

Studies on European *Feltria* species (Acari: Hydrachnidia: Feltriidae)

REINHARD GERECKE

Abstract

Based on revision of museum material and investigations on newly collected samples, the taxonomy of European *Feltria* species is reconsidered. Of the 30 species listed in Limnofauna Europaea (K. O. VIETS 1978), five are considered 'species incertae': *Feltria insolita* (Walter, 1947), *F. pugionipalpis* K. Viets, 1955, *F. disjuncta* Walter, 1947, *F. golatensis* Rensburg, 1971, and *F. piersigi* Walter, 1907. A further six are considered junior synonyms: *F. raetica* Bader, 1975 = *F. cornuta* Walter, 1927 **n. syn.**; *F. ursulae* Bader, 1975 = *F. minuta* Koenike, 1898 **n. syn.**, *F. handschini* Bader, 1975 = *F. setigera* Koenike, 1898 **n. syn.**, *F. fossea* Rensburg, 1971 = *F. zschokkei* Walter, 1928 **n. syn.**, *F. airolensis* Rensburg, 1971 = *F. rubra* Piersig, 1898 **n. syn.**, *F. minutissima* Bader, 1975 = *F. rubra* Piersig, 1898 **n. syn.**

The synonymization of *F. stygophila* Walter, 1947 with *F. subterranea* K. Viets, 1937, proposed by K. VIETS (1959), but not accepted by most later authors including K. O. VIETS (1978), is confirmed, while synonymizations with *F. rubra* Piersig, 1898, proposed by LÁSKA (1957) for *F. clipeata* Piersig, 1898, and by SCHECHTEL (1910) for *F. scutifera* Piersig, 1898 are rejected. Both must be considered 'species incertae'.

Feltria longispina Motaş & Angelier, 1928 **n. stat.**, and *F. drilonensis* K. Viets, 1936 **n. stat.** are elevated to species rank. The taxonomic status of four species described from SE Europe, but not documented by type material (*F. amplexa* Motaş & Tanasachi, 1944; *F. cornuta paucipora* Szalay, 1946; *F. mira* Motaş & Tanasachi, 1948 and *F. pectinifera* Szalay, 1946), remains uncertain until new material is available from the areas of the type localities.

Feltria cantonatii **n. sp.** is described from a spring in the Sicilian Peloritani mountains.

Lectotypes are designated for *Feltria oedipoda* K. Viets, 1922, *F. stygophila* Walter, 1947, *F. handschini* Bader, 1975 and *F. raetica* Bader, 1975.

Key words: Water mites, Feltriidae, Europe, revision, synonymy, new species.

Zusammenfassung

Basierend auf Untersuchungen an Typenmaterial und neu aufgesammelten Populationen wird die Taxonomie europäischer *Feltria*-Arten einer Revision unterzogen. Unter den 30 in der Limnofauna Europaea (K. O. VIETS 1978) aufgelisteten Arten sind fünf als 'species incertae' anzusehen: *Feltria insolita* Walter, 1947, *F. pugionipalpis* K. Viets, 1955, *F. disjuncta* Walter, 1947, *F. golatensis* Rensburg, 1971, und *F. piersigi* Walter, 1907. Weitere sechs werden synonymisiert: *Feltria raetica* Bader, 1975 = *F. cornuta* Walter, 1927 **n. syn.**; *F. ursulae* Bader, 1975 = *F. minuta* Koenike, 1898 **n. syn.**, *F. handschini* Bader, 1975 = *F. setigera* Koenike, 1898 **n. syn.**, *F. fossea* Rensburg, 1971 = *F. zschokkei* Walter, 1928 **n. syn.**, *F. airolensis* Rensburg, 1971 = *F. rubra* Piersig, 1898 **n. syn.**, *F. minutissima* Bader, 1975 = *F. rubra* Piersig, 1898 **n. syn.**

Die von K. VIETS (1959) vorgeschlagene Synonymisierung von *F. stygophila* Walter, 1947 mit *F. subterranea* K. Viets, 1937 wurde von den meisten späteren Autoren, einschließlich K. O. VIETS (1978), nicht akzeptiert, wird hier aber bestätigt. Hingegen sind die Synonymisierungen mit *F. rubra* Piersig, 1898, die von LÁSKA (1957) für *F. clipeata* Piersig, 1898, und von SCHECHTEL (1910) für *F. scutifera* Piersig, 1898 vorgeschlagen wurden, nicht akzeptabel. Die beiden Arten sind als 'species incertae' anzusehen.

Feltria longispina Motaş & Angelier, 1928 **n. stat.** und *F. drilonensis* K. Viets, 1936 **n. stat.** sind als selbständige Arten anzusehen. Der taxonomische Status von vier Arten, die aus Südosteuropa beschrieben wurden, aber nicht durch Typusmaterial dokumentiert sind (*F. amplexa* Motaş & Tanasachi, 1944; *F. cornuta paucipora* Szalay, 1946; *F. mira* Motaş & Tanasachi, 1948 und *F. pectinifera* Szalay, 1946), bleibt ungewiss, solange keine neuen Aufsammlungen aus der Umgebung der Typuslokalitäten verfügbar werden.

Feltria cantonatii **n. sp.** wird aus einer Quelle im Peloritani-Gebirge (Sizilien) beschrieben.

Für *Feltria oedipoda* K. Viets, 1922, *F. stygophila* Walter, 1947, *F. handschini* Bader, 1975 und *F. raetica* Bader, 1975 werden Lectotypen festgelegt.

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1 Introduction

The Feltriidae is a highly distinct, monotypic family of hygrobatoid water mites. In addition to *Feltria* Koenike, 1882 s. str., widely distributed in the Holarctic, but extending southwards to Myanmar [Burma] (LUNDBLAD 1941) and Mexico (CRAMER 1986), the genus includes the subgenera *Azugofeltria* Motaş & Tanasachi, 1948, recorded from Europe and North America, *Feltriella* K. Viets, 1930, distributed like *Feltria* s. str., and *Neofeltria* Cook, 1963, exclusively recorded from North America.

All mites of the genus are small-sized and therefore easily overlooked and insufficiently documented in limnofaunistic studies. As populations are often strongly female-biased, early descriptions were often restricted to this sex, and also in the recent revisional studies of BADER (1973, 1974a–b, 1975a–b, 1976, 1979, 1994) much weight was given to female morphology. Instead, some character states important for species discrimination are restricted to males. As several species are often found coexisting in suitable habitats, attribution of sexes is problematic, preconditioning taxonomic confusion and serious problems with species recognition during past decades. In this paper, an attempt is made to resolve taxonomic questions on the base of type material from the museums in Basel (NHMB) and Frankfurt a. M. (SMF), and collections made during the past decades (if not mentioned otherwise, from the author's field work).

This revision of European *Feltria* species is of basic importance for the new edition of "Süßwasserfauna von Mitteleuropa" (in prep.). There, in Vol. 7/2-2 (Acari III), a dichotomic key will be given for the species known from central and northern Europe.

A total number of 26 *Feltria* species is now accepted in the area covered by Limnofauna Europaea (K. O. VIETS 1978) – counting in addition to the species treated here, *Feltria* (*Feltriella*) *baderi* Oezkan, 1982 from Turkey and *F.* (*Feltria*) *tsemberae* Tuzovskij, 1999 from the Taiga region. The diagnostic characters of four species, *F. amplexa*, *F. cornuta paucipora*, *F. mira* and *F. pectinifera*, are not clearly defined and require further revision.

All European *Feltria* species are indicators of natural conditions in streams. They disappear when their habitats are disturbed by pollution, seasonally unstable flow or siltation of substrata.

Acknowledgements

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2 Material and Methods

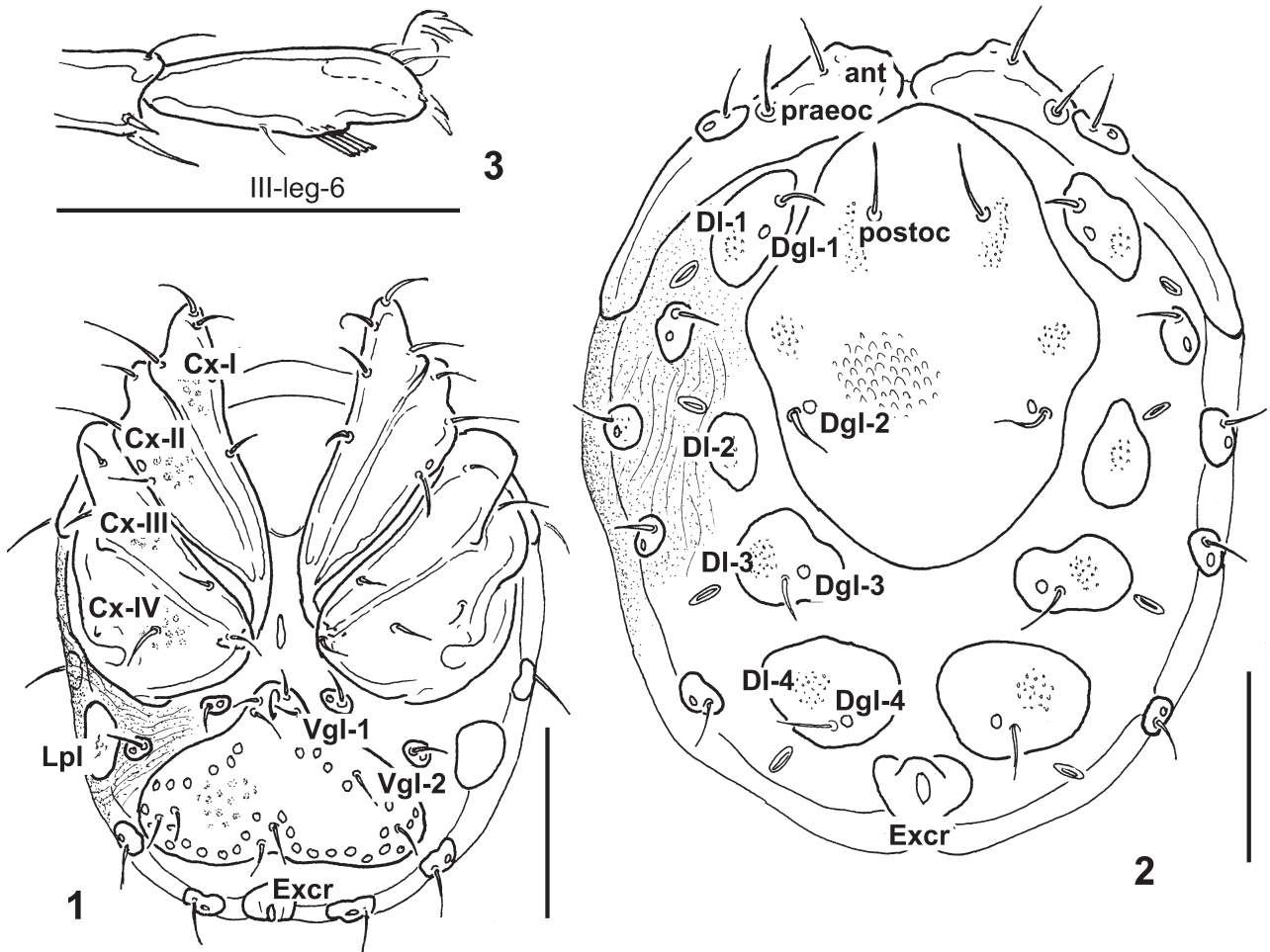
For a detailed preparative methodology see GERECKE et al. (2007). Taxa are treated in alphabetic order (except the newly described *Feltria cantonatii* n. sp.). All measurements are in µm.

In the course of this investigation, measurement values, in water mite taxonomy frequently used for species definition, resulted in limited use for two reasons: (1) there is obviously a strong intraspecific variability in size, with the consequence that species discrimination on the base of absolute measurement values produces results which are highly problematic; (2) due to small size, proportions of appendages are difficult to establish (they may be strongly influenced by little changes in position, or squeezing, especially in older collection material). For these reasons, I decided to give little weight to measurement data and treat such values only when they appeared of particular diagnostic significance.

The results of extensive measurement series from the studied material are given in Tabs. 1, 2. To make species better comparable in these large tables, they are arranged in groups of similar species. Character states not measureable from the studied material appear as empty fields.

Special remarks are necessary concerning two aspects of *Feltria* morphology: (1) A body region that merits particular attention in feltriid taxonomy is the frons of idiosoma. In the older material on which this study is mostly based, this region could not be observed in a satisfactory manner. In future, separation and fusion of sclerite elements in this area should be studied, either before slide-making, or with a special cutting technique, in frontal view. I expect both, species-specific character states, and sexual dimorphism in this part of the *Feltria* body. (2) The plesiotypic number of slit organs in Feltriids is five, all arranged in the dorsal furrow (TUZOVSKIJ 1987), but in many cases, especially in little cleared, or darkened collection preparations, they cannot be identified with certainty. If the number of these organs appears variable in the figures given here, this is most probably due to problems in optic resolution. Species-specific reductions of single pairs of slit organs cannot be excluded and this aspect merits attention in future studies, but the figures here cannot be used for considering this point of view.

In the "Material examined" section, the first place is reserved to the type material, the remaining material is treating collections in alphabetic order.



Figs. 1–3. *Feltria (Feltria) brevipes* (after GERECKE et al. 2009, modified), general morphology and abbreviations. – 1. ♂, venter. 2. ♀, dorsum. – Dorsolateral muscle attachment sites DI-4, located lateral to dorsoglandularia Dgl-1-4, given as areas of stronger porosity; additional muscle insertions (dorsocentralia) visible lateral to postocularia and anterior to Dgl-2 (these, as well as lateroglandularia and slit organ platelets scattered in the lateral membranous part of dorsum, here not numbered). 3. ♂, III-leg-6. – Scale bars: 100 µm.

Abbreviations

Ac-1	first acetabulum
ant	antenniformia
Cx	coxal
Cxfd	coxal field
Cx-I	first coxae
Dc-1-4	dorsocentralia 1–4
Dgl-1-4	dorsoglandularia 1–4
DI-1-4	dorsolateralia 1–4
dL	dorsal length
dn	deutonymph
dShd	dorsal shield
Excr	excretory pore
genfd	genital field
H	height
Id	Idiosoma
I-leg-6	leg 1, sixth segment (tarsus)
L	length

Lpl	lateral platelet
Lgl-1-5	lateroglandularia 1–5
n	number
P-1	palp, first segment
postoc	postocular seta
praeoc	praeocular seta
Vgl	ventroglandulare
W	width

Acronyms of depositories

BENF	collection D. BENFATTI, Verona
BGL	Berchtesgaden (material in coll. GER)
CRENODAT	Museo Tridentino di Scienze Naturali, Trento [Spring research project]
GER	collection R. GERECKE, Tübingen
NHMB	Naturhistorisches Museum Basel
SMF	Senckenberg Museum Frankfurt a. M.

3 Taxonomy

3.1 The family Feltriidae

Diagnosis (modified after COOK 1974)

Idiosoma flattened and heavily sclerotized, with dorsalia variously expanded and fused, often to form a large dorsal shield surrounded by minor glandular and muscle attachment platelets; on the ventral side, coxal plates pleiotypically separate in four groups, occasionally fused to each other, and sometimes also to the genital plate to form a continuous ventral shield; membranous parts of integument strongly lined; lateral eyes not incapsulated, but associated to laterofrontal platelets; Cx-I with short posteromedial apodemes; Cx-III and Cx-IV without glandularia, but two pairs of glandularia between Cx-IV and genital field; posterior margins of Cx-IV without projections, generally truncate; legs without swimming setae, claws with one or two clawlet(s) and claw blade; genital field with numerous acetabula, located on paired plates flanking the gonopore, lying separate in females, but fused to an unpaired plate in males; excretory pore in posteroventral, terminal or posterodorsal position, surrounded by a sclerite ring, often fused to genital plate in males, to the postgenital sclerite in females; gnathosoma distally without rostrum, proximally with a well-developed anchoral process, chelicerae medially separated; palp five-segmented, a ventral projection may be (rarely) developed on P-2, setal tubercles may be present on P-4.

Biology and bionomy

Feltriids are typically members of the benthic invertebrate community of springs and low order streams under natural conditions. They are frequently found in mosses, often in cascades with turbulent flow, under stones and in gravel substrata, frequently in shaded woodland areas of streams (EFFORD 1962). Some species have adapted to living conditions in the hyporheic interstitial, with a reduced pigmentation and weakly developed lateral eyes. In general, females bear low numbers of very large eggs. Information on life cycles are available for two species only: In *F. rouxi*, a species overwintering at the adult stage, larvae hatch from eggs laid in spring and summer on mosses and parasitize the abdomen of chironomid midges of the subfamilies Chironominae (data from England, EFFORD 1962, 1963, 1965) or Orthoclaadiinae (data from northern Germany, MARTIN 1998, 2000, and Luxembourg, MARTIN & STUR 2006). In *F. minuta*, EFFORD (1962) observed larval parasitism on adult chironomids, but attachment also of larvae to nymphs of Plecoptera and pupae of Trichoptera (in both cases with uncertain continuation of the life cycle, possibly excluding a truly phoretic phase on an aerial adult). This particular feature was questioned for Feltriidae by SMITH & OLIVER (1986), but recent confirmation has

been found in the German Alps, where MARTIN et al. (2010) found the larva of an undetermined *Feltria* parasitizing a trichopteran pupa.

