4A), because it is probably homologous with the anterogenital depression described by GRANDJEAN (1965) in *Fosseremus*.

Apodemes I-II and sejugal apodeme lamellar, apodemes III and IV reduced. Epimeral neotrichy present on epimeres, most distinct on epimere II. Epimeral setation 4-3-3-4. Epimeral setae smooth, seta 1b much longer than other setae, setae 4c and 4d close to each other. Insertions of epimeral setae on distinct small tubercles. Between setae 4a and 4b is an indistinct line, separating the anterogenital area from epimeres III and IV. Discidium large, triangular and sharply pointed.

Distance between genital and anal apertures large, slightly shorter or subequal to length of genital aperture (more than 3/4). Genital plates

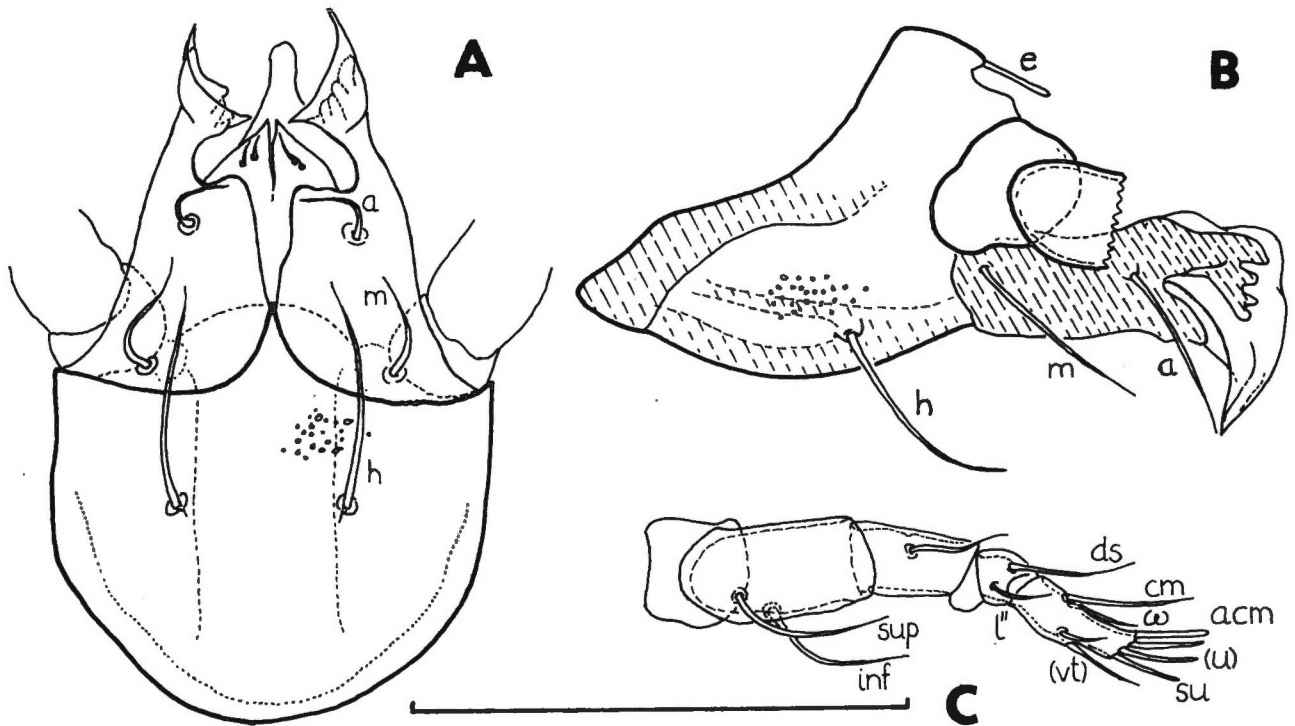


FIG. 5 : *H. visnyai*.

A. — Gnathosoma, ventral view, B. — Gnathosoma lateral view (chelicera and palp removed), C. — palp. Scale : 50 μ m.

(Fig. 4C) shorter than anal ones, with protruding genital tectum on anterior border. Anal plates (Fig. 4D) widest in the posterior quarter. Genital papillae differing in shape : anterior papillae more robust and globose; posterior two pairs are of elongate, clavate form and slightly removed from first pair. All setae of anogenital plate moderate in length and smooth. Six genital setae present on each genital plate, usually in two rows : anterior four setae in paraxial row, posterior two in anti-axial position. Aggenital neotrichy present, Ag 3. Two pairs of anal and three pairs of adanal setae present. Lyrifissure *iad* in adanal position.

Gnathosoma

Gnathosoma with a combination of primitive and derived characters.

Infracapitulum diarthric, with well developed labiogenal suture (Fig. 5A). Rutellum modified, atelebasic, with hyaline expansion, protruding and

pointed ventrally (Fig. 5B). Setae *a*, *m*, *h* long and smooth. Two small, smooth adoral setae present on the lips. Spine *e* long and baciliform.

Palpal setation (solenidion not included) : 0-2-1-2-7, lateral setae of palpal tarsus missing (Fig. 5C). Palpal solenidion narrow and adhering to surface. Four distal setae (*acm*, *us*, *ui*, *su*) eupathidial.

Chelicerae weakly chitinized, gracile. Cheliceral setae smooth, without barbs.

Legs

Legs relatively short, shorter than body, moniliform. All dorsal setae of genu I-III and tibia I-IV coupled with solenidia. Seta *d* on tibia I thin, smooth and usually adhering to solenidion, hardly visible (Fig. 4F). Tarsal solenidion I (ω_1) and tibial solenidia II and III (φ) of typical, baculiform shape. Two solenidia present on tarsus II. Iateral setae present on tarsus II and tarsus III, tarsus IV with two fastigial setae.

The setal formulae of the legs are identical with the leg setation of *H. pyrenaica* n.sp., described in

detail in this paper. Some differences were observed in comparison with NORTON's description of leg setation in *Hungarobelba* sp. A from North America (NORTON, 1977).

Material examined

Slovakia : Slanské vrchy hills, beech forest (*Fagus*), moist litter and mosses on wood, 30. July 1987, 1 male, sample no. TOP-13 (85/87), coll. L. MIKO. Levočské vrchy hills, valley of Tichý potok, litter of mixed beech forest, moist, 2. August 1988, 5 males, sample no. JK-03-88, leg. J. Koščo, coll. L. MIKO. Pieniny Nat. Park, northern slope of Kláštorhá hora hill, mixed forest (*Tilia*, *Acer*, *Fagus*, *Abies*, *Corylus*), moist mosses on the calcareous stones, 21 August 1988, 1 male, sample no. LM-320-88, coll. L. MIKO. Pieniny Nat. Park, rocks under hill of Šafranovka, moist litter of mixed forest (*Fagus*, *Picea*, *Abies*, *Corylus*), 9. September 1989, 6 males and 9 females, sample no. LM-303-89, coll. L. MIKO. Pieniny, Strážany, southern slope of Kýčera hill, moist litter of small mixed forest (*Fagus*, *Picea*, with *Asarum* in undergrowth), 8 June 1990, 2 males, sample no. LM-95-90, coll. L. MIKO.

Ecology

There are few data on the ecological requirements of *Hungarobelba visnyai*. The similarity of habitats in which most of the known material was found is remarkable. Usually it was in relatively warm, humid and non-acid conditions (mostly calcareous, often in the vicinity of rocks) in the submontane-montane zone. This species inhabits rich, mixed litter and detritus, especially that of *Fagus*. The populations were never very numerous, and according to the geographical distribution (Fig. 14) we hypothesise the possible relict nature of this species.

Hungarobelba pyrenaica n.sp.

Unless otherwise noted, the main part of the description concerns specimens from the type series (sample no. R.1445).

ADULT :

General characteristics

Length 360-415 μm , colour yellowish-brown in direct light. Sex-ratio normal. The dimensions of both sexes are without differences. No secondary sexual characters present. A population with 20 individuals taken at random contained 8 females with average body length 378 μm and 12 males with average body length 373 μm (material from Massane). In some samples the males are more abundant than females, in others the situation is reversed. Nymphal scalps are not carried by adults. Body, including the legs, covered by a layer of uniformly granulated, easily removable cerotegument. Body surface finely punctate or microgranulate; this microsculpture is visible after heating in lactic acid and removing the cerotegument layer.

Prodorsum

Generally similar to *H. visnyai*. No prodorsal enantiophysis present (Figs. 6, 8A). Centrodorsal protuberance more rounded, subcircular, slightly protruding anteriorly in lateral view. Apophysis P well developed, sharply pointed. Postbothridial apophysis and lateral enantiophysis as in *H. visnyai*. Propodolateral cavity surrounded by chitinous ridge, porose area (?) indistinct. Exobothridial setae not inserted on tubercle.

Sensillus (Fig. 8B) setiform with flagelliform distal part. Cerotegument on proximal part of sensillus amorphous, hyaline, with circular structure, distally with brush of capitate cerotegument fibres.

