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Previous volumes (2010-2017): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France
ISSN 0044-586X (print), ISSN 2107-7207 (electronic)

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

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HUNGRAROBELBIDAE N. FAM., WITH A DESCRIPTION OF HUNGRAROBELBA PYRENAICA N. SP. (ACARINA, ORIBATIDA)

by Ladislav MIKO¹ and Joseph TRAVÉ²

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 eupherederms, it belongs in the Eremuloidea and is closest to the Damaeidae.

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. kanamas — 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 Pyrenées 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 HUNGRAROBELBA VISNYAI (BALOGH, 1938)

All known descriptions, redescriptions or drawings of this species are, unfortunately, insufficient (Balogh, 1938 and 1972; Ghilarov & Krivolutsky, 1975; Mahunka, 1977), but the main

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Acarologia, t. XXXVII, fasc. 2, 1996.
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 Hungarian 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 nympha! 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 (A₁). Second half of prodorsal enantiophysis (A₂) absent. Similarly, no (or only very slightly developed) posterior tubercles were found opposite the well developed anterior tubercles of postbothridial enantiophysis (B₁) (Fig. 4A). Apophyses of the laterosejugal enantiophysis (L₁, L₂) are both well developed, tubercular, without tips.

Another sclerotized ridge occurs in area between the bothridium and acetabulum II, ventral to insertion of exobothridial setae. 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-
Distinct, usually formed only by ridges of cuticula. 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 ps₁). Setae flagelliform distally, c₁ directed anteriorly, other setae posteriorly and curved medially. Proximally the setae have similar conglomerate of cuticula as on the sensillus. Setae ps₁-ps₃ situated on posterior border of notogaster. ps₁ much longer than ps₂ and ps₃, distance ps₂-ps₃ more than twice that of ps₂-ps₁. 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 (B₄) 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 cuticula. 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 *Fossermus*.

Apodemes I-II and sejugal apodeme lamellar, apodemes III and IV reduced. Epimeral necrotic 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. 4: H. visnyai.
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 baculiform.

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 (ω₁) and tibial solenidia II and III (φ) of typical, baculiform shape. Two solenidia present on tarsus II. Iteral 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

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FIG. 5 : H. visnyai.
A. — Gnathosoma, ventral view, B. — Gnathosoma lateral view (chelicera and palp removed), C. — palp. Scale : 50 μm.
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**


**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 anteriad, approximately in direction of insertions of interlamellar setae.

**Lateral region**

Similar to that of *H. visnyai*. Tracheal system modified: short and branched brachytrachea with
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. — *Calereaeus monilipes*, lateral view.
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). Lateral setae of leg II and III present. Setae $s$ eupathidal in adult.

Solenidiotaxy normal (leg I : 1-2-2, II : 1-1-2, III : 1-1-0. IV : 0-1-0). Solenidia $\omega_1$ of leg I, of legs II and III of typical baculiform shape, strongly curved (Figs. 11A, B, D). Solenidion $\omega_2$ of leg I setiform, coupled with famulus.

Famulus similarly developed as in *Fosseremus* (GRANDJEAN, 1965a). $\varphi_1$ of leg I long, setiform, tactile. All other solenidia bacilliform, slightly curved or straight.
ONTGENY

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). Cеротегумент 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 c₁-c₃ shorter than other setae, c₃ 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, Ip, h₁ more sclerotized than rest of body. Nymphs quadriderificient. Setae c₂, c₃ and ps₁ 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 (Claparede’s organ not included), protonymph 3-1-2-1, deutonymph 3-1(or 2)-2-2, tritonymph 3-2(or 3)-2-3.

Paraproct atrichosity not present. Three setae present on paraprotic 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.

Legs

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

<table>
<thead>
<tr>
<th></th>
<th>leg I</th>
<th>leg II</th>
<th>leg III</th>
<th>leg IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>larva</td>
<td>0-2-3-4-16</td>
<td>0-2-3-3-13</td>
<td>0-2-2-3-13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1-1-1)</td>
<td>(1-1-1)</td>
<td>(1-1-0)</td>
<td></td>
</tr>
<tr>
<td>protonymph</td>
<td>0-2-3-4-16</td>
<td>0-2-3-3-13</td>
<td>1-2-2-3-13</td>
<td>0-0-0-0-7</td>
</tr>
<tr>
<td></td>
<td>(1-1-2)</td>
<td>(1-1-1)</td>
<td>(1-1-0)</td>
<td></td>
</tr>
<tr>
<td>deutonymph</td>
<td>1-4-4-5-16</td>
<td>1-4-3-4-13</td>
<td>2-3-2-3-13</td>
<td>1-2-2-3-12</td>
</tr>
<tr>
<td></td>
<td>(1-2-2)</td>
<td>(1-1-1)</td>
<td>(1-1-0)</td>
<td>(0-1-0)</td>
</tr>
<tr>
<td>tritonymph</td>
<td>1-5-4-5-18</td>
<td>1-4-4-5-15</td>
<td>2-3-3-4-15</td>
<td>1-3-3-4-12</td>
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<td></td>
<td>(1-2-2)</td>
<td>(1-1-1)</td>
<td>(1-1-0)</td>
<td>(0-1-0)</td>
</tr>
</tbody>
</table>

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 genua 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. Iteral 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


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 Besèit (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 larva, 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 Besèit) 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 Aa) ; 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 trachéal 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-
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 to be more probable. Note in this context the situation in Conopippia 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 yunkeri 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 Iturondonobibia (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.