3.2 Genus *Feltria* Koenike, 1882, subgenus *Azugofeltria* Motaş & Tanasachi, 1948

Diagnosis

Dorsum in males with a large shield, bearing four pairs of glandularia, in females with a large central plate surrounded by variously-shaped platelets; all coxae fused to one large coxal plate, with medial suture lines completely obliterated; glandularia between coxae and genital field fused to secondary sclerite margin of Cx-IV; male III-leg-6 with modified ventral setae; gnathosoma with long anchoral apodeme; palp with very long P-5, nearly as long as P-4.

Remarks

Azugofeltria is a well-defined clade, probably with a sister relationship to *Feltria* s. str. (synapomorphy: sexual dimorphism of III-leg-6). Distinct differences between Nearctic and Palaearctic species of the subgenus suggest an early phylogenetic bifurcation into two species groups (COOK 1974). All so far known species are hyporheobiont.

Feltria (Azugofeltria) insolita Walter, 1947, **sp. inc.**

Material examined

Holotype dn, NHMB 3822, "*Feltria insolita* Ny, XVI/65, Aubonne s.-ö. Bière, 21.VII.1944, leg. WALTER".

Remarks

When WALTER described this species from a single deutonymph, he was aware of the significant differences to all *Feltria* species known at that time. One year later, for species with this character combination, the genus name *Azugofeltria* was introduced, with the type species *Azugofeltria mira* Motaş & Tanasachi, 1948, later ranked as a subgenus by COOK (1970). Most probably, this species, or the only further valid species of the subgenus in Europe, *F. motasi* (Schwoerbel, 1961), is a junior synonym of *F. insolita*, but this question cannot be cleared as no diagnostic characters are known at the deutonymphal stage. Consequently, *F. insolita* should be considered a 'species incerta'.

Feltria (Azugofeltria) mira (Motaş & Tanasachi, 1948)

No material was available for the present study.

Remarks

The species is documented in great detail by MOTAŞ et al. (1957). The variability of the only distinct diagnostic

character, a low number of Ac in the genital field, should be investigated with further specimens from the type area. As Ac are often located in the marginal part of genital plates, and consequently hardly visible in tangential view, we cannot exclude that they were partly overlooked. In this case, *F. motasi* (see below) would result a junior synonym of *F. mira*.

Two females in coll. SCHWOERBEL without collecting site information, but held in a drawer along with material from Macedonia (see under *F. motasi*) are of no help for clarifying the problem: One has an Ac number lower than in typical *F. motasi* ($n=42+42$), but the other one is in agreement with that species ($n=76+76$). It is obvious that SCHWOERBEL was in close contact with MOTAS and received parcels with material from the Balkan area, but any detailed documentation is unfortunately lost.

Distribution

Carpathian mountains. Records from German western low mountain range not confirmed.

Feltria (Azugofeltria) motasi (Schwoerbel, 1961) (Figs. 4–10)

Material examined

Holotype ♂, SMF, coll. SCHWOERBEL, “*Azugofeltria motasi* n. sp., ♂, Wagensteig 1959”. – Paratypes: “Typus Gauchach, 30.VIII.[19]60”, 1 ♀; “Gauchach, 30.VIII.[19]60, hyp. Grundw., Allotype Photo”, 1 ♀; “Gauchach, hyp. Grundw., 30.VIII.1959, Photo”, 1 ♂.

Further material: SMF, coll. SCHWOERBEL, 2 ♀♀ of uncertain origin – ex coll. MOTAS?; “Gauchach, 11.IX.[19]60, Ny.”, 1 dn; SMF, K. O. VIETS 50078, “Obere Radau, Harz, Ch-Grabung Ra/12, HUSMANN leg., 3.IV.1959, 2332”, 1 ♂.

Remarks

SCHWOERBEL’s original description (1961) based exclusively on the male specimen from Wagensteigbach. Existence in his collection of additional specimens, including females, was only mentioned in his “Fundort” section (“Inzwischen sind mir 2 ♀♀ und 1 ♂ aus der Gauchach bekannt geworden”). Therefore, notwithstanding absence of type identification on the slide, the Wagensteigbach male has to be considered the holotype, the additional male and two females (“Typus”, “Allotypus”) listed in the original description, are paratypes. All specimens from coll. SCHWOERBEL are in a bad state of preservation, with squeezed and dried detached appendages, and parts of the idiosoma. Therefore, the redescription is based on the well-preserved male from Harz (SMF 50078).

SCHWOERBEL considered three character states as diagnostic for the separation of *F. motasi* from *F. mira*: (1) a higher number of Ac in the genital field, (2) a relatively

longer anchoral process at the proximal margin of gnathosoma, and (3) the stouter shape of the palp. Of these three differences, only the first one can be confirmed: With a length ratio gnathosomal base/anchoral process of 1.66–1.72 this process shows the same proportions as calculated from the figure published by MOTAS et al. (1957, fig. 17: 1.7) and no differences in proportions of palp segments could be found. Instead, all investigated specimens show Ac numbers within the range of 50–90 pairs. From this point of view, *F. motasi* should be clearly distinguishable from *F. mira* (Ac number following original description: ca. 25 pairs). COOK (1974) observed that both European species of the genus, known at the adult stage, were described with a dorsal shield bearing five pairs of glandularia. A revision of the type series and all other available specimens representing *F. motasi*, shows that this detail was given incorrectly in the original description: The anteriormost pair of glandularia figured by SCHWOERBEL is in reality the pair of postocular setae. It is highly likely that the same error was made by MOTAS & TANASACHI (1948) in the original description of *F. mira*.

Distribution

German central low mountain range.

Feltria (Azugofeltria) pugionipalpis K. Viets, 1955, **sp. inc.**

Material examined

Holotype dn, SMF 43031, “Harz, Oker, Romkerhall, 4.VI.1952, HUSMANN coll.”, K. VIETS 7641.

Remarks

For this species, described from a deutonymph and later proposed as a synonym of *F. insolita* by SCHWOERBEL (1961), the same is true as explained for *F. insolita* (see above).

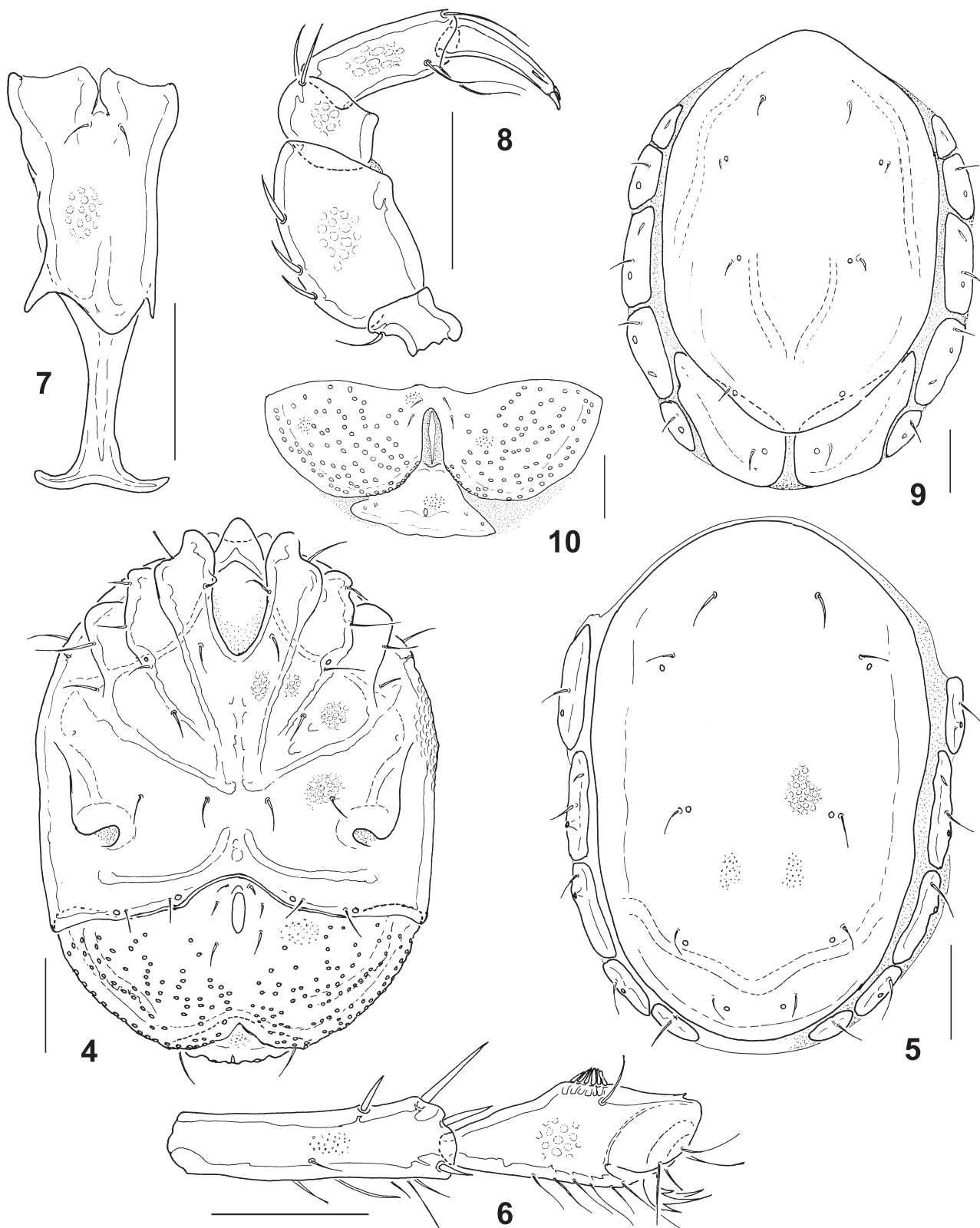
3.3 Genus *Feltria* Koenike, 1882, subgenus *Feltria* Koenike, 1882

Diagnosis

Dorsum with dorsalia and glandularia highly various in size and fusion in both sexes; coxae various, from separate in four groups to fused to one large plate, but medial suture lines always well visible; male III-leg-6 with modified ventral setae; gnathosoma with short anchoral apodeme; palp with relatively short P-5, distinctly shorter than P-4.

Remarks

Feltria has the sexual dimorphism of III-leg-6 in common with *Azugofeltria*, the differences to this subgenus



Figs. 4–10. *Feltria (Azugofeltria) motasi*; ♂, SMF 50078 (4–8); ♀, SMF SCHWOERBEL "Allotyp" (9–10). – 4. Venter. 5. Dorsum. 6. III-leg-5/6. 7. Gnathosoma, ventral view. 8. Palp. 9. Dorsum. 10. Genital field. – Scale bars: 100 μm.

are mostly plesiomorphies and the taxon could be in a paraphyletic relationship with the latter. Most species are rhithrobiont, a few hyporheobiont.

Feltria (Feltria) amplexa Motaş & Tanasachi, 1944

No material available. – Type locality: “Romania, Sinaia, rheocrene of a right affluent of the stream Valea Rea, 890 m N.N., 25.VIII.1942”.

Remarks

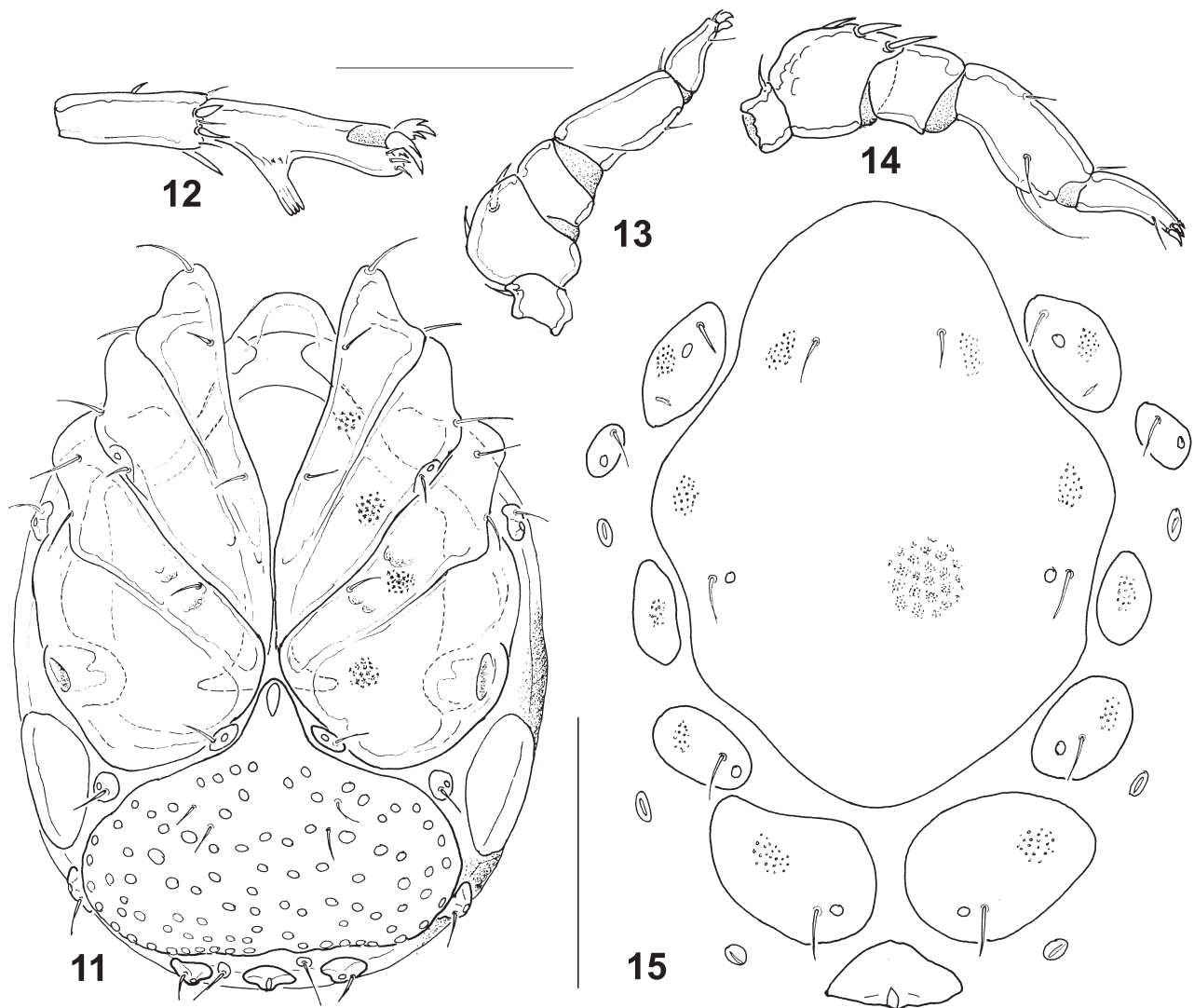
This species was described after a single female for the presence of an unpaired (following MOTAŞ & TANASACHI

(1944) in all other species paired) posterodorsal plate. However, this character was found variable in *F. drilonensis* females (see below). For a judgement on the taxonomic state and relationships of this species, recollection of males and females in the type locality or its surroundings would be desirable.

Feltria (Feltria) armata Koenike, 1902
(Figs. 11–15)

Material examined

SMF 43478, “Pyrenäen: Laruns, Bach, 1.IX.1937” (K. VIETS 5765), 1 ♀; SMF 43479, “Pyrenäen: Laruns, Rinne a.



Figs. 11–15. *Feltria (Feltria) armata*; ♂, SMF 50674 (11–13); ♀, SMF 50675 (14–15). – 11. Venter. 12. III-leg-5/6. 13. Palp. 14. Palp. 15. Dorsum. – Scale bars: 100 µm.

Lac d'Arbouste, VIETS leg., 2.IX.1937" (K. VIETS 5765), 1 ♀; 50674/75, same site and date (K. O. VIETS 5309/10), 1 ♂, 1 ♀.

Remarks

This species was the first representative described of a species group characterized by the particular shape of the male genital field (gonopore small, oval in shape, located on a pointed projection of the genital plate). Furthermore, all species of the group have a sexual dimorphism in the shape of the palp (stouter in males than in females). Following BADER (1973), both sexes of *Feltria armata* are characterized by a deep red colour and a relatively slender idiosoma (L/W in both sexes 1.2–1.3). Again following BADER, further diagnostic features in males are: (1) dorsal shield complete, relatively compact (L/W 1.2–1.3), including Dc-1-4 and Dgl-1-4, with a convex mediofrontal projection; (2) genital field with weakly indented posterior margin, separated from coxal field by a narrow strip of membranous integument; and (3) III-leg-6 with three long, slightly curved setae inserted on a projection in the proximal part of the segment. In females, dorsal shield oval or rhombic and relatively large (>2/3 total idiosoma L), but including only postoc and Dgl-2, while Dgl-1, Dc-2, Dgl-3+Dc-3 and Dgl-4+Dc-4 each lay on separate platelets.