Notogaster

Notogaster of truncate oval form, without distinct anterior border. Notogastral setae positioned as in *H. visnyai*, slightly shorter. Spinae adnatae of medium size, shorter than in material of *H. visnyai* from Slovakia, their tips oriented more anteriorly, approximately in direction of insertions of interlamellar setae.

Lateral region

Similar to that of *H. visnyai*. Tracheal system modified : short and branched brachytrachea with

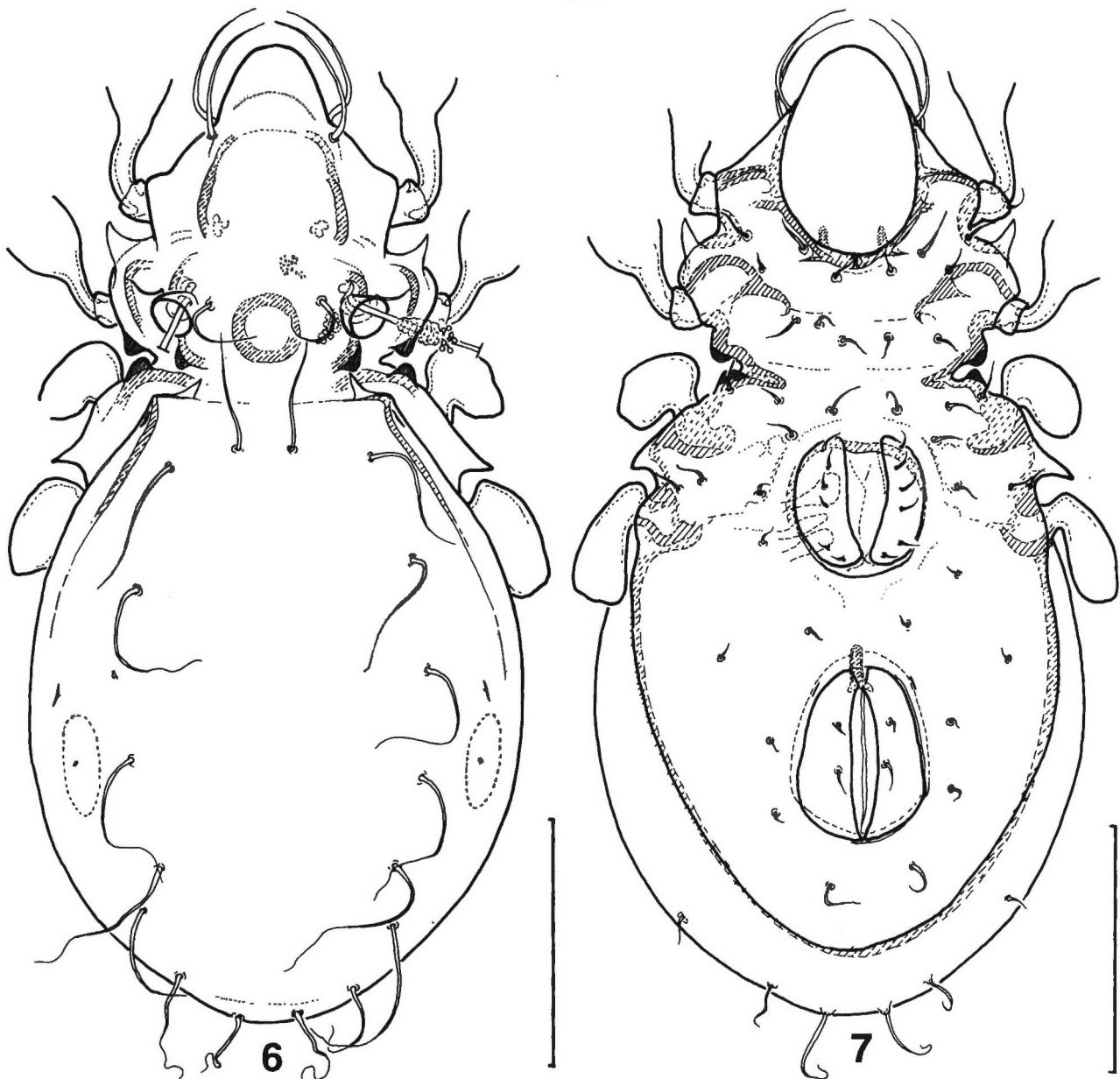


FIG. 6-7 : *Hungarobelba pyrenaica* n.sp.

Specimen from type series (Prats-de-Mollo, Pyrénées Orientales, France) : 6. — Dorsal aspect. 7. — Ventral aspect. Scale : 100 μ m.

normal diameter developed on the place of trachea I (fig. 10 A, B). Secondary branch of brachytrachea positioned before peritreme (as shown in fig. 10 B) or behind them. In some cases, the brachytrachea is simple, without branches. Sejugal trachea with usual branches on both sides of the peritreme, with diameter smaller than that of brachytrachea I and especially trachea III. Both branches long, fragile and difficult to observe. Trachea III simple.

Ventral region

From 10 individuals selected at random (i.e. 20 observations) the normal epimeral formula (4-3-3-4) was observed in 16 cases. In the 4 other specimens one seta was absent on one of the epimeres, so the variability is low. Number of aggenital setae did not vary greatly (in 2 individuals 2 aggenital setae were observed unilaterally, instead of 3).

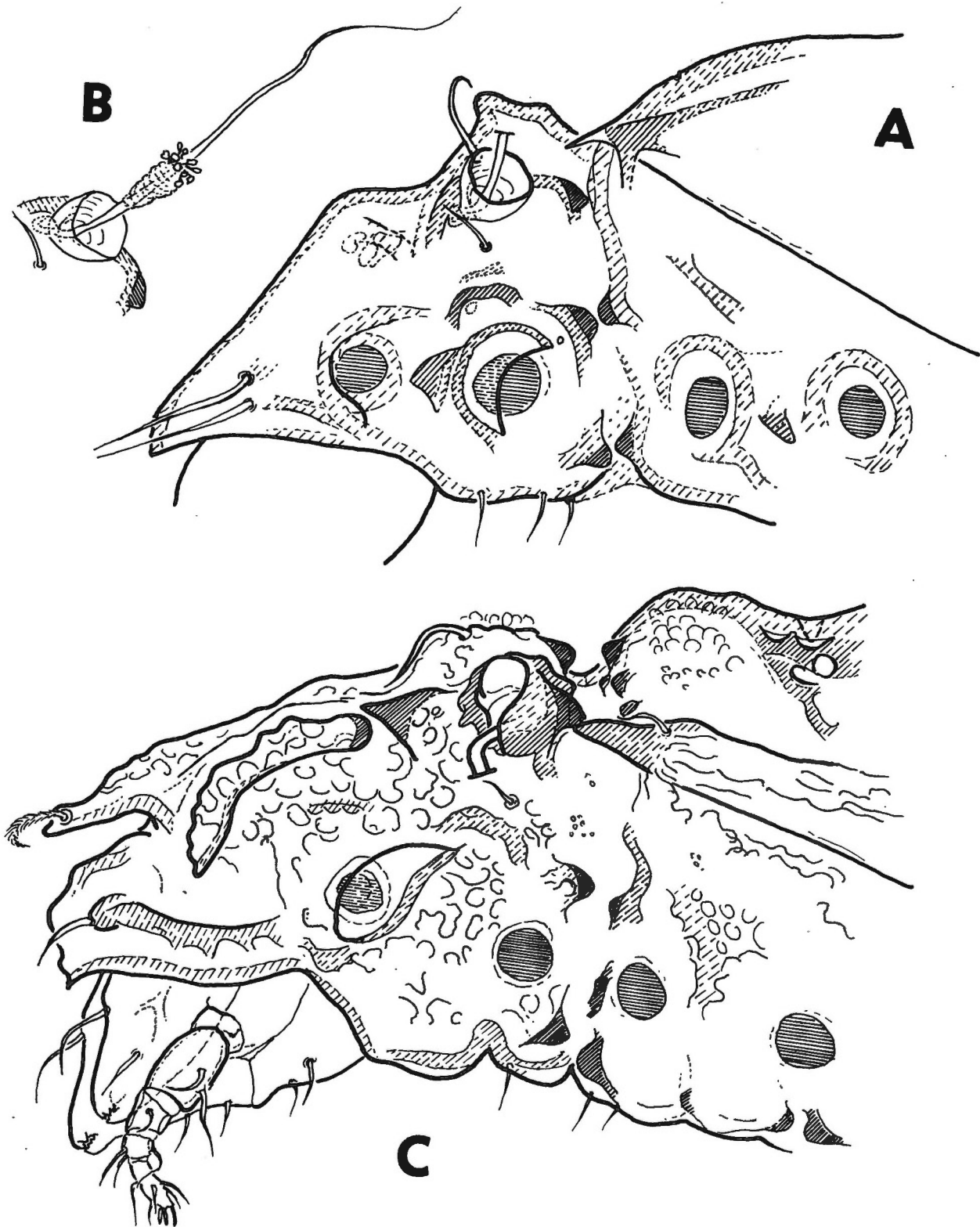


FIG. 8 : A. — *H. pyrenaica* n.sp., lateral view, B. — Sensillus and bothridial region of *H. pyrenaica*, C. — *Caleremaeus monilipes*, lateral view.