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

<table>
<thead>
<tr>
<th>leg</th>
<th>femur</th>
<th>genu</th>
<th>tibia</th>
<th>tarsus</th>
</tr>
</thead>
<tbody>
<tr>
<td>I larva</td>
<td>$d, bv$</td>
<td>$d, (l)$</td>
<td>$d, (l), v'$</td>
<td>$(fh), (pl), e, (pv), (a), (u), (tc), (p), s$</td>
</tr>
<tr>
<td>deutonymph</td>
<td>$(l)$</td>
<td>$v'$</td>
<td>$v''$</td>
<td>$(h)$</td>
</tr>
<tr>
<td>tritonymph</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>adult</td>
<td>$v', l', v''$</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>II larva</td>
<td>$d, bv$</td>
<td>$d, (l)$</td>
<td>$d, (l), v'$</td>
<td>$(ft), (pv), (tc), (a), (p)(u), s$</td>
</tr>
<tr>
<td>deutonymph</td>
<td>$(l)$</td>
<td>—</td>
<td>$l''$</td>
<td>—</td>
</tr>
<tr>
<td>tritonymph</td>
<td>—</td>
<td>$v'$</td>
<td>$v''$</td>
<td>$(i)$</td>
</tr>
<tr>
<td>adult</td>
<td>$v'$</td>
<td>—</td>
<td>—</td>
<td>$(v)$</td>
</tr>
<tr>
<td>III larva</td>
<td>$d, ev$</td>
<td>$d, l'$</td>
<td>$d, l', v'$</td>
<td>$(ft), (pv), (tc), (a), (p), (u), s$</td>
</tr>
<tr>
<td>deutonymph</td>
<td>$r'$</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>tritonymph</td>
<td>—</td>
<td>$v'$</td>
<td>$v''$</td>
<td>$(i)$</td>
</tr>
<tr>
<td>adult</td>
<td>$v'$</td>
<td>—</td>
<td>—</td>
<td>$(v)$</td>
</tr>
<tr>
<td>IV protonymph</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>deutonymph</td>
<td>$d, ev$</td>
<td>$d, l'$</td>
<td>$d, l', v'$</td>
<td>$(tc), s, (a)$</td>
</tr>
<tr>
<td>tritonymph</td>
<td>$r'$</td>
<td>$v'$</td>
<td>$v''$</td>
<td>—</td>
</tr>
<tr>
<td>adult</td>
<td>$v'$</td>
<td>$l'$</td>
<td>—</td>
<td>$v', additional seta near ft''$</td>
</tr>
</tbody>
</table>

**REDEFINITION OF THE GENUS HUNGAROBELBA BALOGH, 1943**

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

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

  Spinae 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.

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


Hungarobelba has recently been placed in the Damaeidae (BALOGH & 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 μm), 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 (c1 present), situated in 2 longitudinal rows. Notogastral setae with flagelliform ends, proximally covered by cerotegument.


Epimeral neotrichy present, epimeral setal formula 4-3(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 slightly larger, blunter and flatter apically than others. Lyrifissure iad in adanal position, anterior of insertion of ad3 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 gastronotic setae on distinct apophyses. No paraproctal atrichosity. Iteral setae of leg I-III tritonymphal.

Developmental formulae as follows: NG (12-12-11); An (3333-3333-222); G (1-3-5-6); Ag (0-1-2-3); PPA paraproctal setae present in all stases; N1 (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-ZACHIVATKINA (1967) Hungarobelba was placed in this family (BALOGH, 1972; GHILOV & 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: Caleremaicus 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 Damaceoidea (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 (agenital 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 TRAVE (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 Caleremaicus (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 tutorium); 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
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),
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 Damaeoidea 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 c₂ (except in Eremulidae); spiniform proral setae II-III-IV (except in Eremulidae); seta ad₃ 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 1965a,b); lyrifissures im and ip absent; ovipositor strongly reduced; preanal organ reduced.

The apomorphic/pleisiomorphic 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 many characters. 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 Hungarobelba 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

Eupherederm 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, c1 always present. Setae c, l, h and ps1 in approximately longitudinal rows.

Epimeral region separated from the genital aperture by more or less visible anterogenous 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 add 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 bacilliform, strongly curved (S-shaped). Proral setae normal. Famulus long.

ONTGENY

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 atrichosis. 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), 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 discidial 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 apophysis 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 setae $d$. Lateral enantiophysis present. Epimeral setae on tubercular apophyses. Aggenital neotrichy usually present (Ag). 3.

— 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 free. 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.


— Sensillus setiform, with long or short amphi. 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.


— 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.


— 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 Pororbelba spinosa (see Grandjean, 1955, p. 215).

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 (H2) 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 dorsosugal 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.

ACKNOWLEDGEMENT

The authors are grateful to Dr Valerie BEHAN-PELLETIER (Biosystematic Research Center, Ontario, Canada), for reading the manuscript and making useful comments.

REFERENCES

BALOGH (J.), 1938. — Belba visnyai nov.sp., eine neue Moosmilben-art. — Folia Entomologica Hung. 3 (1-4) : 83-85.
GHILAROV (M. S.) and KRIVOLUTSKY (D. A.), 1975. — Opreditel obitajushchih v pochve kleshchej [Identification keys for determination of soil-inhabiting mites]: Sarcopiformes. — Nauka, Moscow, 500 pp.
GRANDJEAN (F.), 1965a. — Fosseremus quadriperitis nom. nov. (Oribate). — Acarologia, 7 (2) : 343-375.

GRANDJEAN (F.), 1968. — Schusteria litorea n.g., n.sp. et les Selenoribatidae (Oribates). — Acarologia, 10 (1) : 116-150.