Distribution

Western, central and southeastern Europe, Asia Minor.

Feltria (Feltria) brevipes Walter, 1907

(Figs. 1–3, see also GERECKE et al. 2009: fig. 1 [sub nom. *F. armata*])

Material examined

SMF, K. VIETS 43483, "Holland, Voerenbeek Mesch, 23.VIII.1919, ROMIJN leg.", K. VIETS 6000, 1 ♂.

Remarks

Since its first description, the state of this species was contentious. The most recent statement came from BADER (1973) who refused LUNDBLAD's (1956) synonymization of *F. brevipes* with *F. armata* and considered the following characters as diagnostic: Idiosoma yellowish or pale red, more stout in both sexes (L/W 1.1–1.2); in males: (1) dorsal shield built up as in *F. armata*, but without a mediofrontal projection and more slender (L/W 1.4–1.6); (2) genital field separated from coxal field by a broader strip of membranous integument; (3) III-leg-6 with three long, slightly curved setae inserting without a basal projection

on the ventral surface in the centre or distal half of the segment; in females, dorsal plates arrangement as in *F. brevipes*, but dorsal shield reduced in dimensions (<2/3 total idiosoma L).

The large populations from the Swiss Alps and Jura mountains on which BADER (1973) based his measurements, are unfortunately not documented by well-preserved collection material that can be attributed to his paper. The specimen from The Netherlands (SMF 43483) agrees with BADER's definition in the slender dorsal shield and the location of ventral setae on III-leg-6, but differs in the relative position of the genital field (separated from the coxal field by narrow membrane) and anterior margin of dorsal shield with a convex medial projection. Furthermore it differs in the Dgl-1 which are fused to, not separated from, the dorsal shield, and idiosoma measurement values higher than the maximum given by BADER. For the time being, the general shape of dorsal shield in both sexes, and position of III-leg-6 ventral setae in males appear to be the characteristics most important for distinguishing the two species while, in males, the shape of dorsal shield anterior margin of and extension of membranous integument between coxal and genital field are probably individually variable. In this scenario, the populations from Italy published as *F. armata* by GERECKE et al. (2009) have to be attributed to, and are the first Italian records of, *F. brevipes*.

Distribution

Central Europe to southern Italy, Balkans (Bulgaria: PEŠIĆ et al. 2010), Carpathian mountains. Records from additional areas published under *F. armata* probably referring to this species.

Feltria (Feltria) clipeata Piersig, 1898, **sp. inc.**

syn. to *F. rubra* Piersig, 1898: LÁSKA (1957) (refused synonymy).

Material examined

NHMB 3945/3946, "XIX 28/29, St. Pierre, Chartreuse, 5.VIII.1920, 950 m", "*Feltria clipeata*"[!], 2 ♀♀.

Remarks

As shown by the figures of PIERSIG (1896–1899: tabs. 51, 198), this species has a P-4 with a ventral projection as it was later described for females of the *cornuta* species group. On the same table, the much more slender palp of *F. rubra* is found, clearly a species different from *F. clipeata*. Most probably, *F. clipeata* represents one of the later-described *cornuta*-group species, but in the absence of clearcut diagnostic characters for *cornuta*-like females, *F. clipeata* must be considered a 'species incerta'. In view of their low Ac numbers, two specimens preserved under this name in NHMB probably represent *F. longispina*.

Feltria (Feltria) conjuncta K. O. Viets, 1955

(Figs. 16–19)

Feltria sp.: KLEIN & TOCKNER (1999).

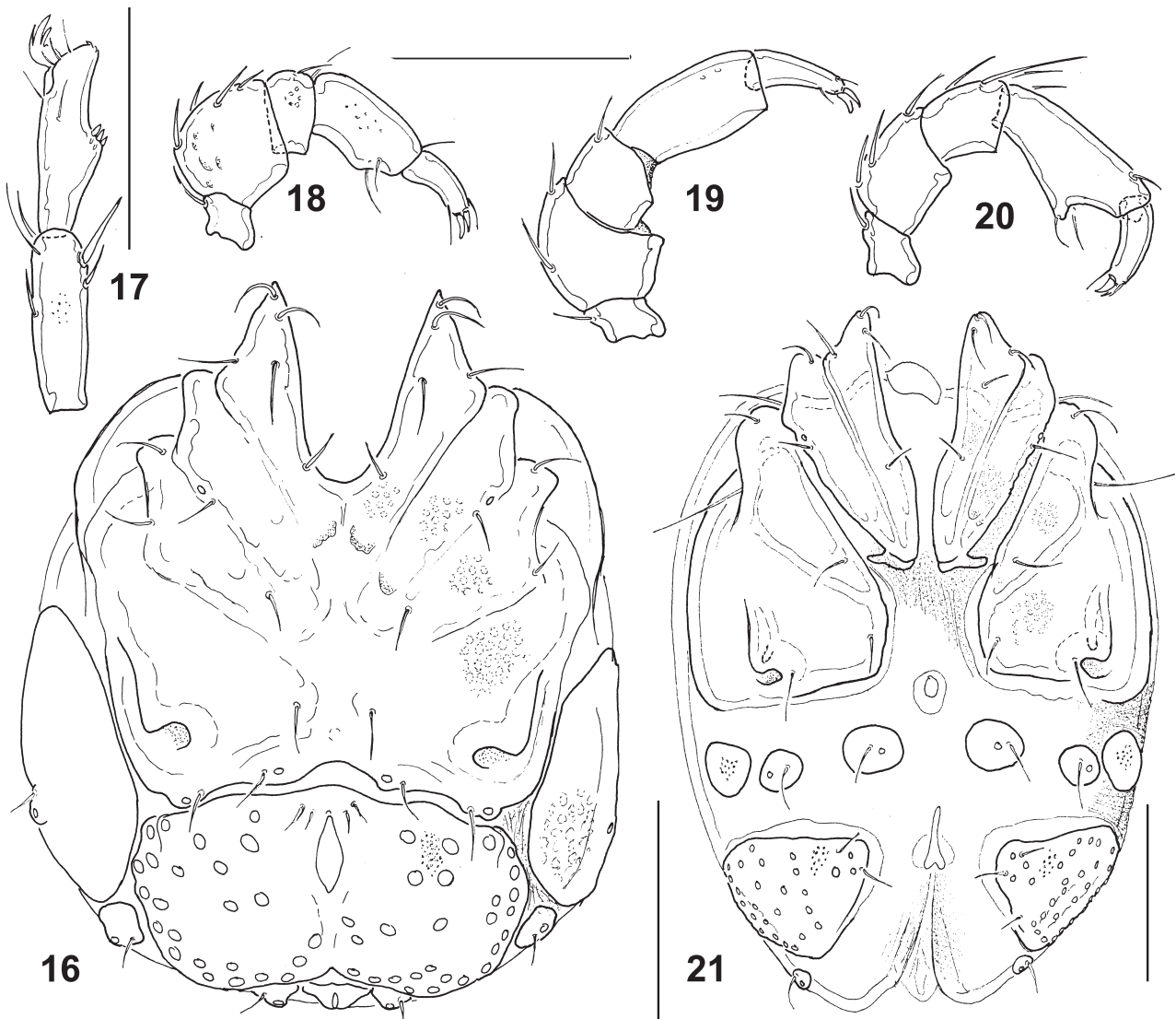
Material examined

GER "CH, Engadin, Val Roseg, ca. 2000 m N.N., KLEIN leg.": Q1S3, 16.IV.1997, 1 ♂; Q5P4, 16.IV.1997, 1 ♀; Q5P5, 16.V.1997, 1 ♀. – "Italy, Verona, Avesa, Val Borago settore 8, 25.III.2005 A. OLIVIERI leg.", 1 ♂, 1 ♀. – NHMB 3755, "Präp. 254, 11.VI.1938, Beinwil", 1 ♀; NHMB 3756–3759, "Lüssel/Lützel, 1972, SCHIESS leg.", 4 ♀♀. – SMF 50665, "Hetzles, Erlangen, unterer Schlierbach, H.-J. STAMMER leg., 12.IX.1949", K. O. VIETS 914, 1 ♂.

First record from Italy.

Remarks

K. O. VIETS (1955a) detected that a male ascribed by WALTER & MOTAŞ (1927) to *F. rouxi* in reality represented this previously overlooked species and described it in both sexes from Bavarian material (figures of the female: K. O. VIETS 1955b: fig. 5). *Feltria conjuncta* is defined in both sexes by the genital field with 25–35 pairs of Ac and a stout palp with relatively long P-5. In addition, males are characterized by: (1) one single, large dorsal shield including DI-1-4 and setae Dgl-1-4; (2) all coxae fused completely to form a coxal shield, with Vgl included into its posterior margin; (3) III-leg-6 with ventral margin slightly inflated in the centre, bearing 3–4 strong setae distinctly



Figs. 16–21. *Feltria* spp. – 16–19. *F. (Feltria) conjuncta*; ♂, SMF 50665 (16–18); ♀, SMF SCHWOERBEL, Andelsbach (19). 16. Venter. 17. III-leg-5/6. 18. Palp. 19. Palp. – 20–21. *F. (Feltria) cornuta*, ♀; CRENODAT 1853 (20); CRENODAT AD 1654 (21). 20. Palp. 21. Venter. – Scale bars: 100 µm.

separated from each other; (4) genital plate subtrapezoidal, anterior margin slightly projecting, posterior margin weakly indented medially, gonopore long, in anterior half of plate; (5) excretory pore on separate platelet in terminal position. Females bear on their dorsum a large anterior shield including D1-1-2 and Dgl-1-2, two paired posterior plates (Dgl-3+D1-3, Dgl-4+D1-4), and the posterodorsally-directed excretory pore platelet; their coxae form three groups (Cx-I fused medially, Cx-II on each side separated from Cx-III by membranous integument), Vgl on separate platelets posterior to caudal margin Cx-IV.

The most similar species, *F. rouxi* and *F. oedipoda* (common character state: a rather stout palp, L/H ratio $P-4 < 3.0$, in *F. oedipoda* males also similarly developed III-leg-6), differ from *F. conjuncta* in male coxae not completely fused to a single coxal plate and not including Vgl into secondary sclerotization, and in the female sex in the shape of P-4 (in *F. rouxi* with straight, in *F. conjuncta* convex, ventral margin) respectively the degree of fusion of coxae (Cx-I in *F. oedipoda* medially separated).

Males of the only other *Feltria* species with a complete coxal field in this sex, *F. subterranea*, differ in a stouter idiosoma with tips of Cx-I anteriorly little projecting, genital field with straight anterior margin and ventral setae of III-leg-6 located on a distinct projection in the proximal part.

Distribution

Alps, Italy, German central low mountain range and western lowlands.

Feltria (Feltria) cornuta Walter, 1927

(Figs. 20–21, see also GERECKE et al. 2009: fig. 2)

Feltria raetica Bader, 1975, **n. syn.**

Material examined

Feltria raetica, lectotype ♀, here designated, NHMB 3889, “*Feltria raetica* ♀, Buogls, 3.VIII.1970, Coll. BaNP 70/71”, “Holotypus”. – Paralectotype, same date and site, NHMB 3890, “Paratypus”, 1 ♀.

Further material: NHMB 3762, *Feltria cornuta* Source Vauclusienne à Bouilli, 22.II.[19]27, ♂ [condition: dried, palps and III-leg detached, not found]. NHMB 3764, “Kaltbrunnental, 24.X.1943, 36/1943, XV/29”, 1 ♂ [legs in situ, palps detached, good condition]; NHMB 3897–98, same site as lectotype of *F. raetica*, 7.X.1977, 2 ♀♀. – SMF, coll. SCHWOERBEL, “*Feltria paucipora*”, “Germany, Black Forest, Gauchach, 30.VIII.1960”, 1 ♀.

Refused identifications: “*Feltria cornuta*”, NHMB 3898, 22.VII.1978, 1 ♂; NHMB 3899, 24.IX.1978, 1 ♂ [both specimens representing *F. zschokkei*].

Remarks

This species has been described and figured in detail in GERECKE et al. (2009).

BADER (1975a) introduced the name *F. raetica* for two females from the NP Graubünden which he compared exclusively with *F. setigera* and *F. handschini*. Only at the very end of his description does he mention the striking similarity to *F. cornuta* in the shape of the palp (P-4 with a seta-bearing ventral projection). Following his group schemata, *F. raetica* should differ from “*minuta*-like” species (a group rather dishomogenous in male morphology, but in females defined by the combination of postantenniformia included into, but Dgl-1 and D1-2 and D1-3 separate from, dorsal shield). To this group he attributed also *F. cornuta*. A holotype of *F. raetica* was not defined in the original description, but on the basis of collecting sites and date, the specimen labelled “holotype” can be identified with one of the two syntypes and is therefore here designated as lectotype. Notwithstanding the fact that its idiosoma has not been dissected and only one palp is left, a rather clear recognition of important morphological details is possible. In shape of dorsum and palp, no differences can be found to differentiate *F. raetica* from *F. cornuta*: The Dgl-1 are not fused to the dorsal shield as stated by BADER, but separated by a strip of striated integument. This is true also for two females later attributed by BADER to *F. raetica* (NHMB 3897–98, both specimens completely undissected, but ventral extensions of P-4 visible), but not for the two males. The latter, specimens never described before, in fact represent without any doubt *F. zschokkei*. *Feltria raetica*, as it is defined by the two syntypes, is a junior synonym of *F. cornuta*.

Distribution

Alps, Dalmatia, German western low mountain range, United Kingdom.

Feltria (Feltria) denticulata E. Angelier, 1949

No material investigated.

Remarks

Since a very detailed redescription of this species was given by GLEDHILL (1983), based on the type series and new material collected in Great Britain, material of this species was not revised. Together with *F. phreaticola* (see there for more details), *F. denticulata* forms a highly distinct group of interstitial-dwelling species.

Distribution

Pyrenees, United Kingdom.

Feltria (Feltria) disjuncta Walter, 1947, **sp. inc.**

Material examined

Holotype dn, NHMB 3823, "*Feltria disjuncta* Ny., WALTER, Aubonne, 21.VII.1944, Aubonne s.-ö. Bière, XVI/66".

Remarks

Following the original description, this deutonymph should differ from all other species known at this stage by the presence of a paired (in other species unpaired) plate posterior to the anterodorsal plate. At the time of the publication, for most European species the morphology of deutonymphs was unknown (a situation little changed since then). In addition the only known specimen is freshly hatched, with little sclerotized idiosoma and distorted appendages, it is quite possible that the plates in question would have fused during ageing and growth. In this difficult genus, describing new species based on the morphological detail of a deutonymph does not make sense. *Feltria disjuncta* must be regarded a 'species incerta'.