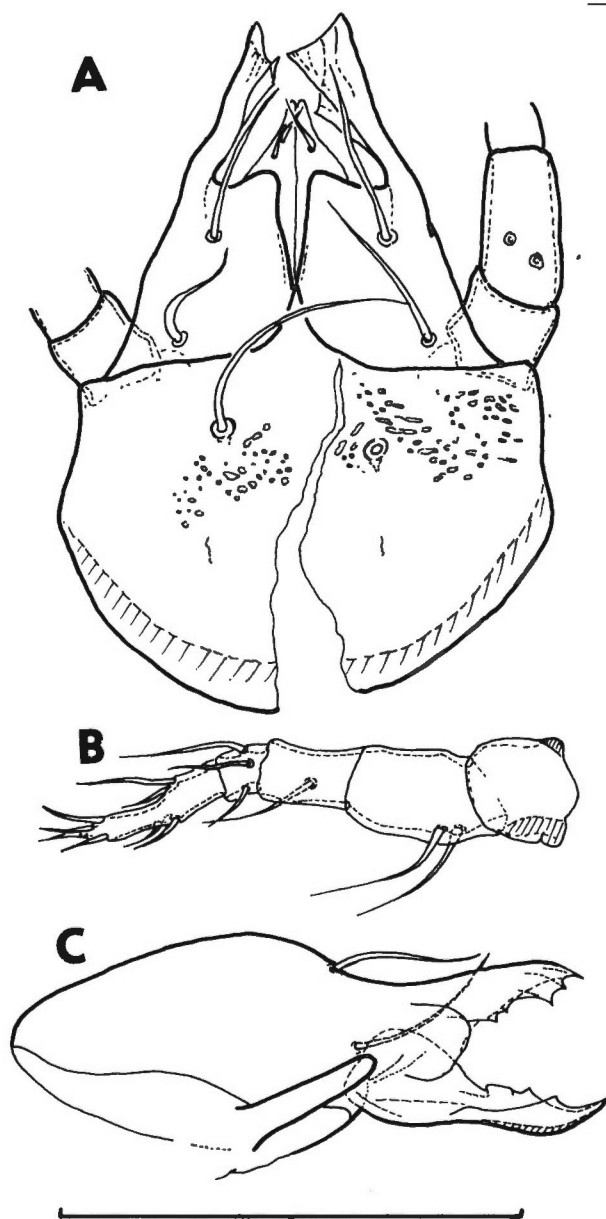


FIG. 9 : *H. pyrenaica* n.sp.

A. — Gnathosoma ventral, B. — Palp, C. — Chelicera. Scale : 50µm.

The male copulatory organ is without special characters, possessing sclerotized parts and 12 eugenital setae. The ovipositor is striking in the neotrichy and dimensions of setae *k* (fig. 10 C). Instead of usual number of 6 setae, 33 pointed and bent, claw-like setae were observed on the individual illustrated in fig 10. The same number and form of setae *k* were found in another individual, but the ovipositor is often contracted, and in spite

of dissection and heating in lactic acid, the number of *k* is impossible to count without error. The number is probably variable, as is usual in cases of neotrichy.

Preanal organ similar to that of *Litholestes altitudinus* Grandjean (1951 : 24), consisting of a basal triangular and considerably sclerotized part, and cylindrical concave part of variable length, resembling the finger of glove.

Generally, there are no essential differences in comparison to *H. visnyai*.

Gnathosoma

Similarly modified as in *H. visnyai*. Rutella (Fig. 9A) more closely positioned, two adoral setae present. Microsculpture of mentum irregular, consisting of single or fused microtubercles.

Palp setation (without solenidion) 0-2-1-3-7 (Fig. 9B).

Chelicerae (Fig. 9C) poorly chitinized, gracile, with lateral velum on digitus mobilis. Cheliceral setae smooth.

Legs

All legs moniliform, monodactyl, covered by cerotegument. Leg setation as follows (without solenidia, famulus included) : I : 1-7-4-5-20 ; II : 1-6-4-5-17 ; III : 2-4-3-4-17 ; IV : 1-4-4-4-14

Dorsal setae of all tibiae coupled with solenidion, seta *d* of tibia I hardly visible, closely adhering to solenidion (Fig. 11A). Similarly, dorsal setae of genu I-III coupled with solenidia. Seta *l*₂' of femur I present in almost dorsal position, near the dorsal seta (Fig. 11A). Two setae present in place of fastigial seta on tarsus IV (see discussion below). Iteral setae of leg II and III present. Setae *s* eupathidial in adult.

Solenidiotaxy normal (leg I : 1-2-2, II : 1-1-2, III : 1-1-0. IV : 0-1-0). Solenidia ω_1 of leg I, of legs II and III of typical baculiform shape, strongly curved (Figs. 11A, B, D). Solenidion ω_2 of leg I setiform, coupled with famulus.

Famulus similarly developed as in *Fosseremus* (GRANDJEAN, 1965a). ϕ_1 of leg I long, setiform, tactile. All other solenidia bacilliform, slightly curved or straight.

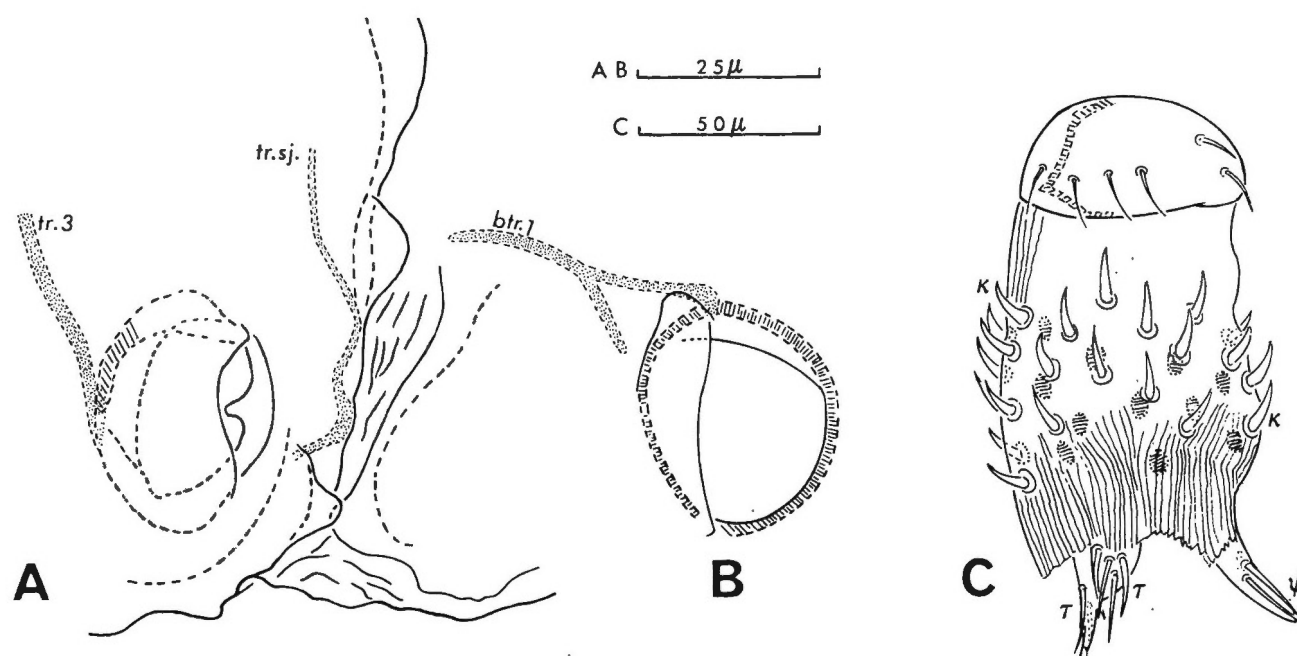


FIG.10 : *H. pyrenaica* n.sp.

A. — Lateral right region of the adult after dissection of leg III, with sejugal trachea and trachea III depicted, B. — Acetabulum I and brachytrachea I, C. — Extruded ovipositor in lateral view, the setae from the opposite side are only schematically Figured (insertion areas hatched). (A and B : material from Massane ; C : material from Prats-de-Mollo).

ONTOGENY

Length of immatures as follows : larva 185μm (1 ex.), protonymph 235μm (1 ex., Massane), deutonymph 275-285μm (5 ex.), tritonymph 325-370μm (5 ex., Massane and Prats de Molo). Cerotegument developed as in adults, but proportionally finer. Nymphs carry exuvial scalps of previous instars.

Dorsal characteristics

Lamellar and rostral setae in a transversal line in all nymphs, rostral setae situated more paraxially in comparison with adult. Bothridium and sensillus well developed in all instars, typical layer of cerotegument present from the larval instar (Fig. 12A, C). Prodorsal protuberance gradually developing, distinct in tritonymph.