Feltria (Feltria) drilonensis K. Viets, 1936, **n. stat.**

(Figs. 22–27)

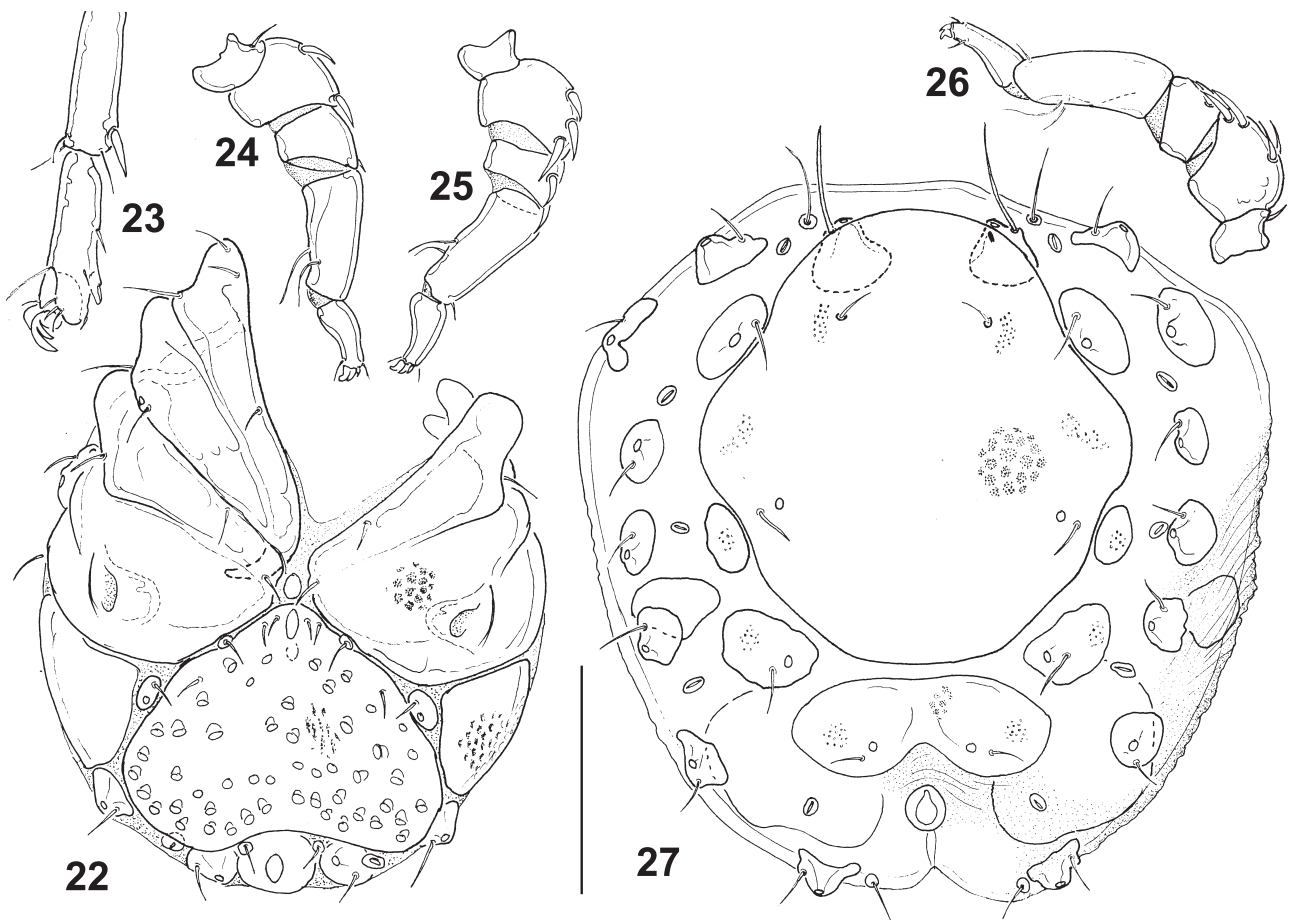
Feltria brevipes drilonensis K. Viets, 1936.

Material examined

Holotype ♂, SMF 43473, "*Feltria brevipes drilonensis*, Jugoslav. Drim, Quelle bei Sv. Naum a. Ohrid See, 2.IX.1934, VIETS leg." (K. VIETS 5038). – Paratypes: SMF 43474, same data as holotype (K. VIETS 5039), 1 ♀; SMF 43475, "Jugoslav., Bach b. Zrpopo b. Prilep, 4.IX.1934, VIETS leg." (K. VIETS 5051), 1 ♀; SMF 43476, "Jugoslav., Bach b. Dečani b. Peć, VIETS leg., 6.IX.1934" (K. VIETS 5057), 1 ♂, 1 ♀.

Remarks

A synonymization of this taxon with the stem species was possibly intended by K. O. VIETS, who excluded it from *Limnofauna Europaea* (1978), but refused by BADER (1973) who gave much weight to the organization of the dorsal plates and glands in females: In *F. drilonensis* females, the muscle attachment platelet Dc-3 is very small



Figs. 22–27. *Feltria (Feltria) drilonensis* paratypes, SMF 43473, ♂ (22–25), ♀ (26–27). – 22. Venter. 23. III-leg-5/6. 24. Left Palp. 25. Right Palp. 26. Palp. 27. Dorsum. – Scale bar: 100 µm.

(following BADER distinctly larger in *F. brevipes*). The two taxa are similar in the stout shape of palp and pleisotypic organization of coxae in four groups, but males differ strongly in the genital field with straight to convex anterolateral margins (concave in *F. armata*, resulting in a pointed anteromedial projection), lateral platelets flanking the genital field enlarged, nearly completely filling the space posterior to the lateral Cx-IV, and with anterior tips reaching level of IV-leg insertions (in *F. brevipes* small, leaving extended membranous areas and anteriorly ending at level of posterior margin of Cx-IV). Furthermore, the setae-bearing ventral projection on III-leg-6 is located far anterior on the segment, with setae appearing to be fused to one single structure (in *F. brevipes* located more proximally, several distinct setae visible).

The studied female paratype is characteristic in having Dgl-4 medially fused to a transverse, unpaired platelet. Fusion/separation of these platelets is obviously subject to individual variability.

The species is similar to *F. brevipes* in rather low dimensions and low numbers of acetabula (<30 in both sexes), the female dorsal shield only slightly longer than large, and the ventral setae on male III-leg-6 located in the distal part of the segment.

Distribution

Eastern Balkans, only known from the type locality in Macedonia.

Feltria (Feltria) golatensis Rensburg, 1971, **sp. inc.**

Material examined

Holotype ♀, NHMB 4073, "*Feltria(?) golatensis* ♀, type specimen, Prep. 118, 30.X.1968, Le Golat, Delémont, Coll. 32 (Hoyers)". – Paratype, NHMB 4074, "*Feltria (?) golatensis* ♀, Prep. 119, 30.X.1968, Le Golat, Delémont 12 °C, Coll. 32", 1 ♀.

Remarks

This species was placed by RENSBERG (1971) near *F. rubra* with the argument "the coxae are similar in the two species", but unfortunately, he did not name the common feature he referred to. Differences he listed as diagnostic in comparison with *F. rubra* are: (1) ventroglandularia smaller; (2) lateral platelets absent [an error, they are well visible]; (3) setation of genital plate different; (4) Dgl-1 on separate platelets; (5) Dgl-3 and DI-3 not fused to dorsal shield, on a common platelet or separate from each other; (6) posterior dorsal plates larger.

Some of the listed differences, in addition also the relatively low number of 40–47 Ac per genital plate, indicate that *F. golatensis* is taxonomically distant from *F. rubra*.

Instead, in Ac number and arrangement of dorsal plates, the two specimens are similar to females, e. g., of *F. schusteri* Bader, 1974. In the absence of males, a final decision on its taxonomic state is impossible and *F. golatensis* is regarded a 'species incerta'.

Feltria (Feltria) inconstans Bader, 1975 (Figs. 28–29)

Material examined

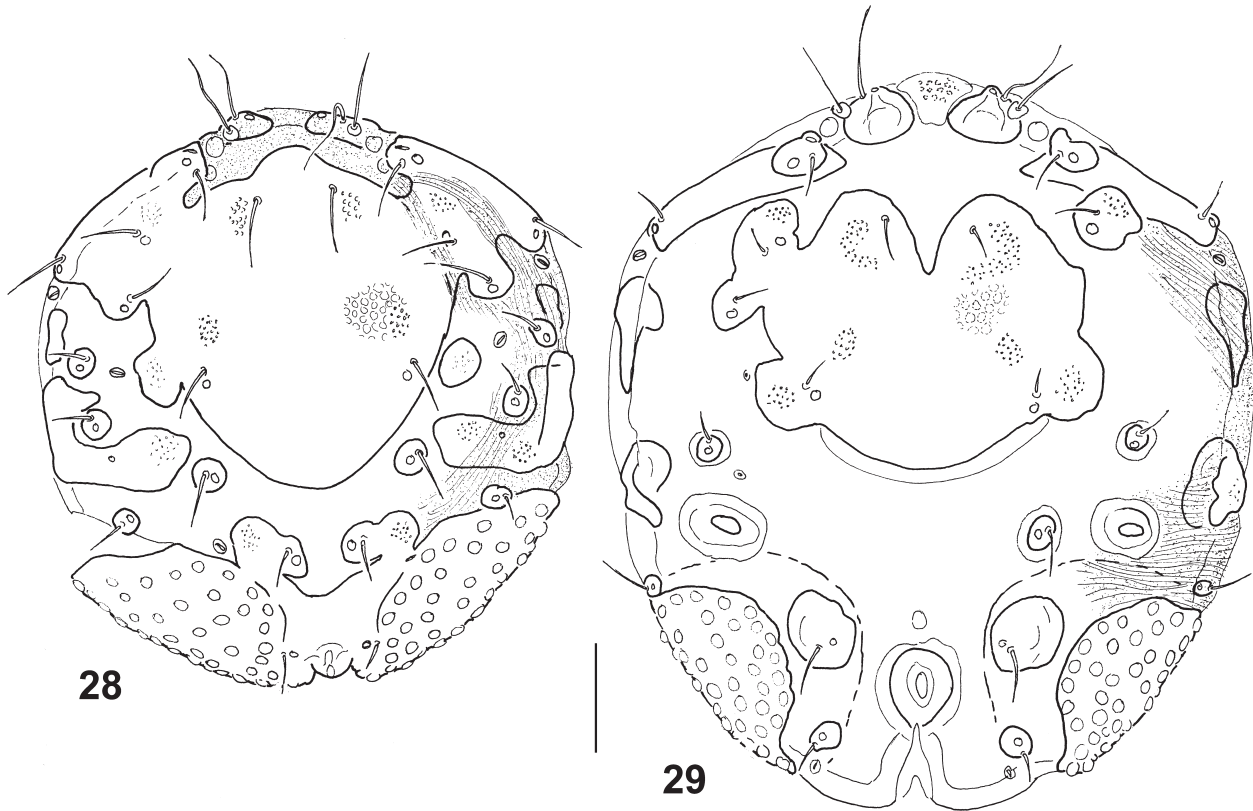
Holotype ♀, NHMB 3806, "Buogls Nr. 2, Nov. 1970". – Paratypes ♀♀, all labelled "Ba NP 70/71, Typus": NHMB 3807, "Buogls Nr. 3, Mai 1971", NHMB 3810, "Buogls Nr. 6, August 1970", NHMB 3811, "Buogls Nr. 4, Sept. 1970", NHMB 3812, "Buogls Nr. 1, Dez. 1970", NHMB 3813, "Buogls Nr. 5, Dez. 1970".

Further material from the type locality, Ova dals Buogls: NHMB 3808, Juni 1970, 1 ♂; NHMB 3809, Aug 1970, 1 dn; NHMB 3814–3815, 26.IX.1975, 2 ♀♀; NHMB 3816, 4.X.1977, 1 ♀; NHMB 3817–3819, 7.X.1977, 3 ♀♀; NHMB 3820, 2.X.1986, 1 ♀; NHMB 3821, Stabelchod, 21.VII.1986, 1 ♀.

Condition of the material: male with gnathosoma detached, but mounted in oblique position; all females with gnathosoma in situ, rendering palp measurements impossible for all specimens.

Remarks

Both sexes of *F. inconstans* differ from all other *Feltria* species in the dorsal sclerotization: In the male, Dgl-1 and DI-1 are fused both to the anterolateral margins of the dorsal shield and to the anterolateral sclerites bearing prae- and postantenniformia. In this way, paired sclerotized bridges extend from the dorsal shield on both sides to the anterolateral body surface. Furthermore, DI-3 are fused to the lateral platelet to form a L-shaped dorsolateral sclerite, and, in the posterior part, the genital plate extends dorsally, completely surrounding the excretory pore, with Dgl-4 and DI-4 fused to its posterior (due to bending to the dorsal surface "secondarily anterior") margin. In contrast, females have the dorsal sclerotization reduced in comparison with other species of the genus, with the main dorsal shield covering less than half of the dorsal surface. This shield is wider than long and characterized by a deep anteromedial indentation. As documented in BADER'S (1975a) figs. 6e–f, the shape of this shield is rather inconstant due to a high variability in fusion or separation of the neighbouring Dgl-1, DI-1, Dgl-2 and DI-2, while other platelets are always separated. Some of the females are ovigerous, bearing up to three eggs. In both sexes, but namely in the male, we can observe that neighbouring platelets are fused via subcutaneous bridges extending below the lineated superficial integument. In ventral sclerotization, the shape of palps, and setation of male III-leg, *F. inconstans* is very



Figs. 28–29. *Feltria (Feltria) inconstans*, dorsum. – 28. ♂, NHMB 3808. 29. ♀, NHMB 3817. – Scale bar: 100 µm.

similar to *F. setigera*, but males have Cx-I medially fused, in *F. setigera* generally separate.

At a first glance, character combinations of specimens attributed to *F. inconstans* appear somewhat aleatoric and the high degree of asymmetry and individual variability could suggest that we have to deal with misshapen specimens of another species, e. g. *F. setigera*. However, females with the characteristically indented dorsal shield were found at the type locality in considerable numbers: after publication, BADER (1977) found in addition five specimens listed above. They were furthermore associated with a population of *F. setigera* (sub nom. “*F. handschini*”), but no specimens with intermediate morphology were found, and in another site of the same area (Stradin, BADER 1977), the latter species was found in high density, but no specimens with *inconstans*-like morphology. These distributional observations support the view that *F. inconstans* is a well defined species with a very interesting character combination.

In the deutonymph NHMB 3809, no particular features were found that could demonstrate conspecificity with *F. inconstans*.

Distribution

Alps.

Feltria (Feltria) longispina Motaş & Angelier, 1928,
n. stat.
(Figs. 30–38)

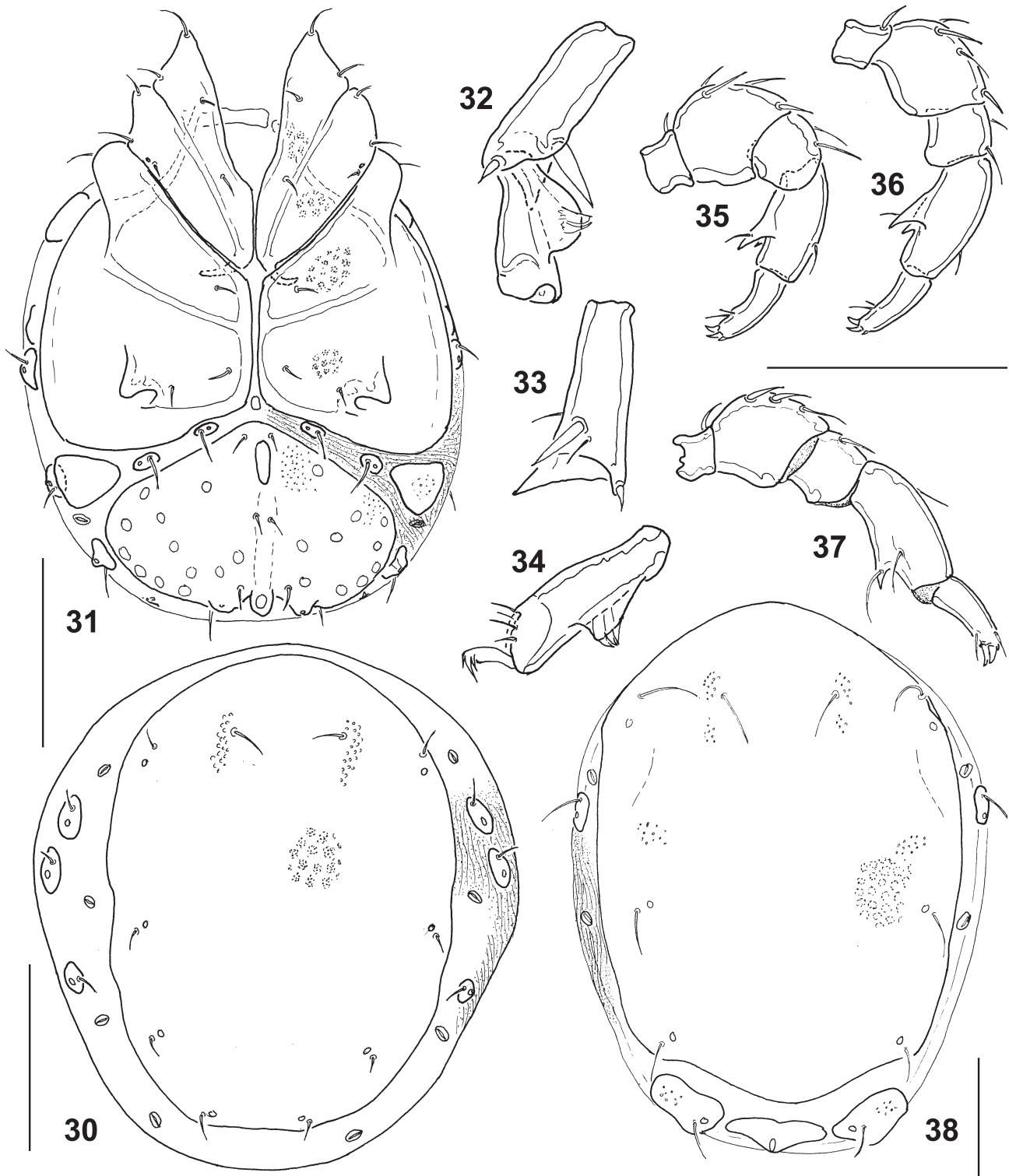
Feltria cornuta longispina Motaş & Angelier, 1928.

Material examined

Holotype ♂, NHMB 3761, “Ruisseau de l’Auzon (Massif Central), 23.VI.[19]27, *Feltria cornuta* [*macrospina* n. var.??]”.

Further material: Museo Civico di Storia Naturale Verona, IBENF 168, “Emilia Romagna (MO), Val di Luce, T. affluente di destra del Rio delle Pozze, 44° 08' 53,5 N 010° 37' 59,2 E, 1322 m, BENFATTI 000604/01”, 1 ♂. – NHMB “Ochrida-See, ?1928, STANKOVICH 76”, XXVIII/20, 1 ♂ [condition: palps lacking]. – SMF, coll. SCHWOERBEL, “Germany, Black Forest, Steina”, some labelled “hyp. Grundw.”, one dated “Mai 1961”, 3 ♀♀; “Gauchach 30.VIII.[19]60”, 1 ♀. – SMF, K. O. VIETS 50670, “Schwarzwald, Quelle im Haslachtal zwischen Falkau u. Lenzkirch, SCHWOERBEL leg., 9.III.1960” (K. O. VIETS 1956), 1 ♂; 50762, “Lunz Österreich, Ufergrabung am Seebach, HUSMANN leg., 2.IX.1958” (K. O. VIETS 1944), 1 ♀, 1 dn.

First record from Italy.



Figs. 30–38. *Feltria (Feltria) longispina*; ♂, I BENF 168 (30–36); ♀, SMF 50670 (37–38). – 30. Dorsum. 31. Venter. 32. III-leg-5/6. 33. III-leg-5, separate. 34. III-leg-6, separate. 35. Left palp. 36. Right palp. 37. Palp. 38. Dorsum. – Scale bars: 100 μ m.

Remarks

Most parts of the collections of both authors are lost and the location of the holotype of this taxon was previously unknown. In addition to the agreeing collecting-site and -date, measurement values and figures, identity of this specimen with the holotype is supported because the authors obviously had asked WALTER for his comment. Apparently they decided first for the name “*macrospina*” and nobody took care to change the label since the taxon was described.

This taxon is obviously a well-defined separate species. In addition to the name-giving character in III-leg (III-leg-5 distal margin extending to form an acute, pointed projection flanking the insertion of the terminal segment, in *F. cornuta* this margin equally rounded) and lower Ac numbers (14–28, in *F. cornuta* 35–60 pairs), males differ from *F. cornuta* also in generally minor dimensions (idiosoma L/W 320–380/250–290, *F. cornuta*: 370–450/260–340).

Attribution of females is still difficult, but probably possible on the base of Ac numbers: females by SCHWOERBEL attributed to *F. paucipora* (collected together, and probably conspecific, with *F. longispina* males) have 15–35 pairs of Ac (in *F. cornuta* 34–65).

The specimen from Lake Ohrid is in agreement with the original description, but a definitive attribution is difficult due to the loss of the palps.

Feltria tsemberae Tuzovskij, 1999, with a distribution from Asian Russia to the extreme northeastern Europe (Russia, Petshoro river basin), is similar to *F. longipalpis* in the shape of male III-leg-5/6 and arrangement of dorsal sclerites in both sexes, but differs in the stouter shape of male idiosoma (tips of Cx-I little projecting over anterior margin) and the presence of only one pointed ventral extension on P-4 (TUZOVSKIJ 1999).

Distribution

Alps, northern Italy, German western and central low mountain range, Balkans.

Feltria (Feltria) minuta Koenike, 1898

(Figure see GERECKE et al. 2009: fig. 3)

syn.: *F. kulczinskyi* Schechtel, 1910: WALTER (1922).

Feltria ursulae Bader, 1975, n. syn.

Material examined

Feltria kulczinskyi, syntypes, NHMB 3837–3841, “Zakopane 28.IX.1909”, 2 ♂♂, 3 ♀♀ [condition: all slides completely dried, but details well visible, specimens not squeezed; probably the material could be restored by remounting].

Feltria ursulae, holotype ♀, NHMB 4068, “*Feltria ursulae* ♀, Astras-Dadora, 24.VII.1962, 2100 m, Coll. Ba 19/62” [condi-

tion: idiosoma with one palp separated, idiosoma squeezed, undissected; a further palp, by far more stout in shape than given in BADER’s fig. 64f and possibly belonging to one of the male paratypes, mounted on the same slide]. – Paratype ♀, NHMB 4071, same site and date [undissected].

Rejected attribution: Male paratypes of *F. ursulae*, NHMB 4069–4070, same site and date as the holotype, obviously belong to *F. setigera* (see under this species).

Remarks

Feltria minuta has been described and figured in detail in GERECKE et al. (2009). There, a figure of the venter of a male (fig. 3) from the southern Alps, showing medially fused Cx-I+II, is misleading. The study of numerous populations from the Berchtesgaden National Park (GERECKE & MARTIN 2006) and a re-examination of the northern Italian material, indicate that Cx-I+II may be closer together in juvenile specimens, but are always clearly separated medially. No continuous coxal plate is formed in this species.

The specimens from Zakopane make part of the type series of *F. kulczinskyi*. Notwithstanding the bad state of preservation, all important details are visible which allow to confirm the synonymy of this species with *F. minuta* first proposed by WALTER (1922). It is interesting to note the presence of a part of the widely lost collection of SCHECHTEL in NHMB.

Feltria ursulae was described from 2 ♂♂ and 2 ♀♀ collected in a remote spring along with specimens attributed to *F. minuta*, *F. rubra* and *F. setigera* (BADER 1975a). As the author selected a female holotype and attributed erroneously two males of *F. setigera* to the species, discussion of diagnostic characters is difficult, necessarily limited to the female sex. For reasons which are unclear, BADER decided to compare this species with *F. ishikariensis* Imamura, 1954, a species from Japan completely different, e. g. in a low number of 30 + 30 Ac. More informative results come from a comparison with the other three species recorded from the type locality: *Feltria setigera* (to which the male paratype belongs) and *F. rubra* differ in the dorsal position of the excretory pore, the latter also in the dorsal sclerite pattern (Dgl-1 fused to, but D1-1 separate from, dorsal shield), the former in generally lower Ac numbers. *Feltria minuta*, a species with the excretory pore in the ventral or terminal position, is also similar in the pattern of dorsal sclerites. From a re-examination of populations collected in the Berchtesgaden National Park, Ac numbers of female *F. minuta* normally lay between 60 and 80, but may increase also to 90 and more. Thus, there is convincing evidence that *F. ursulae* is a junior synonym of *F. minuta*.

Distribution

Large parts of Europe.

Feltria (Feltria) oedipoda K. Viets, 1922
(Figs. 39–41)

Material examined

Lectotype ♂, here designated, SMF 43489, “Harz 25, Qu. westl. Oderkirch, Abt. 177/178, 26.VII.21, VIETS leg.” (K. VIETS 2922). – Paralectotypes: SMF 43490, “Harz 4, Qu. a. Wege Altenau-Romkerhall, Abt. 44., 5.X.21, VIETS leg.” (K. VIETS 2991), 1 ♂; SMF 43493, “Harz 32, Qu. i. Gr. Spritzental, Abt. 131b. Dorfhaus, 5.X.1921, VIETS leg.” (K. VIETS 3015), 1 ♀.

Further material: NHMB 3875, “Val Ftur, 30.VII.1982, 86, Coll. NP82/35”, 1 ♂. – SMF 50704, “Kreuzsteinbächl a. Fahrweg Flossenbürg-Siebenhütte, Oberpfälzer Wald, H.-J. STAMMER leg., 25.VIII.1949” (K. O. VIETS 963), 1 ♂; SMF 50705, “Kreuzsteinbächl, rechte Quelle, Oberpfälzer Wald, H.-J. STAMMER leg., 25.III.1949” (K. O. VIETS 974), 1 ♂.

Remarks

Feltria oedipoda is characterized in both sexes by coxal plates separated by membranous sutures into four groups, the genital field bearing numerous Ac (females 35–55, males up to 90) and a rather stout palp. In addition, males are characterized by a continuous dorsal shield including all Dgl and muscle attachments, III-leg-6 with a distinct ventral projection in the basal part of the segment, bearing three characteristic, short, peg-like setae and the genital field with anterior margin forming an obtuse angle and bearing a rather long gonopore in the anterior part; excretory pore plate and flanking glandularia fused to the posterior genital plate margin. Females have a rather large dorsal shield covering most of the dorsum and including Dgl-1/2 and DI-1/2, but posteriorly leaving Dgl-3+DI-3 and Dgl-4+DI-4 on paired, separate platelets flanking the dorsally-directed excretory pore plate.

Distribution

Alps, German western and central low mountain range, Carpathians).

Feltria (Feltria) paucipora Szalay, 1946

Feltria cornuta paucipora Szalay, 1946.

No material available (type series lost). – Type localities: “Bihar, Riv. Körös near discharge of rivulet Dragán, underground-water, 27.IX.1942 leg. CHAPPUIS”, 1 ♂; “Bihar, Rév, 13.XI.1942, leg. BALOGH”, 1 ♂.

Refused identifications: SMF SCHWOERBEL, Germany, Black Forest, Gauchach, 30.VIII.1960, 1 ♂ [= *F. cornuta*]; Steina, some labelled “hyp. Grundw.”, one dated “Mai 1961”, 4 ♀♀ [= *F. longispina*]. – NHMB 3898, 22.VII.1978, 1 ♂; NHMB 3899, 24.IX.1978, 1 ♂ [both specimens = *F. zschokkei*].

Remarks

SZALAY (1946) compared this taxon only with *F. cornuta* to which he placed it as a subspecies. Differences in

the shape of the dorsal shield (Dgl-1 fused), coxae (more slender, suture lines more oblique to the longitudinal axis) and genital field (by far lower number of Ac) suggest that *F. paucipora* must be considered a separate species, not a subspecies of *F. cornuta*.

A major problem exists regarding the similarity between *F. paucipora* and *F. longispina*, a further taxon originally introduced as a subspecies and here elevated to species rank. All differential character states named above are found expressed in the same way also in *F. longispina*. From the original description we can discuss potential differences as follows (*F. longispina* in parentheses):

(1) Smaller in size [idiosoma L/W 245/190 (270–380/195–320)]. The dimensions of the only slightly shorter dorsal shield [L/W 213/164 (210–350/150–265)], and a calculation from SZALAY’s fig. 2a (dorsal L/W ratio 1.29), suggest that SZALAY measured idiosoma L as dorsal L. Under this precondition, idiosoma measurements of the described specimen lay at the lower limit of the variability range of *F. longispina*. Instead, palp measurements are in fact below the limits known for *F. longispina*. In several occasions, we could observe that little weight can be given to measurements published by SZALAY.

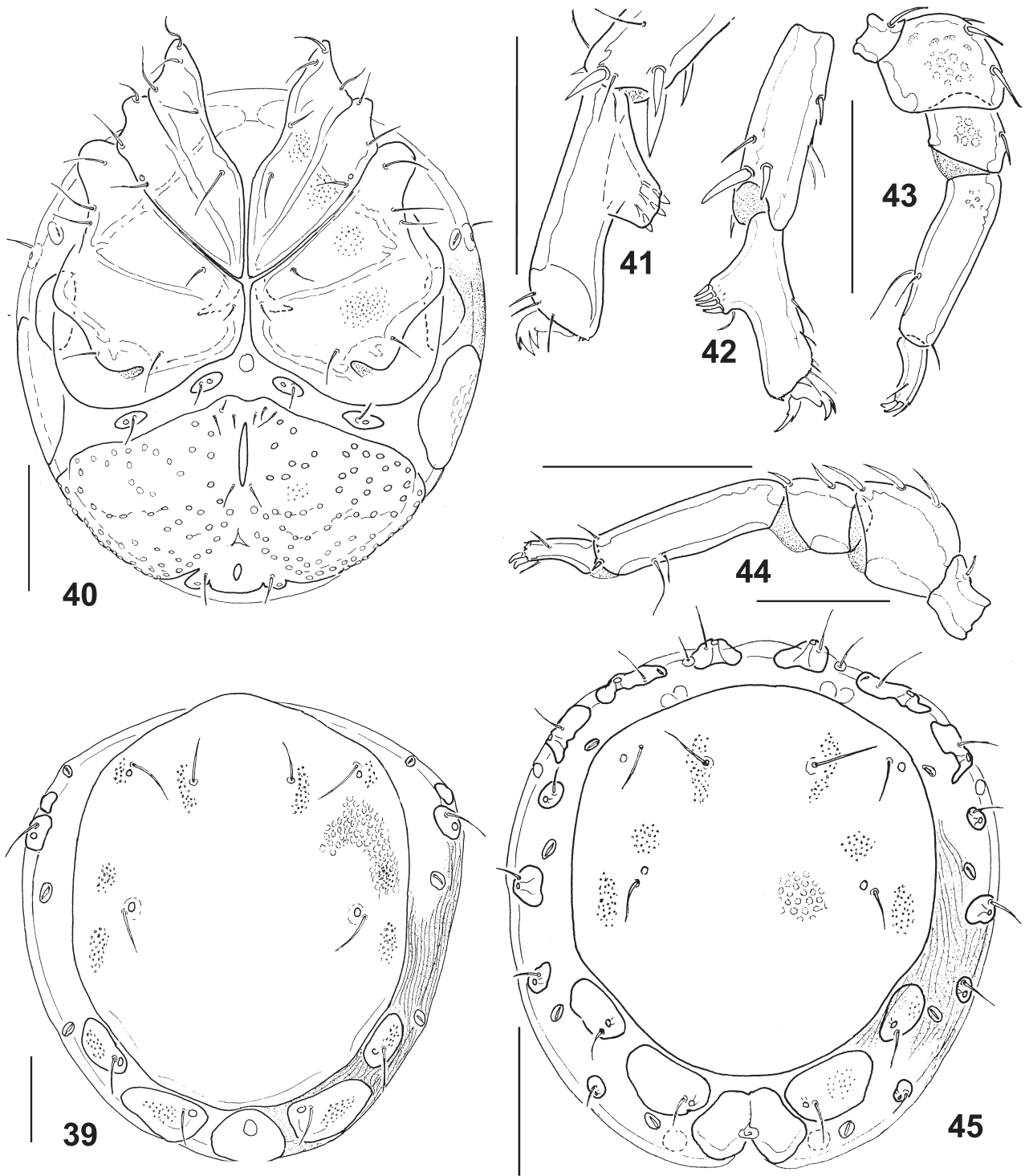
(2) A cover of “small, flat, semiglobular papillae” on sclerotized surfaces has never been described for another *Feltria* species and I suggest that this observation is not well expressed in the original description (one of the few SZALAY published in the English language). Probably he refers to the porosity typically found in feltriids and visible also in his fig. 2a.

(3) A small protuberance associated with a fine seta, located anterior to the large ventral extension of P-4 is equally found in *F. cornuta* and *F. longispina*. It is sometimes overlooked when the palp is observed in a slightly oblique position.

(4) The ventral setae on III-leg-6 are obviously not located on an enlarged, convexly protruding socket covering more than half of the segment surface (as in *F. cornuta* and *F. longispina*), but are longer and, following SZALAY’s fig. 2d and description, are inserted directly onto the segment surface (“4–5 flat formations are sitting close in a line, seeming like spine-bristles which appear to be enclosed in a chitinous cover”). Also, segment III-leg-5 appears to be different from typical *F. longispina* in the absence of a prominent, spine-like distal sheath flanking the base of III-leg-6 and the subapical setae on the ventral side less strongly developed.

If this combination of character states finds confirmation from further material from the region of the type locality, *F. paucipora* could be recognized as a separate species – at present obviously it requires a new description.

All males attributed by SCHWOERBEL to *F. paucipora* differ from the original description, and agree with *F. longispina* in the shape and setation of III-leg-5/6. Also the females from his collection do not show significant differ-



Figs. 39–45. *Feltria* spp. – 39–41. *F. (Feltria) oedipoda*; ♀, SMF 50704 (39); ♂, NHMB 3875 (40–41). 39. Dorsum. 40. Venter. 41. III-leg-5/6. – 42–45. *F. (Feltria) phreaticola*; ♂, SMF 50712 (42–43); ♀, SMF SCHWOERBEL, Gauchach (44–45). 42. III-leg-5/6. 43. Palp. 44. Palp. 45. Dorsum. – Scale bars: 100 µm.

ences to *F. longispina*, and the single specimen recorded from Switzerland (RENSBURG 1971) is obviously lost, there is no evidence for the presence of *F. paucipora* in Central Europe.

Distribution

Pyrenees, Balkans, Carpathians.

Feltria (Feltria) pectinifera Szalay, 1946

No material available (type series lost). – Type locality: “Romania, Bihar, Jádremete, river Jád, underground water, I.VIII.1942, coll. CHAPPUIS”.

Remarks

This species was described after a single, “probably young” (SZALAY 1946) male and by K. VIETS (1959) considered a junior synonym of *F. subterranea*. Instead, SZALAY (1961) and following authors (e. g. K. O. VIETS 1978) continued to treat *F. pectinifera* as separate species. Differences in comparison with *F. subterranea* should exist in a lower number of palp setae and the absence of lateral eye pigment. As the holotype and only known specimen is lost, a decision on the state of this species will be possible only after recollecting in the type locality or its surroundings.