All gastronotic setae on apophyses or at least small tubercles (*c*-setae in larva). Development of setation typical of eupherederm oribatids. Larva unideficient, setae c_1 - c_3 shorter than other setae, c_3

with two bristles. Setae *dp* and *lp* distinctly barbed. Setae *dm* twice as long as setae *l* and *da*. Insertion apophyses of centrodorsal setae and setae *lm*, *lp*, *h*₁ more sclerotized than rest of body. Nymphs quadrideficient. Setae c_2 , c_3 and ps_1 shorter than other setae in tritonymph (Fig. 12D). All nymphal stages lack cornicle for attachment of exuvial scalps.

Ventral region

Development of epimeral setation as follows : larva 2-1-1 (Claparède's organ not included), protonymph 3-1-2-1, deutonymph 3-1(or 2)-2-2, tritonymph 3-2(or 3)-2-3.

Paraproctal atrichosity not present. Three setae present on paraproct in larva and protonymph, two in deutonymph and tritonymph. 3 genital setae present in deutonymph, five in tritonymph. Development of aggenital setae as follows : 0-1-2-3 (in one case 3 aggenital setae were found unilaterally in tritonymph).

Gnathosoma generally similar to adult, inferior seta of palp protonymphal.

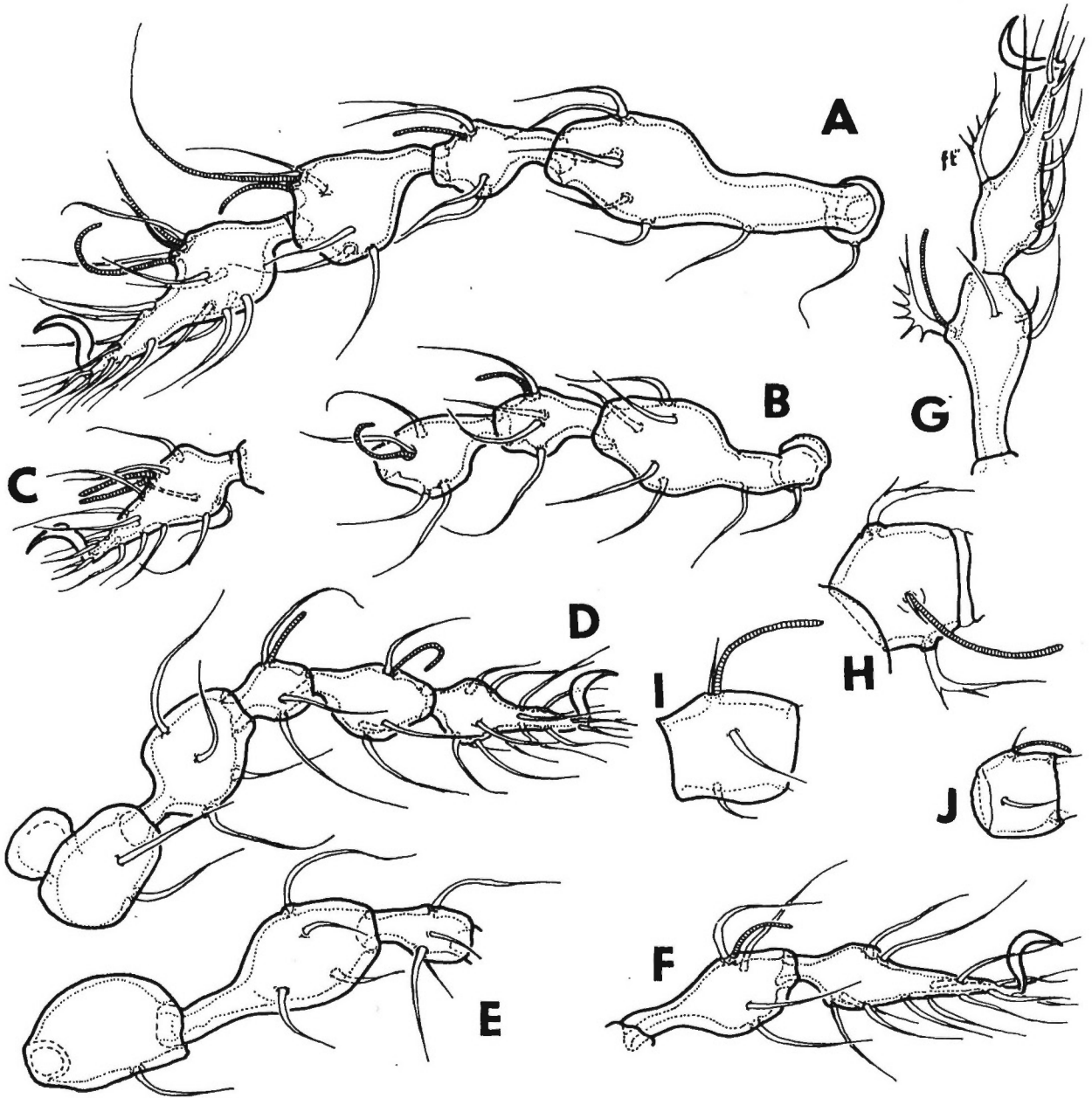


FIG. 11 : *H. pyrenaica* n.sp.

A. — leg I, B. — Femur, genu and tibia II, C. — Tarsus II, D. — Leg III, E. — Trochanter, femur and genu IV, F. — Tibia and tarsus IV (adult), G. — Tibia and tarsus IV of tritonymph, H. — Genu I of larva (dorsal), I. — Genu II of larva, J. — Genu III of larva.

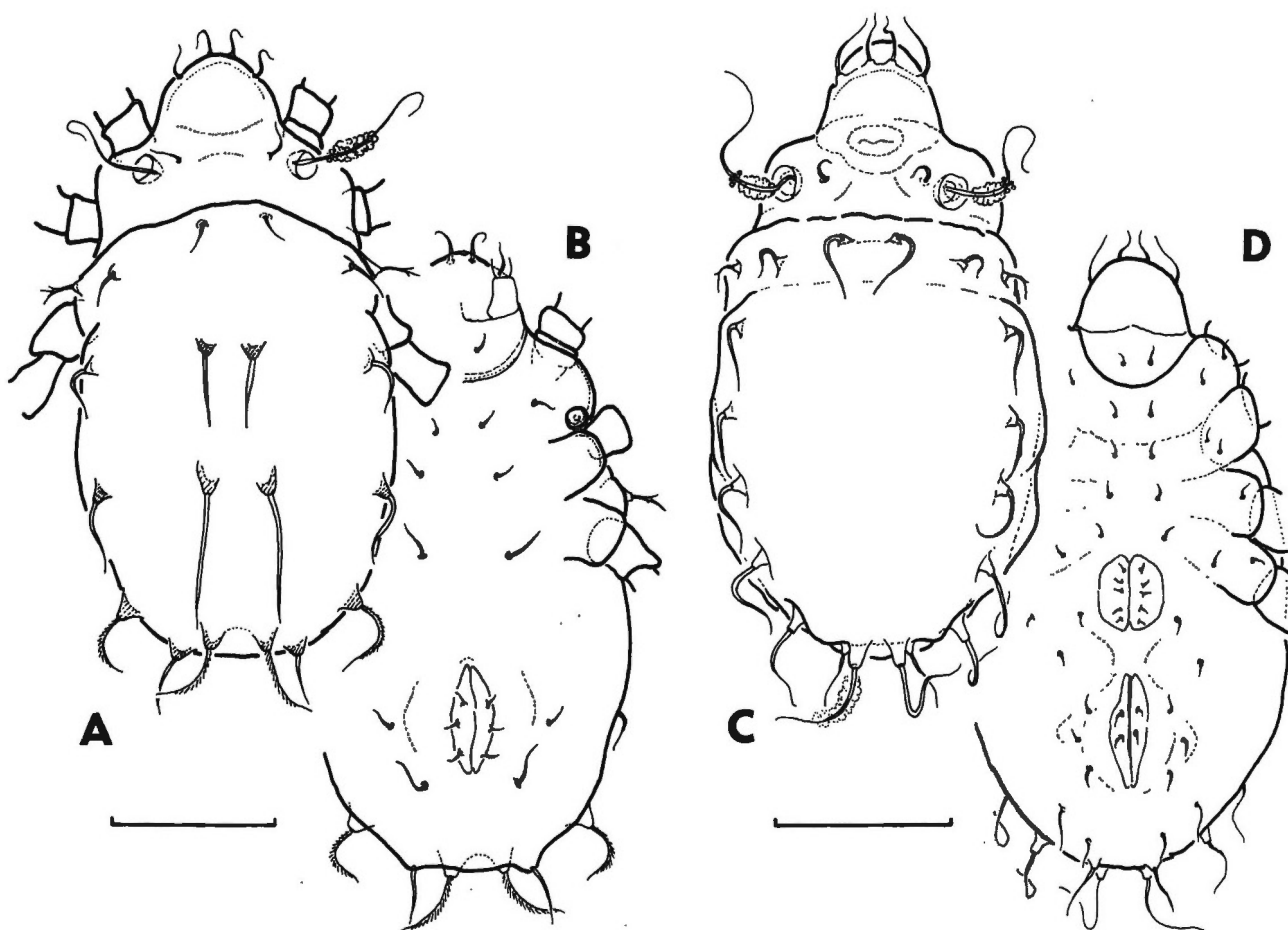


FIG. 12 : *H. pyrenaica* n.sp.