Feltria (Feltria) phreaticola Schwoerbel, 1959 (Figs. 42–45)

Material examined

Holotype ♂, SMF, coll. SCHWOERBEL, “*Feltria* Typus *F. phreaticola* n. sp. ♂, Gauchach Grundwasser 100 cm”. – Paratypes: same site, 30.VIII.1960, 2 ♂♂, 2 ♀♀; 5.IX.1960, 1 ♂; without date 1 ♀.

Further material: SMF, coll. SCHWOERBEL, “Mt 5/1c”, possibly from a study of TILZER (1968) in Austria, 1 ♂; SMF 50712, “Ufergrabung oberhalb Biol. Stat. Lunz, Österreich, HUSMANN leg., 4.IX.1958” (K. O. VIETS 1947), 1 ♂; SMF, K. O. VIETS 50713, “Ybbs, Österreich, Schottergrabung unterhalb Brücke Langau, HUSMANN leg., 9.IX.1958” (K. O. VIETS 1952), 1 ♂; SMF 50714, as 50713 (K. O. VIETS 1953), 1 ♀, 1 dn.

Remarks

SCHWOERBEL aimed to describe this species first on the basis of a single male, but added to his manuscript a footnote concerning further specimens from the type locality (“Mehrere ♂♂ und ♀♀ ...”). The specimens in question are not explicitly labelled as types but obviously represent the material SCHWOERBEL dealt with.

Together with *F. denticulata*, this species differs from all other European species of the genus in the slender shape of palp (P-4 L/H > 3.0). A similarly slender palp is only found in the taxonomically distant *F. menzeli*, a species differing in the male sex in the absence of a sexual dimorphism of

III-leg-6 and in both sexes in the organization of dorsal plates (male: a small anterior and a large posterior plate; female: five larger plates flanked by four smaller platelets). Males of *F. phreaticola* and *F. denticulata* both have one large dorsal shield, females of *F. phreaticola* bear one large dorsal plate, posteriorly followed by two pairs of glandular platelets (Dgl-3/4) while *F. denticulata* females have one large anterior and one transverse posterior plate. Furthermore, both sexes of *F. phreaticola* differ from *F. denticulata* (in parentheses) in the equally convex shape of P-2 ventral margin (with a denticulated proximoventral extension) and the presence of > 40 (< 20) pairs of Ac and males in the presence, on III-leg-6, of a very distinct ventral projection in the centre of the segment, bearing 3–4 flattened, closely adpressed setae (III-leg-6 basally narrow, expanded distally, with 4–5 broad, blade-like ventral setae in the distal half).

Distribution

Alps, German central low mountain range.

Feltria (Feltria) piersigi Walter, 1907, **sp. inc.**

Material examined

Holotype ♀, NHMB 3876, “*Feltria piersigi* ♀ WALTER, Ammerwaldtal, Coll. PIERSIG”, “Typus P. S., Schützensteig, Jägerhaus, Blöckenau, VIII/85” [condition: dried, gnathosoma and palps lacking (probably, as normal in this part of the NHMB collection, mounted on a separate slide – this obviously has been lost)].

Attribution to *F. piersigi* rejected (see under *F. schusteri*): NHMB 3884, “Val Nuglia, 27.VII.1981, Ba NP81/60”, 1 ♂; NHMB 3885–3887, “Saalfelden/Hintertal, 16.VIII.1974, Ba”, 1 ♂, 2 ♀♀.

Remarks

BADER (1975a) made an attempt to redescribe *F. piersigi* from seven females collected in the Swiss National Park, in addition mentioning one male that “he did not dare to ascribe to this species”. All these specimens were obviously not preserved in his collection – instead, we find the above-mentioned two males and two females. In his redescription, BADER proposed to separate *F. piersigi* from the similar *F. zschokkei* on the base of the shape of the dorsal shield (larger due to prominent mediolateral extensions), size of Dgl-3 and Dl-3 (larger) and the position of the lateral plate lateral to IV-leg insertions (in *F. piersigi* lying perpendicular, in *F. zschokkei* parallel to the longitudinal axis). These character states are found identically in *F. schusteri*, described by BADER (1974b) from a site where specimens also attributed to *F. piersigi* were collected (NHMB 3885–3887). In view of the scanty available information about *F. piersigi* and the poor state of the holotype, this species must be considered a ‘species incerta’.

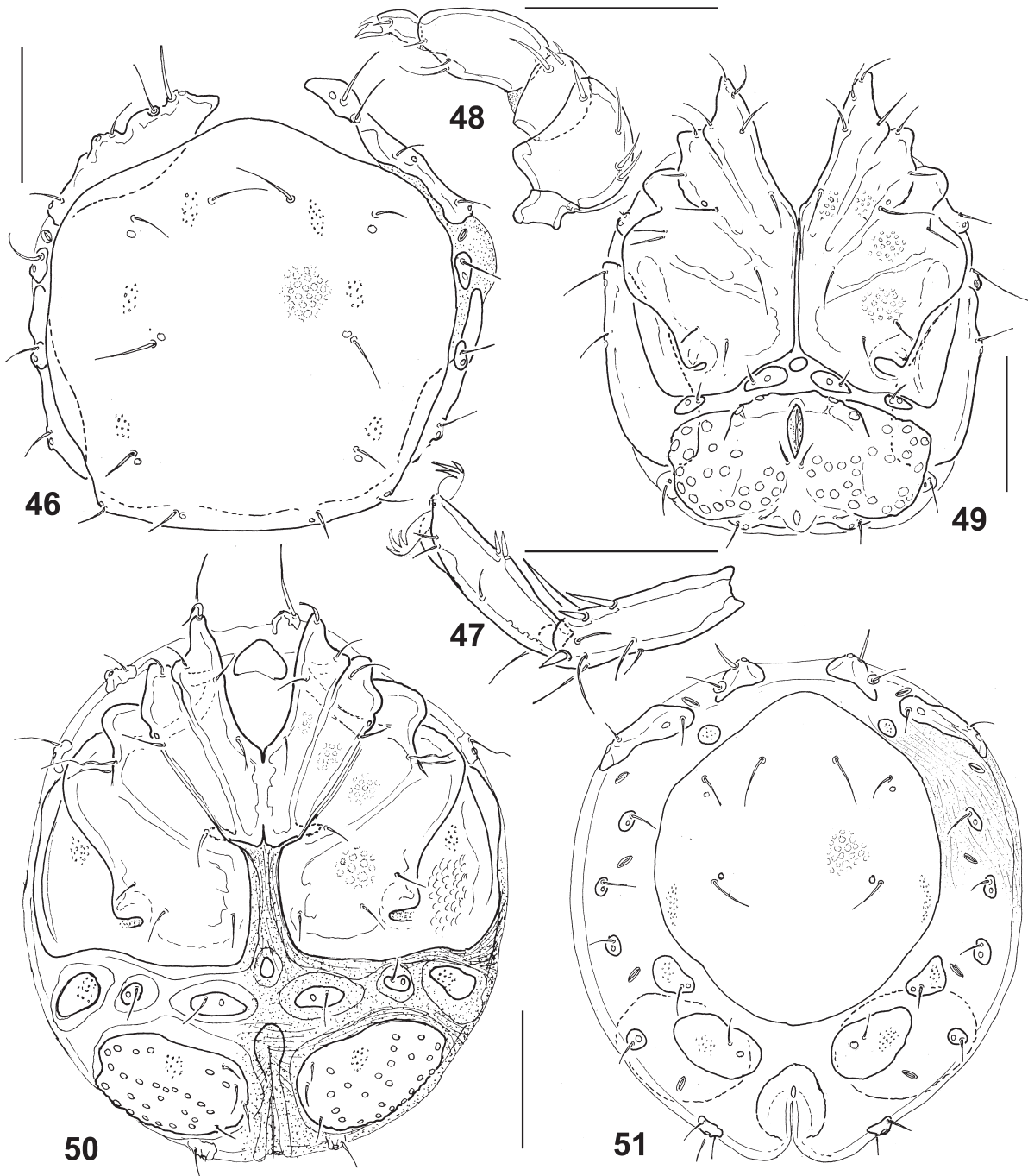
Feltria (Feltria) rouxi Walter, 1907

(Figs. 46–51)

Material examined

Syntype ♀, NHMB 3502, "*Feltria rouxi*, ♀ ov. WALTER",
"Muttenz. Bäche, 17.IV.1906, V/44".

Further material: NHMB 3919, "*Feltria westfalica* VIETS ♀,
Kaltbrunnental, 10.VI.1906, Coll. WALTER, Diss. 130 XIX/16",
1 ♀; NHMB 3920, "*Feltria westfalica* VIETS ♂, Mühlebach bei
Allschwil, 7.III.1920, Coll. WALTER XII/08", 1 ♂; "Germany,
Farver Au and Himmelreichbach, leg. MARTIN", 1992–1996,
6 ♂♂, 6 ♀♀. – NHMB 3903–3904, 3907–3908, "Switzerland,
Lüssel/Lützel, leg. SCHIESS, 1972", 2 ♂♂, 2 ♀♀.



Figs. 46–51. *Feltria (Feltria) rouxi*. – 46. ♂, NHMB 3903, dorsum. 47. ♂, NHMB 3903, III-leg-5/6. 48. ♂, MARTIN, Farver Au, palp. 49. ♂, NHMB 3904, venter. 50. ♀, MARTIN, Himmelreichbach, venter. 51. ♀ holotype, NHMB 3502, dorsum. – Scale bars: 100 µm.

Remarks

The species was described from two females, but the second syntype, collected in Kaltbrunnental near Basel, is obviously lost. The male was described for the first time by K. O. VIETS (1955a, in more detail 1955b) under the name of *F. romijni*, a species recognized by BADER (1974a) and most subsequent authors as a junior synonym of *F. rouxi*.

Males attributed by BADER to this species are characterized by a large dorsal shield including all Dgl and DI, a pair of large, rod-shaped frontal plates including antenniformia and Lgl-1+2 and Lgl-5 placed on a large longitudinal lateral plate. Coxal plates closely adpressed to each other and fused on both sides, but medially separated by a longitudinal membranous strip. III-leg-6 ventrally without a distinct elevation, often slightly convex, bearing 2–4 short, pointed setae located side by side in the centre of the segment. Genital field transversely subrectangular, with slightly convex anterior margin, posteriorly including the excretory pore and the glandularia flanking it, bearing 28 relatively large Ac, mostly located near lateral and posterior plate margins; gonopore in the anterior part, its anterior edge on a projection elevated over the genital plate surface. Measurements and ratios: Idiosoma L/W 330–350/270–300, dorsal L 290–320, L/W ratio 1.1, dorsal shield L/W 255–300/220–290, ratio 1.0–1.2; coxal field L/W 230–240/260–280; IV-leg-III L ca. 80; genital field L/W 95–100/185–210, ratio 0.5; L/H P-1, 21/25; P-2, 74/68; P-3, 30/49; P-4, 76/43; P-5, 43/22 (ratio P-2/P-4, 0.98, P-3/P-4, 0.40), very stout (ratio P-4/P-5, 1.78, L/H P-2, 1.1, P-3, 0.6, P-4, 2.1).

A detailed description of the female with figures of the idiosoma is found in the first publication of the species (WALTER 1907). He gives the following measurements and ratios: Idiosoma L/W 400/330 (ratio 1.2); dorsal shield L/W 300/246 (ratio 1.21); L P-1, 21; P-2, 66; P-3, 36; P-4, 75; P-5, 45 (ratio P-2/P-4, 0.88, P-3/P-4, 0.48, P-4/P-5, 1.67); I-leg 258; II-leg 282; III-leg 345; IV-leg 380; gonopore 135; L/W genital plate 75/115 (ratio 1.5, about 30 Ac). From a reinvestigation of the syntype NHMB 3502 results that WALTER's description was probably based on the other, now lost, syntype. As the data agree rather well concerning the shape and proportions of genital plates and palp, conspecificity of the two specimens is supported. Minor differences in palp segment proportions could be both, the consequence of deformations in the appendage flattened over hundred years under the coverslip, or the result of intraspecific variability; the latter could also explain the less slender dorsal shield (L/W ratio 1.13). Instead, an important difference is found in the shape of the coxae: WALTER and all subsequent authors underline that Cx-I of both sides are medially fused, and anterior margins of Cx-III are closely adpressed to posterior margins of Cx-II. Instead, in the syntype NHMB 3502, a fine, but distinct medial line

separates the medially touching Cx-I, and Cx-II are separated from Cx-III by a strip of membranous integument.

In view of the absence of further type specimens for re-investigation, we deduce that the presence of a medial suture line, or, is a general feature of *F. rouxi*, overlooked by WALTER in both specimens, or, is subject to individual variability. The character state is consequently best defined as follows: "Cx-I medially closely adpressed to each other, leaving only a fine suture line that may disappear in ageing specimens".

The palp of this species was not figured in the original description. The strongly squeezed palps of the investigated type allow only for the statements that: (1) they do not bear ventral extensions on P-4, and (2) they have a proportionally short P-4 (33 %, following measurements in the original description, 31 %).

The dorsal idiosoma of *F. rouxi* females is covered by a large central shield including Dgl-1, Dgl-2 and DI-2, with bluntly projecting anterior and posterior, and subparallel lateral margins, and two elongate platelets lying in oblique position in the membranous posterior dorsum – anterolaterally the small Dgl-3+DI-3, posteromedially the larger Dgl-4+DI-4.

A re-examination of two specimens (NHMB 3919–3920) from Switzerland, formerly attributed to *F. westfalica*, does not produce any contradiction to the synonymization of this species with *F. rouxi*, first proposed by BADER (1974a).

Distribution

Most parts of Europe except for the alpine belt.

Feltria (Feltria) schusteri Bader, 1974
(Figs. 52–54)

Material examined

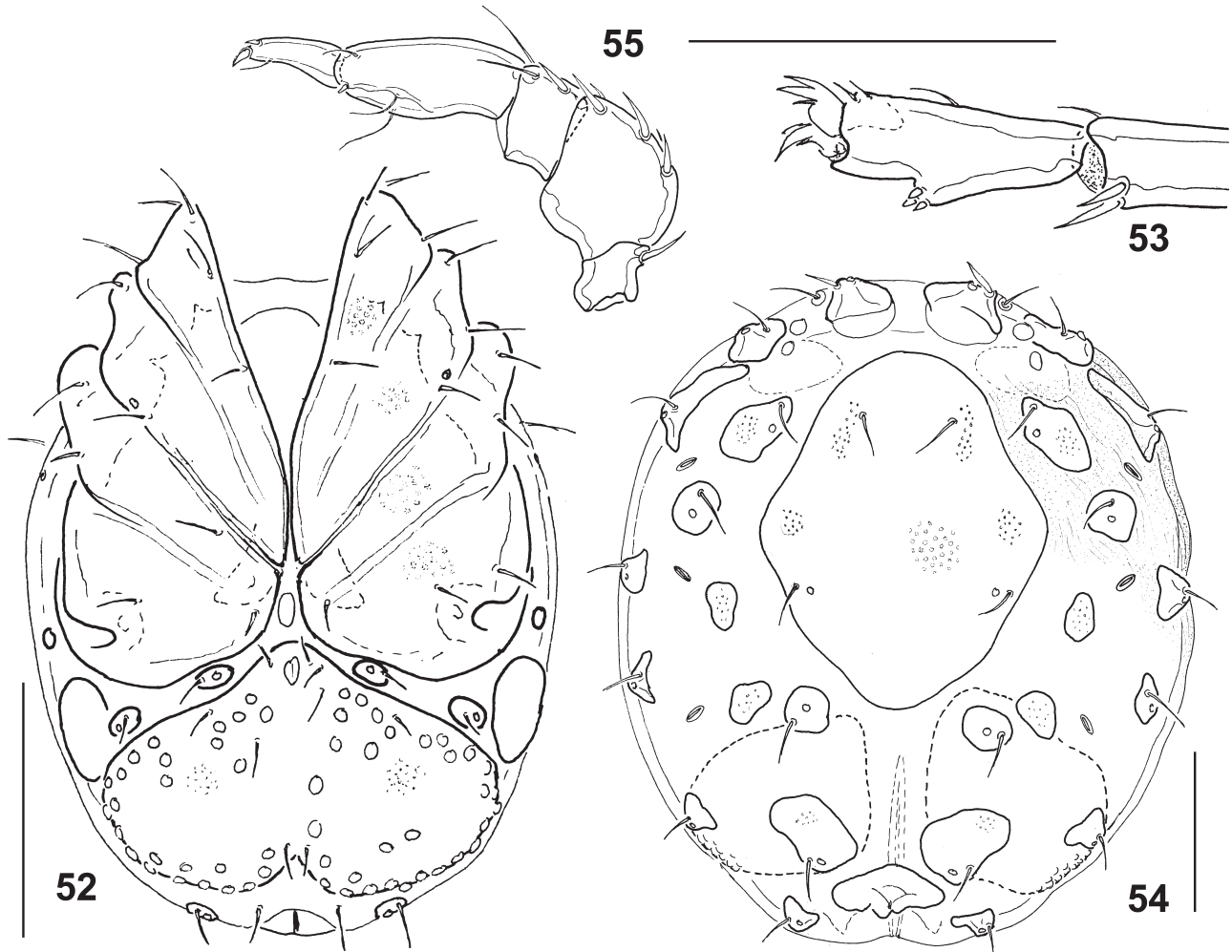
Holotype ♀, NHMB 3952, "*Feltria schusteri* ♀, Saalfelden, Hintertal, 16.VIII.1974, Coll. Ba". – Paratypes, NHMB 3953–3955, same site and date, 2 ♂♂, 1 ♀.