A. — Larva dorsal, B. — Larva ventral, C. — Tritonymph dorsal, D. — Tritonymph ventral. Scale : A, B. — 50µm ; C, D. — 100 µm.

Legs

Chaetotaxic formulae of legs as follows (famulus included, solenidia in parentheses) :

	leg I	leg II	leg III	leg IV
larva	0-2-3-4-16 (1-1-1)	0-2-3-3-13 (1-1-1)	0-2-2-3-13 (1-1-0)	
protonymph	0-2-3-4-16 (1-1-2)	0-2-3-3-13 (1-1-1)	1-2-2-3-13 (1-1-0)	0-0-0-0-7
deutonymph	1-4-4-5-16 (1-2-2)	1-4-3-4-13 (1-1-2)	2-3-2-3-13 (1-1-0)	1-2-2-3-12 (0-1-0)
tritonymph	1-5-4-5-18 (1-2-2)	1-4-4-5-15 (1-1-2)	2-3-3-4-15 (1-1-0)	1-3-3-4-12 (0-1-0)

Dorsal setae of all stages coupled with respective solenidia. Dorsal setae of femur I, II, IV, those of genua I-IV and tarsi I-IV, as well as lateral setae on

genus I, II and tibia I and II of nymphs strong, dark, with spiniform bristles (Fig. 11G). Larval solenidia of genua I-III slightly curved, bacilliform, coupled with thin, short companion seta (Figs. 11H, I, J). Second lateral seta on femur I added in adult. Ventral setae of tarsi I-IV not added in tritonymph, present only in adult. Iateral setae I-III tritonymphal (n3-n3-n3-0, as usual in higher oribatids). Antiaxial fastigial seta of tarsus IV regressive in nymphs (Fig. 11G). In adult, supplementary seta occurs near *ft''*, but usually (with some exceptions) in the paraxial position (if we accept, that the larger seta is *ft''*, which is protonymphal). The homology of this seta is problematic ; the use of the notation *ft'* is contradictory and such development of tarsus IV setation is unknown elsewhere.

Material examined

Pyrenées Orientales (France) : Corsavy, mosses on border of beech forest, calcareous, 1000 m a.s.l., 18 August 1954, 1 ad., coll. J. TRAVÉ, sample R.33. Corsavy, *ibid*, 5 September 1954, 2 ad., coll. J. TRAVÉ, sample R.37. Argeles-sur-Mer, Massane forest, litter and humus layer on river bank under *Fagus sylvatica* and *Quercus pubescens*, accumulated with *Sarothamnus scoparius*, on slate ("micaschistes"), 630 m, 21 December 1955, 4 ad., coll. J. TRAVÉ, sample R.1373. Argeles-sur-Mer, Massane forest, soil under rock on river bank, on slate, 640 m., 13 December 1957, 1 tritonymph, coll. J. TRAVÉ, sample R.235. Argeles-sur-Mer, Massane forest, litter and humus soil under *Fagus* with *Rubus* sp., on slate on the river bank, 660 m, 11 June and 28 July 1986, 39 adults, 30 nymphs, 1 larva, leg. F. Duran, coll. J. TRAVÉ, samples R.1891 and R.1892. Laroque des Albères, Col de l'Ouillat, litter on the soil, on slate, 1000 m, 28 September 1960, 3 ad., 4 nymphs, leg. Y. COINEAU, coll. J. TRAVÉ, sample a269. Prats-de-Mollo, sieved litter and humus soil from entrance of the Ste Marie cave, on limestone, 1200 m, 2 April 1957, 12 ad., 9 nymphs, coll. J. TRAVÉ, sample a537. Prats-de-Mollo, near Col d'Ares, Chapelle Sta Marguerite (*Locus typicus*), soil on limestone rocks, 1330 m, 17 November 1971, 12 ad., 6 tritonymphs, 16 deutonymphs, 2 larvae, coll. J. TRAVÉ, sample R.1445 — HOLOTYPE (coll. J. TRAVÉ) and 11 paratypes : coll. L. MIKO and J. TRAVÉ. Prats-de-Mollo, litter and humus soil in entrance of En Brixot cave, on limestone, 1190m, 11 September 1973, 1 ad., coll. J. TRAVÉ, sample R.1584. Prats-de-Mollo, humid litter near walls of Mas En Brixot, on limestone, 1160 m, 11 September 1973, 29 ad., 3 nymphs, coll. J. TRAVÉ, sample R.1591

Catalonia : Montseny Mountains (Province of Barcelona), thick layer of humid *Fagus* litter by the road from San Celoni to Santa Fé, on silicate, 1050 m, 7 April 1981, 1 ad., coll. J. TRAVÉ, sample R.1776. Ports de Beseit (Province of Tarragona), mixed humus soil and litter of *Fagus*, *Acer* and *Pinus*, in relict beech forest, on limestone, 1200 m, 12 April 1982, 14 ad., 10 nymphs, 1 larve, coll. J. TRAVÉ, samples R.1812 and R. 1813.

Ecology

Present data on the distribution of *H. pyrenaica* shows some similarities with the habitats of *H. visnyai*. All samples containing *H. pyrenaica* were taken in pure or mixed beech forests, on silicate, acidic or calcareous material. The habitats are always relatively humid and situated in shade. Altitude varies from 600 to 1330 m above sea level. The two richest samples (R.1891 and R.1892) from the Massane forest are from litter and humus on brown acid soils (colluvium), with pH 5.6, carbon content 28 %, nitrogen content 1.64 %, and C/N ratio about 17.

Beech forests of Albères (Massane forest, Col de l'Ouillat, Montseny, Ports de Beseit) are of the meridional mediterranean type. The forests of Vallespir uplands (Corsavy, Prats-de-Mollo) are montane.

Differential diagnosis

Hungarobelba pyrenaica n.sp. differs from *H. visnyai* by several characters. The most important are : body length greater (360–415 µm, *H. visnyai* 335–370µm); colour of body lighter; cerotegument fine, with small granuli, rarely with amorphous parts; absence of prodorsal enantiophysis (apophysis A_a); sensillus with a different type of cerotegument (amorphous, hyaline, with circular structure, distally with brush of capitate cerotegument fibres); prodorsal protuberance more rounded; rutella more closely positioned anteriorly; palpal tibia with three setae.

REMARKS

a) The tracheal system of *Hungarobelba pyrenaica* (as well as *H. visnyai*) is intermediate between the normal system, with 3 tracheae, and the reduced system of oribatids without trachea I (*système trachéen subnormal*, GRANDJEAN, 1965, p. 104). A similarly developed tracheal system with brachytrachea I is known in *Damaeolus* (GRANDJEAN, 1965a, p. 373). Oribatids with the reduced tracheal system are the Gymnodamaeoida and the genus *Fossere-*

	femur	genu	tibia	tarsus
leg I				
larva	<i>d, bv</i>	<i>d, (l)</i>	<i>d, (l), v'</i>	<i>(ft), (pl), e, (pv), (a), (u), (tc), (p), s</i>
deutonymph	<i>(l)</i>	<i>v'</i>	<i>v''</i>	—
tritonymph	<i>v''</i>	—	—	<i>(it)</i>
adult	<i>v', l₂'</i>	—	—	<i>(v)</i>
leg II				
larva	<i>d, bv</i>	<i>d, (l)</i>	<i>d, l', v'</i>	<i>(ft), (pv), (tc), (a), (p)(u), s</i>
deutonymph	<i>(l)</i>	—	<i>l''</i>	—
tritonymph	—	<i>v'</i>	<i>v''</i>	<i>(it)</i>
adult	<i>(v)</i>	—	—	<i>(v)</i>
leg III				
larva	<i>d, ev</i>	<i>d, l'</i>	<i>d, l', v'</i>	<i>(ft), (pv), (tc), (a), (p), (u), s</i>
deutonymph	<i>l'</i>	—	—	—
tritonymph	—	<i>v'</i>	<i>v''</i>	<i>(it)</i>
adult	<i>v'</i>	—	—	<i>(v)</i>
leg IV				
protonymph	—	—	—	<i>ft'', (pv), (p), (u)</i>
deutonymph	<i>d, ev</i>	<i>d, l'</i>	<i>d, l', v'</i>	<i>(tc), s, (a)</i>
tritonymph	<i>l'</i>	<i>v'</i>	<i>v''</i>	—
adult	<i>v'</i>	<i>l''</i>	—	<i>v', additional seta near ft''</i>

TABLE 1 : Development of leg setation in *Hungarobelba pyrenaica* n.sp.

mus, which is member of the Damaeolidae. Thus, the family Damaeolidae contains 2 members, one with brachytrachea I and one with a reduced tracheal system. Is the brachytrachea a rudiment or a vestige of a trachea ? Tracheae are of secondary origin, and although the normal tracheal system is quasi-general in superior oribatids, the hypothesis of rudimentary origin seems us to be more probable. Note in this context the situation in *Conoppia microptera* (Berlese) with the simultaneous presence of sejugal brachytrachea of variable form and normal trachea leading into the same tracheal vestibule.

b) Large setae *k* of ovipositor are also known from *Tegeocranellus laevis* (Berlese), but in normal numbers (GRANDJEAN, 1962, p. 85, fig. 2). We note the remark of GRANDJEAN (1968, p. 145) on the ovipositor of *Fortuynia yunkerii* van der Hammen, with similarly developed setae *k* and neotrichy (18k). This neotrichy is much weaker than in *Hungarobelba* and these species are not closely related. The same is probably true in *T. laevis*, whose relations remain uncertain without knowledge of the immatures.

c) *Hungarobelba* cf. *visnyai* found by SALOÑA and ITURRONDOBEITIA (1989) in *Fagus* litter in mountain areas of Vizcaya (Spain) share some character states of *H. pyrenaica*. On the other hand, some differences are present. The position of this form needs detailed study.