Further material (attribution to *F. piersigi* rejected, see under this species): NHMB 3884, "Val Nuglia, 27.VII.1981, Ba NP81/60", 1 ♂; NHMB 3885–3887, "Saalfelden/Hintertal, 16.VIII.1974, Ba", 1 ♂, 2 ♀♀.

Remarks

I propose to attribute the specimens NHMB 3884–3887 to *F. schusteri* while *F. piersigi* is considered here a 'species incerta' (explained above under *F. piersigi*).

Feltria schusteri belongs to the *armata* species group, characterized by the male gonopore being very small and located on a distinct, acute-angled medial projection of the anterior genital plate margin. Males differ from the other species of the group in the combination of the absence of a posterior indentation of the genital plate III-leg-6 with a



Figs. 52–55. *Feltria* spp. – 52–54. *F. (Feltria) schusteri*; ♂, “*F. piersigi*” NHMB 3886 (52–53); ♀, “*F. piersigi*” NHMB 3885 (54). 52. Venter. 53. III-leg-5/6. 54. Dorsum. – 55. *F. (Feltria) setigera*, ♂, D BGL 753, palp. – Scale bars: 100 μ m.

convex ventral extension bearing 3–4 stout, nail-like setae. Females of this species group are characterized by Dgl-1 lying free in the dorsal furrow and a straight ventral margin P-4. Species recognition of females may become difficult due to variability of character states. In general, *F. schusteri* females differ from other species of the group in the combination of a rather low number of Ac (<50 pairs), Dgl-3 and DI-3 lying on separate platelets, and the excretory pore in dorsal position.

Distribution

Alps (Austria, Switzerland).

Feltria (Feltria) scutifera Piersig, 1898, **sp. inc.**

Feltria rotunda Piersig, 1896/99: K. VIETS (1956).

syn. to *Feltria rubra* Piersig, 1898: SCHECTEL (1910) (rejected synonymy).

Material examined

Feltria rotunda, probably syntypes, 2 ♀♀ [each one slide idiosoma, one slide gnathosoma], NHMB 3950–3951, “*Feltria rotunda* ♀, PIERSIG, Hohe Tatra, Coll. PIERSIG”, “P. S., Hohe Tatra, VIII/78–79” [condition: only palps and gnathosoma, dried]; NHMB 3948–3949, “*Feltria rotunda* ♀, PIERSIG, Hohe Tatra, Coll. PIERSIG”, “P. S., Kohlbach, Hohe Tatra, VIII/65–66”.

Remarks

The name of *F. rotunda* was introduced by PIERSIG (1896–1899) with figs. 184a–c in his table 47, but without any written comment. Since then, this name was ignored in the bibliography until K. VIETS (1956) synonymized it with *F. scutifera*. The taxonomic state of the latter, described from the Tatra mountains as well, was subject to contrasting discussion. In his study of Silesian water mites, LÁSKA (1957) agreed with SCHECTEL (1910) and MOTAŠ (1928) who synonymized it with *F. rubra*. Instead, from a

re-examination of the syntypes of *F. rotunda* (the holotype of *F. scutifera* being lost) results that K. VIETS (1936) was correct in stating significant differences between *F. scutifera* and *F. rubra*: The syntypes of *F. rotunda* have (1) a dorsal shield distinctly small in size, with Dgl-1 and Dl-1 lying on a separate common platelet, not fused to the main plate, (2) by far larger plates Dgl-3+Dl-3, Dgl-4+Dl-4 and excretory pore sclerites, and (3) a distinctly lower number of 53 + 53 Ac. *Feltria scutifera* females (the male has never been described) are rather similar to *F. zschokkei*, a species recorded by PIERSIG from the Tatra under the name *F. muscicola*. In view of the poor state of the syntypes and the general problem to associate females and males in *Feltria* species, *F. scutifera* (with its junior synonym *F. rotunda*) should be regarded a ‘species incerta’.

Feltria (Feltria) setigera Koenike, 1898
(Fig. 55, see also GERECKE et al. 2009: fig. 4)

Feltria handschini Bader, 1975, n. syn.
Feltria cf. *georgei*: CREMA et al. (1996).

Material examined

Feltria handschini, lectotype ♂, here designated, NHMB 3790, “♂, Stradin, 13.VIII.1970, Ba NP70/71”. – Paratypes: same site, NHMB 3781–3785, 4 ♀♀ (NHMB 3781 uncorrectly labeled “holotype”), same date; NHMB 3791–3794, 4 ♂♂, same date; 4 ♀♀, 13.VIII.[19]70.

Feltria ursulae, 2 ♂♂ paratypes, NHMB 4069–4070, “As-tras-Dadora, 24.VII.1962, 2100 m, Coll. Ba 19/62” [condition: NHMB 4069 undissected, NHMB 4070 gnathosoma in situ, one palp detached, the other one lacking – eventually ended up in the ♀ holotype slide of *F. ursulae*, see under this species].

GER, “*Feltria* cf. *georgei*” [publ.: CREMA et al. 1996], “Trentino-Alto Adige, Catinaccio GA-1-B-lo/7-92”, 7 ♀♀; “Cevedale BR-1-B-lo-7/94”, 3 ♂♂, 6 ♀♀; “Cevedale BR-2-B/7-94”, 1 ♀.

Remarks

As appropriate figures had never been published by the author of this species, WALTER (1922) gave a thorough re-description of *F. setigera*, illustrating also the dorsum of the female holotype (with Dgl-1 and Dl-1 fused to the main dorsal shield). He documented furthermore the variability in the male III-leg-6, he observed in his material from the Swiss Alps. Results of an investigation of rich material now available from Italian, German and Austrian parts of the Alps, show that the ventral extensions of the male III-leg-6 in fact may be shaped in a rather different manner: In general III-leg-6 bear two or three apically pointed setae located closely adpressed to each other and forming together a kind of triangular velum. These setae are located together on an elevated base in the proximal third of the segment. Occasionally they appear to be “consumed” (apically rounded), or are completely absent, leaving only the socket with the corresponding insertion grooves, in other

cases they are reduced or increased in number (one to four). Observation of asymmetric conditions in single individuals support the interpretation that these phenomena are individual modifications without taxonomic significance.

The two male paratypes attributed by BADER to *F. ursulae* agree from all points of view with *F. setigera*, a species also recorded from the type locality of *F. ursulae*.

In his description of *F. handschini*, BADER (1975a) did not mention a holotype (notwithstanding he selected and labelled a female), but listed a total of 98 specimens (13 ♂♂, 85 ♀♀) from two sites in the Swiss National Park (Ova dals Buogls 9 ♀♀, Stradin 13 ♂♂, 76 ♀♀) on which the description was based. Of these syntypes, only the above-mentioned 13 specimens are still preserved, all characterized by red labels. Bader gives measurements of the male palp, but only in one male the palp is detached (and unfortunately lost).

From BADER (1975a) we can deduce the following major reasons for introducing *F. handschini* as a new species: Females: (1) minor in size (L/W 300–390/245–320) and more slender; (2) coxal field L 220–240; (3) Dgl-1+Dl-1 separate from the dorsal shield; (4) genital field extending to the dorsal surface. Males: (1) minor in size (L/W 260–310/210–240); (2) genital field (not coxal field as in females) minor in size, but number of Ac similar; (3) ventral socket on III-leg-6 with two setae, L 90–100.

As mentioned above, setation of male III-leg-6 is subject to strong variability. Also the lectotype of *F. handschini* bears two pointed setae on one leg, but three such setae on the other, demonstrating that this character is not suitable for species definition. Strangely enough, on the pages preceding the introduction of *F. handschini*, he had demonstrated the strong variability of *F. setigera* in several of the above-mentioned characters. In fact, as his description does not reveal any stable difference, *F. handschini* is obviously a junior synonym of *F. setigera*.

Distribution

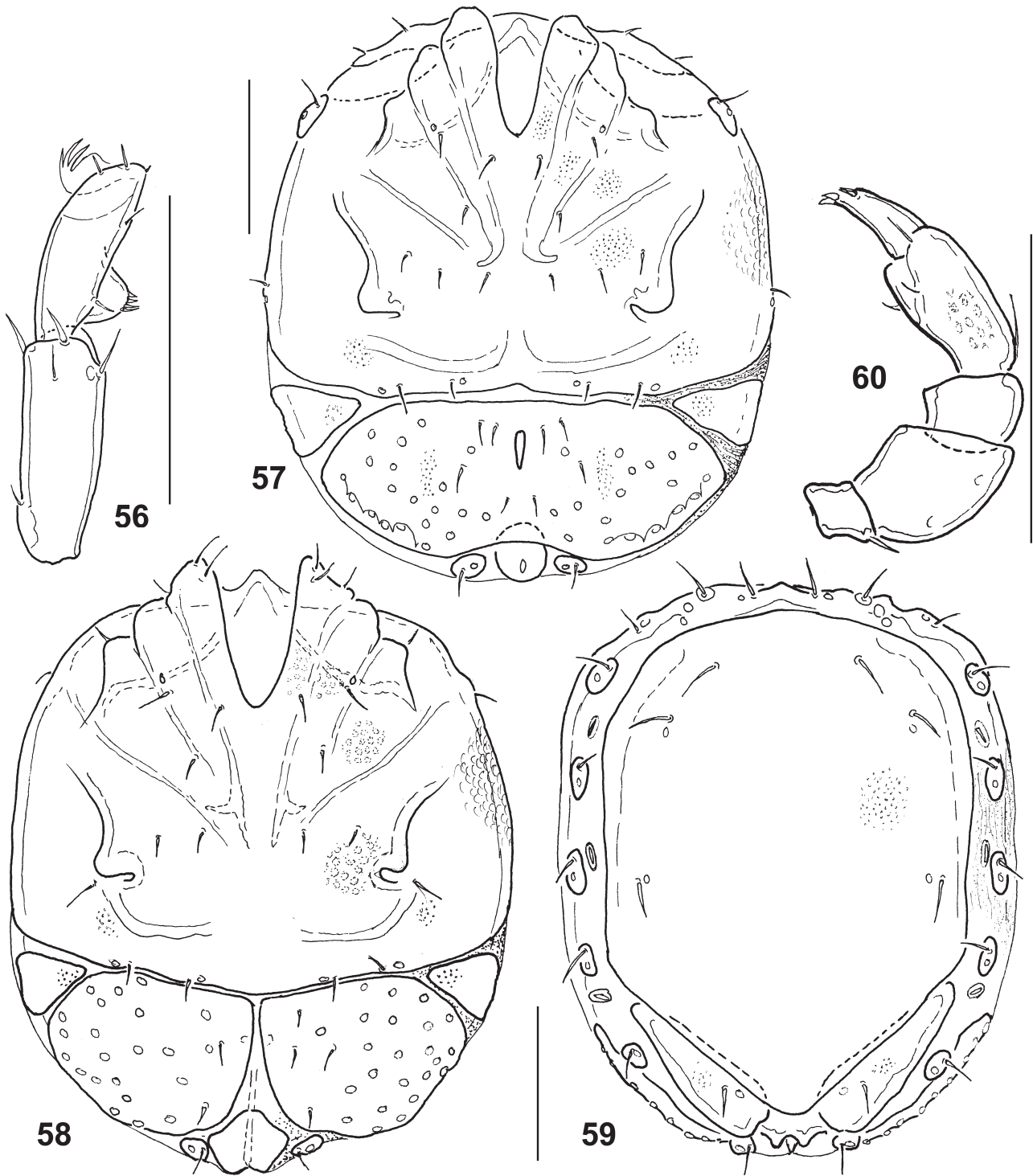
Alps, northern Italy, German western and central low mountain range, Carpathians.

Feltria (Feltria) subterranea K. Viets, 1937
(Figs. 56–60)

Feltria stygophila Walter, 1947: K. VIETS (1959).

Material examined

Lectotype ♂ of *Feltria stygophila* Walter, 1947, here designated, NHMB 3967, “*Feltria stygophila* Walter, Aubonne, unterhalb Quellbecken, 21.VII.1944, Coll. WALTER”. – Paralectotypes of *F. stygophila*, NHMB 3964–3966, same area and date as lectotype, “Aubonne s.-ö. Bière”, 2 ♀♀, 1 dn.



Figs. 56–60. *Feltria (Feltria) subterranea*; ♂ holotype, *Feltria stygophila* NHMB 3967 (56–57); ♀, “*F. stygophila*” NHMB 3964 (58–60). – 56. III-leg-5/6. 57. Venter. 58. Venter. 59. Dorsum. 60. Palp. – Scale bars: 100 μ m.

Further material: SMF, coll. SCHWOERBEL, “Andelsbach”, 1 ♀; “Steina, Okt. 1959”, 1 ♀; “Gauchach, 30.VIII.[19]60”, 1 ♀; “obere Gauchach, Juni 1961”, 1 ♀.

Uncertain attribution: SMF, coll. SCHWOERBEL, “*F. rubra* n. sp., Mt 5/1c”, 1 ♂; “*Feltria subterranea*, Mt 2/1a”, 1 ♀.

Remarks

Feltria stygophila was described from 2 ♂♂, 4 ♀♀ and 9 dn syntypes collected at five different sites in Switzerland, but a large part of the type series is apparently lost. It is near at hand to select the single available male as the lectotype of the species. As no significant differences between lectotype and paralectotypes of this species and the investigated material of *F. subterranea* could be found, I confirm the synonymization proposed by K. VIETS (1959).

Feltria subterranea is similar to *F. minuta* in the straight anterior margin of the genital field in males, but both sexes differ from this, and from all other species of the subgenus, in the coxal plates which are completely fused forming a continuous coxal shield. They are furthermore characterized by a complete dorsal shield in both sexes, a rather low number of Ac (< 30), and in males, by III-leg-6 with a convex proximoventral projection bearing 3–4 stout setae.

Two specimens from coll. SCHWOERBEL are of unclear origin, possibly from a study of TILZER (1968) in Austria. They differ from the material studied of *F. subterranea* in larger size (e. g. idiosoma L ♂ 380, ♀ 400; genital field L in both sexes 130), higher numbers of Ac (♂ 28, ♀ 42), a less slender female dorsal shield (L/W 1.2) and a distinctly greater projecting ventral extension on male III-leg-6. In view of the unclear geographical origin, these specimens are not treated in detail. They indicate, either a wider variability range of *F. subterranea*, or, the presence of an undescribed sister taxon.

Distribution

Alps, United Kingdom, German western and central low mountain range, Carpathians.

Feltria (Feltria) zschokkei Walter, 1928
(Figure see GERECKE et al. 2009: fig. 5)

Feltria muscicola Piersig, 1898: WALTER (1922).

Feltria fossea Rensburg, 1971, **n. syn.**

Material examined

Feltria fossea, holotype ♂, NHMB 4072, “*Feltria* (s. s.) *fossea* sp. nov., type specimen”, “Präp. 112, 17.X.1968, Foss bei Bedrina, 8 °C, ♂, Coll. 30”.

Further material: NHMB 4080 (idiosoma), NHMB 4081 (palp), “*Feltria muscicola?* Piersig ♀, Partnun, 24.VII.1904, Coll. WALTER/Diss., *F. minuta zschokkei?*, 1 ♀ [condition: both slides dried, palps slightly squeezed]. – “*Feltria paucipora?*”, NHMB 3898, 22.VII.1978, 1 ♂; NHMB 3899, 24.IX.1978, 1 ♂ (see under *F. paucipora*).

Remarks

Feltria zschokkei is described and depicted in detail in GERECKE et al. (2009). It belongs to the *armata* species group (see discussion of *F. schusteri*). The species differs from the other species of the group in males in a deep posterior indentation of the genital plate, in females in the combination of a rather high number of Ac (> 50 pairs), Dgl-3 and Dl-3 lying on separate platelets, and the excretory pore in the dorsal position.

The attribution of the female from Partnun to *F. muscicola* was probably done by BADER (handwriting), while WALTER, as his handwritten correction shows, was convinced that it belonged to *F. zschokkei*. In fact, it agrees with females of the latter species in all important details and there is no reason to question the synonymy proposed by WALTER (1922).