REDEFINITION OF THE GENUS *HUNGAROBELBA* BALOGH, 1943

In BALOGH (1972) the genus *Hungarobelba* is placed in the family Belbodamaeidae, superfamily Damaeioidea, and characterized by the following combination of character states :

No lamellae or lamellar ribs present. No ventral neotrichy (!), chelicerae normal, not suctobelboid. Apodemata 3 reduced, epimeres 3 and 4 fused. Notogaster hemispheric, legs generally long, with moniliform joints. Eight pairs of notogastral setae arranged in 2 parallel longitudinal lines (= belboid type).

Spinac adnatae present. Solenidion of tibia IV with protecting seta, genu IV with 4 setae. Asso-

ciated setae on genu I-III and tibia II-IV. Setal formula of genua 4444, trochanters 1121.

GHILAROV and KRIVOLUTSKY (1975) defined the genus similarly, but gave some new characters and different setal formula of the genua :

Spinae adnatae present. Legs relatively short, moniliform. Solenidion of tibia IV always with protecting seta (= Belbodamaeidae). Body form narrow, width of propodosoma and hysterosoma equal. Notogaster rounded posteriorly and horizontal anteriorly. Spinae adnatae large, in humeral position. Setae c_1 differ from other notogastral setae. Trochanteral setation 1121, genual 4433. Tibial solenidia II-IV with protection seta.

Hungarobelba has recently been placed in the Damaeidae (BALOGH and BALOGH, 1992).

Published definitions are insufficient and erroneous for several characters. The genus *Hungarobelba* can be defined as follows :

Diagnosis

Eupheredermous oribatids of medium size (330-420 μ m), usually not carrying the nymphal exuvia. Body covered by granular, tubercular or irregular cerotegument.

Prodorsum with deep prodorsal groove and distinct prodorsal protuberance, appearing as a round or quadrangular formation in dorsal view. A small propodolateral cavity with sclerotized ridge present laterally from bothridium. Bothridium funnel-like, not fused with postbothridial apophysis. Sensillus long, setiform with flagellate distal part, proximally covered by cerotegument. Pedotecta I and II not developed, apophysis *P* present. Postbothridial apophysis, lateral and parastigmatic enantiophyses present.

Notogaster ovoid, oval or broadly oval, with indistinct, straight (truncate) anterior border. Spinae adnatae present in humeral position. Ng 11 (c_1 present), situated in 2 longitudinal rows. Notogastral setae with flagelliform ends, proximally covered by cerotegument.

Gnathosoma with modified rutellum. Chelicerae gracile, with lateral velum. Cheliceral setae smooth. Palp tarsus with 7 setae.

Epimeral neotrichy present, epimeral setal for-

mula 4-3(or 2)-3-4. Indistinct anterogenital area present. Discidium well developed, sharply pointed. G 6, A 2, Ad 3. Aggenital neotrichy present, Ag 3 (rarely 2). Distance between genital and anal plates longer than 1/2 length of genital aperture. Genital papilla V_a slightly larger, blunter and flatter apically than others. Lyrifissure *iad* in adanal position, anteriad of insertion of ad_3 or at same level. Branched or simple brachytrachea present in place of trachea I. Ovipositor with strong neotrichy (over 30 setae), setae *k* strong, pointed and curved.

Legs moniliform, shorter than body, covered by cerotegument. Tibiae I to IV and genua I-III with companion seta *d*. Some solenidia of legs I-III baculiform, strongly curved. An additional seta present near fastigial seta on tarsus IV of adult.

Larva unideficient, nymphs quadrideficient. Larval bothridium and sensillus similar to adult, well developed. No cornicle present on nymphs, all gastronomic setae on distinct apophyses. No paraproctal atrichosity. Iteral setae of leg I-III tritonymphal.

Developmental formulae as follows : NG (12-12-11) ; An (33333-3333-222) ; G (1-3-5-6) ; Ag (0-1-2-3) ; PPA paraproctal setae present in all stases ; N1 (0-0-0-0-7) ; PF pn : inferior seta of palpal femur protonymphal ; DDC ad : companion setae *d* of genua and tibia persist to the adult.

REMARKS ON THE STATUS OF *HUNGAROBELBA*

BALOGH (1943) proposed a new genus *Hungarobelba* in the family Damaeidae for a species described in the genus *Belba* in 1938. After erection of family Belbodamaeidae by BULANOVA-ZACHVATKINA (1967) *Hungarobelba* was placed in this family (BALOGH, 1972 ; GHILAROV & KRIVOLUTSKY, 1975). As shown by NORTON (1979), the concept of the family Belbodamaeidae is incorrect and was thus rejected. NORTON also gave the basic synapomorphies of Damaeidea, remarking, that *Hungarobelba* might differ from other damaeid genera. Additional differential characters of Damaeidae (see below) are discussed by NORTON (1978).

As shown in the present work, *Hungarobelba*

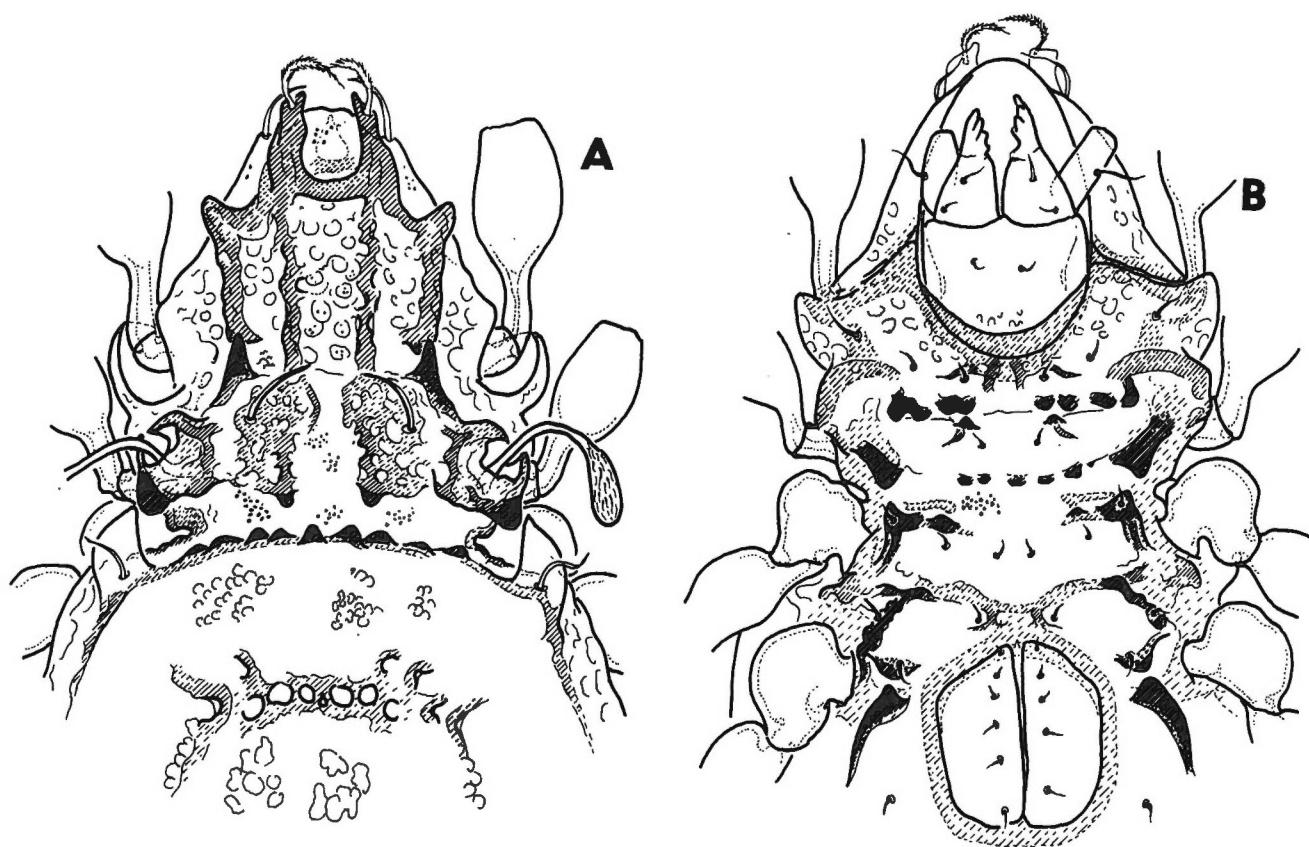


FIG.13 : *Caleremaeus monilipes*

Specimen from Krkonose, Giant Mountains, Czech Republic, leg. M. KUNST 1964 : A. — Dorsal aspect of anterior part of body, B. — Ventral view.

does not share some characters typical of *Damaeoida* (sensu NORTON, 1978 and 1979), e.g. : triangular prodorsum well separated from usually circular notogaster ; legs long, leg IV longer or as long as body ; regression of seta *d* on tibia I of adult ; chelicerae robust, well sclerotized ; cheliceral seta *chb* with fringe of barbs ; palp setation 0-2-1-3-9 ; rutellum with globular hyaline expansion ; cornicle *k* present on nymphs for attachment of exuvial scalps ; paraproctal atrichosity (At 3), only vestigial paraproctal setae sometimes present.

Because of the lack of these states and the presence of other characters (aggenital neotrichy, prodorsal protuberance, lateral enantiophysis, ontogeny etc., see description and below) the position of *Hungarobelba* in the Damaeidae is rejected.

We examined the possibility of inclusion of *Hungarobelba* in the Caleremaeidae. As shown by TRAVÉ

(1961), there are some similarities between *Hungarobelba* and *Veloppia*, especially in the form of the notogaster, structures on prodorsum and development of the chelicerae. Other similarities with *Caleremaeus* (Figs. 8A, 13 A,B) include : presence of laterosejugal enantiophysis dorsal to the acetabula II and III ; similar development of anterior region of notogaster ; deep prodorsal groove with prodorsal enantiophysis ; sclerotized ridge between the rostral seta and acetabulum I present ; small sclerotized ridge dorsad of acetabulum I-acetabulum II present (non tutorialum) ; long famulus ; and structure of genital papillae.

In spite of these similarities, many basic characters are very different. The prodorsum is not sculptured in *Hungarobelba*, pedotectum I is not developed (except the apophysis P), there is no tutorial or lamellar ridge, seta *c*₁ is present on notogaster, setae



FIG.14 : Geographical distribution of *Hungarobelba* species in Europe.

1. — *Hungarobelba visnyai*, 2. — *H. pyrenaica* n.sp.

d are present on all tibiae and genua I-III, leg II shares two solenidia on tarsus, iteral setae are present in adults, epimeral region is without deep grooves and enantiophyses. The special characters of *Hungarobelba* (ovipositor with neotrichy, brachytrachea I) do not occur in *Caleremaeus*. Important ontogenetic differences were also found (different leg chaetotaxy, absence of paraproctal atrichosity). Thus, *Hungarobelba* cannot be included in the Caleremaeidae.

On the other hand, morphological and ontogenetical characters of *Hungarobelba* sp. are in very good agreement with the definition of Eremuloidea (especially with a group of families called "division B") given by GRANDJEAN (1965). The only important difference is the presence of a sharply pointed discidium in *Hungarobelba*.

Both species of *Hungarobelba* share the most striking synapomorphy of this group of Eremuloidea, aggenital neotrichy (additive oligotrichy, Ag 3

in adult). Some other shared character states, used by GRANDJEAN (1965) for the definition of this group (absence of dorsophragma and pleurophragma, absence of tutorium, monodactyly, absence of cornicle or similar formations in the nymphs) are probably symplesiomorphies. *Hungarobelba* also shares some special derived character states known from different families of Eremuloidea. The following of these are considered apomorphic, despite some having apparently evolved several times in Brachypylina : presence of globular and granular cerotegument on body surface ; notogastral setae with cerotegument layer and flagelliform end ; presence of humeral ridge with humeral angle on notogaster ; absence of distinct dorsosejugal scissure ; presence of brachytrachea I ; presence of lateral enantiophysis ; modified rutella ; gracile chelicerae ; long, setiform famulus

Establishing apomorphies in Eupheredermes is problematic. As shown recently by WOAS (1990),

	HUN	AME	CTE	ERE	DAM
pedotectum I	—	+	+	+	(—)
pedotectum II	—	+	+	—	—
discidium	+	+	+	—	—
lamellar ridge	—	(—)	+	+	—
funnel-like bothridium	+	—	—	—	—
spinae adnatae	+	—	—	—	—
ant. border of notogaster	trunc.	trunc.	trunc.	trunc.	round
seta c_2	+	—	—	+	+
Ng setae position	2 rows	n	n	n	n
preanal organ	n	n	n	n	r
<i>iad</i> before ad_3	+	—	—	+	+
palp	n	n	n	n	d
rutellum	d	n	n	n	d
cheliceral setae	2	2	2	2	0-1
proral setae	n	d	d	n	n
solenidia with comp. seta d	(—)	+	(—)	—	—

TABLE 2 : Comparison of selected morphological characters of *Hungarobelba* (HUN) with those of eremuloid families Amerobelbidae (AME), Ctenobelbidae (CTE), Eremulidae (ERE) and Damaeolidae (DAM). Explanation : + : character state present, (+) usually present, — : absent, (—) : usually absent, n — normal, usual state, d — derived, modified state, r — reduced.

damaeoid and eremuloid mites share a very high typolytic and typogeneric activity, e.g. it is very difficult to find autapomorphies of individual groups. On the other hand, many of the so-called plesiomorphic characters can in fact be considered as “archapomorphic”. Very probably, the convergence of parallel lineages has often occurred in this group of oribatid mites. WOAS (1990) considered that the Eremuloidea and Damaeioidea form a single, related group, probably monophyletic. The division of this “Eremuloidea sensu lato” into smaller monophyletic groups is very difficult.

Despite this, summing up the absence of many damaeoid apomorphies and presence of (1) aggenital neotrichy and (2) above mentioned derived characters, we consider *Hungarobelba* as a member of the Eremuloidea sensu GRANDJEAN (1965).

What is the position of *Hungarobelba* within the Eremuloidea? Comparison of morphological features of *Hungarobelba* with the definitions of European families of Eremuloidea (table 2) shows, that the most similar morphology can be found in family Damaeolidae. The following synapomorphies support the idea that *Hungarobelba* and the Damaeolidae form a relatively well-defined monophyletic group : reduced tracheal system (brachytrachea in place of trachea I); notogastral setae with layer of cerotegument during ontogeny and in

adult; modified rutellum; strongly curved (S-shaped) baculiform solenidia on the legs; long setiform famulus.

Some other shared character states are exclusively present in *Hungarobelba* and Damaeolidae within the Eremuloidea (regression of pedotectum I, absence of lamellar ridges, presence of distinct anterogenital area), but their apomorphic/plesiomorphic state is unclear.

All other families of Eremuloidea with 3 aggenital setae in adult are separated by following synapomorphies : dorsal setae on legs regressive in adult; sensillus with branches (pectinate or ciliate); absence of seta c_2 (except in Eremulidae); spini-form proral setae II-III-IV (except in Eremulidae); seta ad_3 in front of lyrifissure *iad* (except in Eremulidae).

Other character states shared by this group (presence of pedotectum I and pedotectum II, presence of lamellar ridges) are considered plesiomorphic.

Considering the Damaeolidae/*Hungarobelba* as a monophyletic group, a question arises, whether *Hungarobelba* can be placed into Damaeolidae or not. However, significant differences exist between *Hungarobelba* and the Damaeolidae. *Hungarobelba* does not share the following character states of Damaeolidae, considered to be autapomorphic :

chelicerae modified, with reduced setation (0 or 1 seta); palp reduced, modified, with reduced setation (5 setae at most on palp tarsus, see GRANDJEAN 1965 a,b); lyrifissures *im* and *ip* absent; ovipositor strongly reduced; preanal organ reduced.

The apomorphic/plesiomorphic relationships of some other character states of Damaeolidae are unclear (notogaster rounded or broadly obtuse anteriorly, dorsal setae of legs II-III-IV present but not accompanying respective solenidia, sensillus flattened/thickened distally, paraproctal atrichosity in nymphs).

The presence of autapomorphies is also essential to decide whether *Hungarobelba* forms a paraphyletic or monophyletic group. We consider *Hungarobelba* as the sister-group of Damaeolidae, with the following apomorphies: setiform sensillus with flagelliform end, proximally with club-shaped conglomerate of cerotegument; funnel-like bothridium; prodorsum with distinct prodorsal protuberance; humeral ridges and humeral angles with spinae adnatae present on the notogaster; epimeral neotrichy present; epimeral setae on small tubercles; discidium well developed, pointed; ovipositor with strong neotrichy, setae *k* strong, curved and pointed.

Of these character states, at least the form and shape of sensillus, prodorsal protuberance, special type of spinae adnatae and neotrichy of ovipositor may be considered autapomorphic. In this situation the erection of a new family is necessary.

At the present state of our knowledge the family Hungarobelbidae is monotypic. However, *Costeremus yezoensis* Fujikawa and Fujita, 1985 resembles species of *Hungarobelba* in many characters. On the other hand, it has lost the spinae adnatae and epimeral as well as aggenital neotrichy is absent. Nymphs of this species are unknown. The type species of *Costeremus*, *C. ornatus* Aoki, 1970, resembles *Hungarobelba* in some other characters (prodorsal structures, spinae adnatae present, etc.). The genus *Costeremus* was placed in the Damaeolidae, but the similarities to characters of *Hungarobelba* are closer than to those of damaeolid species. Thus, it is possible that *Costeremus* should be included in Hungarobelbidae, but a detailed study of this genus is needed. Also the species *Hungaro-*

belba baloghi Bulanova-Zakhvatkina, 1967 must be studied in detail. It perhaps belongs to a separate genus and its placement in Hungarobelbidae is not excluded, but it needs further investigation. In this respect the definition of the family given below may require expansion.

Hungarobelbidae fam. nov.

ADULTS

Euphereiderm eremuloid (*sensu lato*) oribatids of medium size. Body, proximal part of sensillus and notogastral setae covered by granular, tubercular or amorphous cerotegument.

Prodorsum triangular, without pedotecta I and II. Bothridium funnel-like, sensillus usually setiform with flagelliform end. Distinct prodorsal groove present, tending to form prodorsal enantiophysis. No lamellae nor lamellar ridges present. Tutorium absent. Often with chitinous formations in interbothridial region. Sejugal region with enantiophyses or tubercles. Postbothridial apophysis, lateral enantiophysis (above level of acetabula) and parastigmatic enantiophysis (below level of acetabula) always present. Postbothridial apophysis not fused with bothridium. Discidium present.

Notogaster oval to broadly oval, with straight or truncate anterior border. Humeral region well developed, usually with spinae adnatae. Usually 11 notogastral setae, *c*₁ always present. Setae *c*, *l*, *h* and *ps*₁ in approximately longitudinal rows.

Epimeral region separated from the genital aperture by more or less visible anterogenital region. Epimeral setae on tubercular apophyses, with tendency to neotrichy. Epimeres III and IV not fused completely, despite sometimes being hard to observe. G6, A2, Ad3. Aggenital neotrichy usually present (Ag 3). Lyrifissures *iad* in adanal position, anterior to insertion of *ad*₃ or level with it. Preanal organ well developed. Ovipositor with neotrichy. Brachytrachea present in place of trachea I.

Legs monodactyl, moniliform, shorter than body. Solenidion of tibia I with companion seta *d*. All genual solenidia with companion setae. Solenidia of tibiae II, III and IV also usually with companion

setae. Two solenidia on tarsus II. Some tarsal and tibial solenidia baciliform, strongly curved (S-shaped). Proral setae normal. Famulus long.

ONTOGENY

Eupheredermes, larva unideficient, nymphs quadrideficient. Body surface covered by cerotegument similar to that of adults. Exuvial scalps carried by nymphs, usually reticulate. No cornicle present for its attachment. Larval bothridium and sensillus well developed. All gastronomic setae of larva and nymphs inserted on apophyses. Larval, and usually also nymphal, gastronomic setae of differing sizes. No paraproctal atrichosity. Ventral neotrichy, if present, is additive oligotrichy.

Formulae : NG (12-12-11), An (33333-3333-222), G (1-3-5-6), Ag (0-1-2-3), N1 (0-0-0-0-7), PF pn : inferior seta of palpal femur protonymphal.

The Hungarobelbidae and related families can be separated using the following key (not based on neotrichy) :

- 1 Discidium present as a discoidal carina or sharply pointed laterally. Sejugal region with apophyses and enantiophyses, postbothridial/humeral apophysis (B_a or H_a) and parastigmatic enantiophysis (S) present. Spinae adnatae or distinctly tubercular posterior apophyse of humeral/postbothridial enantiophysis usually present..... 2.
- Discidium absent, sejugal groove without distinct dorsal and lateral apophyses or enantiophyses. Spinae adnatae or distinct humeral tubercles absent..... 6.
- 2 (1) Bothridium funnel-like, not or weakly chitinized distally, not fused with postbothridial/humeral anterior apophysis. Pedotecta I and II absent. Propodolateral apophysis laterally between legs I and II and true spinae adnatae present or absent..... 3.
- Bothridium not funnel-like, if rounded then with sclerotized walls, fused with postbothridial/humeral anterior apophysis. Pedotectum I always well developed, pedotectum II usually also present. No true spinae adnatae present..... 4.
- 3 (2) Anterior border of notogaster truncate, straight. Spinae adnatae, if present, in humeral position, at the end of humeral ridge. Legs shorter than body. Solenidion of tibia I with companion seta d . Lateral enantiophysis present. Epimeral setae on tubercular apophyses. Aggenital neotrichy usually present (Ag 3) **Hungarobelbidae** fam. nov.

— Notogaster circular or subcircular, with rounded anterior border. Spinae adnatae, if present, on anterior border of notogaster, without distinct humerus. Legs longer or as long as body. Solenidion of tibia I always free¹. Well developed parastigmatic enantiophysis present in lateral sejugal region, lateral enantiophysis absent or (rarely) present as a single anterior tubercle. Epimeral setae usually not on apophyses. Aggenital neotrichy absent..... **Damaeidae** Berlese, 1896.

4 (2) Sensillus spindle-shaped, lanceolate or clavate. Pedotectum II absent. Prodorsum highly sculptured, tutorial ridge present. All epimeres distinct, separated by epimeral and sejugal grooves, with epimeral enantiophyses..... **Caleremaeidae** Grandjean, 1965.

— Sensillus setiform, with long or short ami. Pedotectum II well developed. Prodorsum without distinct macrosculpture, tutorial ridge not developed. Epimera III and IV fused, not distinctly separated from anogenital region. Epimeral region IV without enantiophyses. 5.

5 (4) Long, well developed lamellar ridges present. Sensillus usually with smaller number of long rami. Centrodorsal apophyses present on anterior border of notogaster between the humeral enantiophyses..... **Ctenobelbidae** Grandjean, 1965.

— Lamellar ridges absent or fine, shorter. Sensillus with short or very short numerous rami. No centrodorsal apophyses present on anterior border of notogaster..... **Amerobelbidae** Grandjean, 1954.

6 (1) Notogaster fused with prodorsum, prodorsum depressed. Ten pairs of notogastral setae, c_1 absent. Epimeral groove IV distinct and deep..... **Ameridae** Grandjean, 1965.

— Notogaster not fused with prodorsum, with a distinct anterior border. Prodorsum not depressed. 11 notogastral setae, c_1 present. Epimeral groove IV absent..... 7.

7 (6) Tibiae and tarsi with "crispins". Prodorsal cuticle sculptured. Pedotectum II well developed..... **Eremobelbidae** Balogh, 1961.

— Tibiae and tarsi normal developed, without "crispins". Prodorsal cuticle not distinctly sculptured. Pedotectum II absent..... 8.

8 (7) Notogaster rounded or broadly obtuse anteriorly. Gnathosoma modified, palp reduced. Pedotectum I absent or very reduced. Lamellar ribs not developed. Sensillus lanceolate, with flagelliform tip or clavate. Tibial and genual solenidia, except that of tibia I, not coupled with companion setae, free. Tracheal system with brachytrachea I or reduced (subnormal)..... **Damaeolidae** Grandjean, 1965.

— Notogaster truncate, with straight anterior border. Gnathosoma not modified, palp normally developed.

1. There is a rare exception, in some races of *Porobelba spinosa* (see GRANDJEAN, 1955, p. 215).

Pedotectum I present. Lamellar ridge present. Sensillus setiform with or without short bristles. Tibial solenidion IV free, companion setae of tibial solenidia I-III suppressed, tracheal system normal
..... Eremulidae Grandjean, 1965.

REMARKS

GRANDJEAN's etymology of prodorsal and sejugal enantiophyses and apophyses was changed several times. In this paper we follow the designation of enantiophyses (apophyses) as used by GRANDJEAN (1960), NORTON (1978) and BEHAN-PELLETIER and NORTON (1985).

One can speculate that the posterior tubercle of humeral enantiophysis (H_2) is homologous with the spinae adnatae of *Hungarobelba* or the humeral plates of *Caleremaeus*. Homology of these structures with spinae adnatae of Damaeidae is questionable, because damaeid spinae adnatae are very variable in position and, moreover, the postbothridial enantiophysis is often fully developed, i.e. spinae adnatae may be not related to the dorsosujugal enantiophyses. On the other hand, it is interesting that damaeid spinae adnatae are often correlated with the size and development of prodorsal sejugal tubercles and are often present if a posterior tubercle is missing (usually dorsal).

Another possible homology may be between the postbothridial and humeral enantiophyses. Usually, if the position of bothridium is more anterior, not close to notogaster anterior border, the bothridia are funnel-like, expanded and not sclerotized and the distinct postbothridial anterior apophysis is often present. On the other hand, if the position of the bothridia is posterior, close to the notogaster, the bothridia are posteriorly sclerotized or have a distinct humeral apophysis. The shift of bothridia from an anterior position posteriorly to the notogaster along with its sclerotization and incorporation, seems to be a general trend in oribatid evolution.

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