Feltria fossea was described by RENSBERG from a single male “because of: the arrangement and fusion of the dorsal shields; the structure of the acetabular plate with its deep posterior indentation, the presence of the triangular ventrolateral shields and the structure of the coxae”. Furthermore, he stated that the species should be “related to *F. zschokkei*”. In fact, except for the cryptic statement about the “structure of the coxae” all details given as diagnostic for *F. fossea* agree well with the character combination typical for *F. zschokkei*. A reconsideration of the holotype did not reveal any difference in comparison with the latter species of which *F. fossea* is a junior synonym.

Distribution

Alps, northern Italy, Balkans, German central and western low mountain range, Carpathians, Caucasus.

Feltria (Feltria) cantonatii **n. sp.**
(Figs. 61–67)

Holotype, ♂: SMF, “Italy, Sicily, Peloritani mountains (Messina), S. Lucia del Mela, Vallone Mandrazza, spring, 570 m a. s. l., WC 273 128, GERECKE leg., GER I 545, 7.XII.1986”.

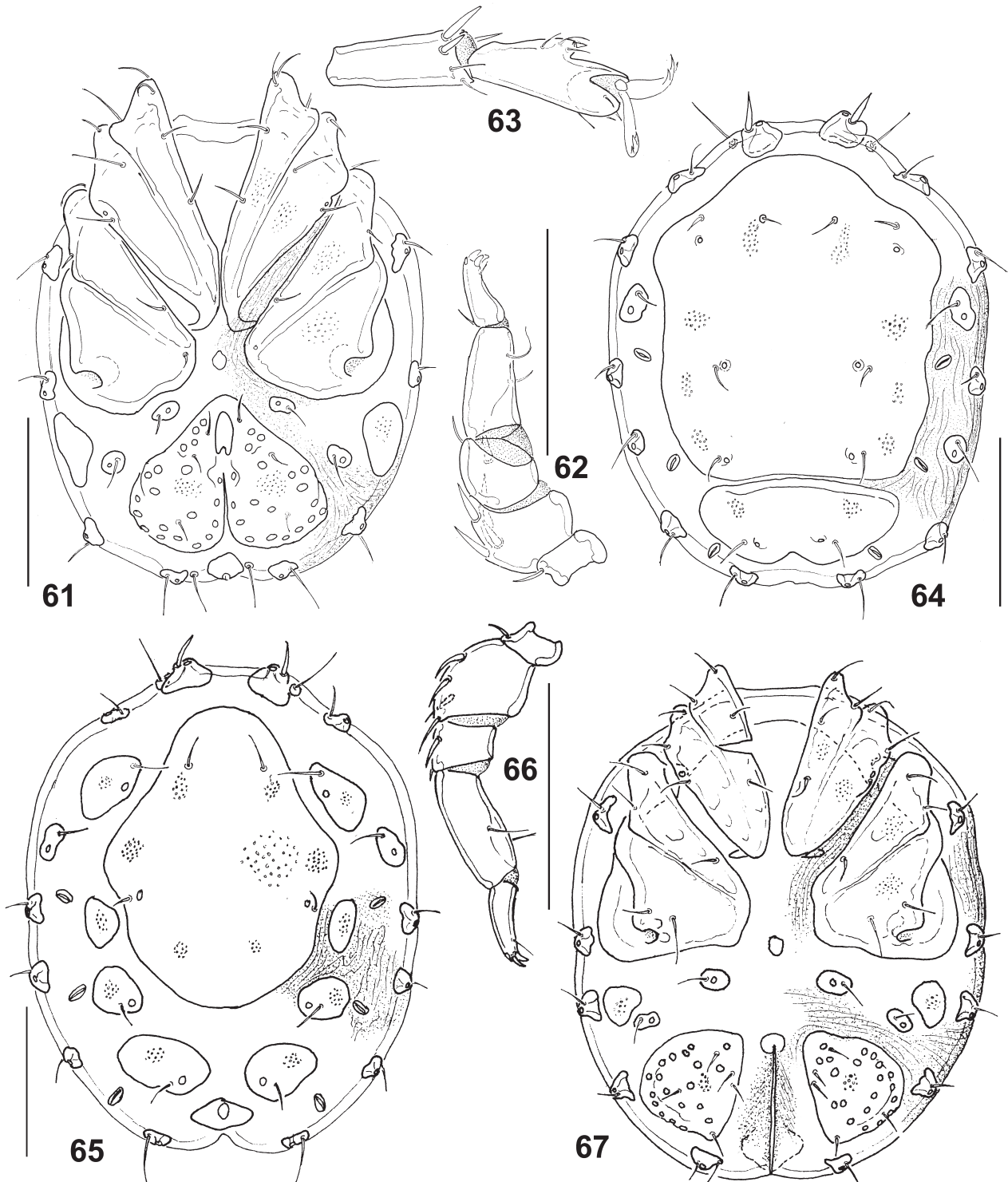
Paratype: 1 ♀, same data as holotype.

Derivatio nominis

The new species *Feltria cantonatii* n. sp. is dedicated to MARCO CANTONATI, leader of the Phycology and Limnology Section at the Natural History Museum Trento and undefatigable protagonist of investigation and protection of Italian spring habitats.

Diagnosis

Both sexes: Small in dimensions (idiosoma L < 340, palp total L < 180). Frontal area with all glandularia and setae on separate platelets. Coxal plates in four groups. Genital field with 20–25 pairs of Ac. – Male: Dorsum with large anterior shield and transverse posterior plate. Centre



Figs. 61–67. *Feltria (Feltria) cantonatii* n. sp., type series I 545; ♂ holotype (61–64); ♀ paratype (65–67). – 61. Venter. 62. Palp. 63. III-leg-5/6. 64. Dorsum. 65. Dorsum. 66. Palp. 67. Venter. – Scale bars: 100 μ m.

of ventral margin of III-leg-6 with an anteriorly-directed projection ending in a stout, peg like seta. Genital field inversely heart-shaped, gonopore in the acute-angled an-

terior part, posterior margin with a deep, narrow indentation. Excretory pore in terminal position. Palp robust and stout. – Female: Dorsum with rhomboid shield surrounded

by four rounded platelets. Excretory pore in posterodorsal position. Palp more slender than in male.

Description

Both sexes: Frontal area with praeantenniform glandularia, praeocular setae and Lgl-1 all lying on separate platelets, not fused to each other; leg claws with narrow blade and dorsal/ventral clawlets.

Male (all measurements in μm): Idiosoma L/W 295/220 (ratio 1.3), dorsal L 275; anterior dorsal shield L/W 195/175 (ratio 1.1), including Dgl-1-3 and DI-1-3, separated from posterior plate (L/W 50/116, ratio 0.4, medially fused Dgl-4+DI-4) by a straight transverse suture line; coxal field L/W 190/190; III-leg-6 L 60, in centre of ventral margin with an anteriorly-directed projection bearing three fine setae and, apically, one stout, peg-like seta. Vgl lying free in the membranous area between coxae and genital field, laterally flanked by triangular lateral platelets. Genital field inversely heart-shaped, L/W 90/120 (ratio 0.75), bearing three pairs of setae and 21 pairs of Ac which are arranged mostly along plate borders; gonopore in the acute angled anterior part, longish-oval, its posterior margin with a fine, anteriorly-directed projection; posterior margin with a deep, narrow indentation extending over more than 50% of plate length. Excretory pore in terminal position, flanked by a pair of seta-bearing platelets and a pair of glandularia. Palp robust and stout, P-4 equally narrowed from base to tip, with a weakly-developed ventral groove flanked by two setae; L/H P-1, 14/24; P-2, 43/41; P-3, 27/32; P-4, 46/24; P-5, 32/13 (ratio P-2/P-4, 0.93, P-3/P-4, 0.59, P-4/P-5, 1.41); total L 162; relative L and L/H ratio P-1, 9%, 0.60; P-2, 26%, 1.04; P-3, 17%, 0.85; P-4, 28%, 1.93; P-5, 20%, 2.41.

Female: Idiosoma L/W 340/270 (ratio 1.3), dorsal L 330; dorsal shield L/W 205/160 (ratio 1.3), including postocularia and Dgl-2, surrounded by platelets Dgl-1+DI-1; DI-2; Dgl-3+DI-3; Dgl-4+DI-4; coxal field L/W 190/230; genital plate L/W 85/60 (ratio 1.4), with 25 pairs of Ac. Excretory pore in posterodorsal position. Palp more slender than in male, P-4 maximum H in distal part of segment; L/H P-1, 16/20; P-2, 46/37; P-3, 24/27; P-4, 56/22; P-5, 35/13 (ratio P-2/P-4, 0.82, P-3/P-4, 0.42, P-4/P-5, 1.61); total L 176; relative L and L/H ratio P-1, 9%, 0.80; P-2, 26%, 1.23; P-3, 13%, 0.88; P-4, 32%, 2.54; P-5, 20%, 2.75.

Differential diagnosis

Feltria cantonatii belongs to the *armata* species group (male genital field anterior margin strongly projecting to form an acute angle, gonopore small, located in this projecting part). In this group, a deep indentation of the male genital field is found only in *F. zschokkei*, a species differing (1) in both sexes in a higher number of Ac (30–70); in

the male sex, (2) ventral surface of III-leg-6 without projection, bearing a comb-like group of long setae in proximal/central part of the segment, and (3) higher numbers of genital setae. Males of *F. drilonensis* are similar in the ventral setation of III-leg-6 (but with the extension inserting more distally), but differ – in addition to the unindented posterior genital plate margin – in a smaller gonopore and presence of a complete shield covering the whole dorsum. Variability of females in this group needs additional study with more material. At present state of knowledge, female *F. drilonensis* can be distinguished from *F. cantonatii* in their relatively larger dorsal shield (L/W < 1.1), *F. schusteri* in the separation of DI-3 from Dgl-3, and *F. brevipes* in the sclerites of antenniformia that are enlarged, together covering the whole frontal idiosoma margin (GERECKE et al. 2009, sub nom. *F. armata*, err.). In its very small dimensions, *F. cantonatii* is at the lower end of the size range in this group. Similarly small specimens are known only from *F. drilonensis* and *F. brevipes* (both sexes), and *F. schusteri* (males), but all these species have longer palps (> 170 in males, > 190 in females).

Habitat

The type locality and only known collecting site of this species is a gentle seeping spring in a remote valley of a mountain range widely degraded by deforestation and pasture. Along with surrounding groundwater outflows it forms an oasis-like site giving origin to a stream that is remarkable for the presence of the relict fern *Woodwardia radicans* (L.) (GRAMUGLIO et al. 1978). Neighbouring springs are the type locality and only known collecting site of *Javalbia eremita* Gerecke, 1991, and harbour further interesting water mite species such as *Torrenticola crenobia* Di Sabatino & Cicolani, 1988, *Sperchon resupinus* K. Viets, 1920 and *Stygohydracarus* cf. *subterraneus* Walter, 1947 (GERECKE 1991).

Distribution

Sicily, only known from the type locality.

3.4 Genus *Feltria* Koenike, 1882,
subgenus *Feltriella* K. Viets, 1930

Diagnosis

Dorsum with dorsalia and glandularia very variable in size and with fusion in both sexes, species with a dorsal shield bearing four pairs of glandularia; coxae various, from separate in four groups to fused to one large plate, but medial suture lines always well visible; male III-leg-6 without modified ventral setae; gnathosoma with short anchoral apodeme; palp with relatively short P-5, distinctly shorter than P-4.

Remarks

Along with the Nearctic *Neofeltria*, *Feltriella* is characterized by the absence of sexual dimorphism in III-leg. The two subgenera differ from each other in the extension of a pair of dorsoglandularia (with or without muscle attachment scars, see COOK 1974), and display together a plesiomorphic character combination in comparison with *Feltria* + *Azugofeltria*. All species known so far are rithrobiont or krenobiont.

Feltria (Feltriella) menzeli Walter, 1922
(Figs. 68–70)

Material examined

Holotype ♂, NHMB 3829, slide with red label inscription calligraphy WALTER “DIV b 16 P 206b”, “*Feltria menzeli* Walter ♂, Partnun, 18.VII.1913”. – Paratypes [with label “Typus”]: NHMB 3824–3828, with old labels “Partnun 8.1915, Coll. MEN-

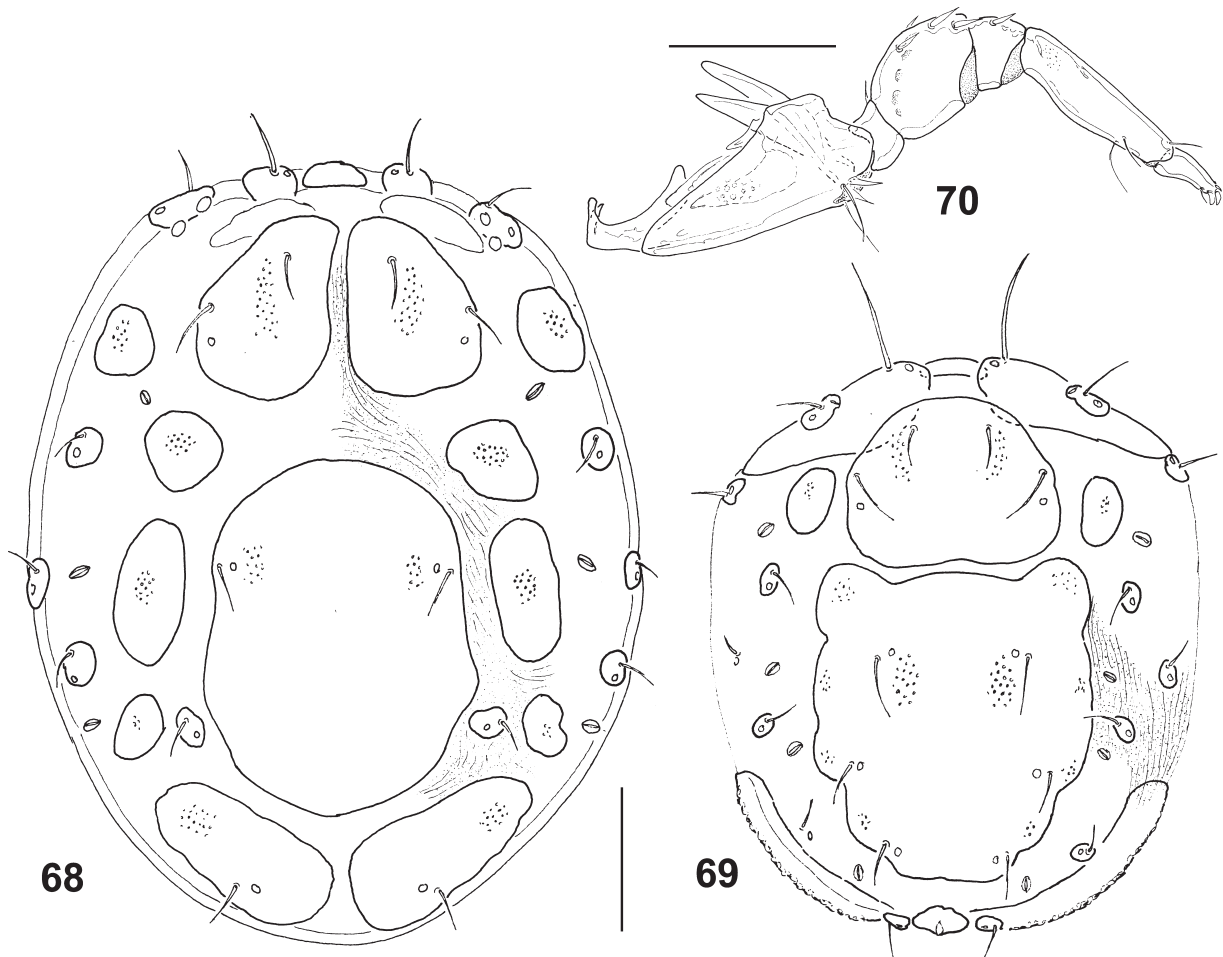
ZEL, Weberlis Höhle”, 2 ♂♂, 3 ♀♀; NHMB 3830–3831, same data as before, without “Typus” label, 2 ♂♂; NHMB 3832–3836, same data as before, with new labels (BADER), 5 ♂♂.

Further material: GER, “Austria, NP Gesäuse, HÖBO, Hartelsgraben, Höllboden Wasserfallquelle, 553.152 E, 271.249 N, 1050 m, 5.VII.2008”, 1 ♂, 2 ♀♀; “HAGL Traufen SE Scheibebauer, an Straße, 554.667 E, 274.206 N, 512 m, 11.VI.2010”, 1 ♂; “Italy, 1449 Int, Calabria (RC), Aspromonte, Cardeto, Fiumara, S. Agata upstream Cardeto, 600 m, WC 67 15, 10.VIII.1986, interstitial”, 1 ♀; “I 502, Sicilia (PA), Madonie, Polizzi Generosa, Grotticella, Piano della Noce, 1050 m, VB 122 903, 11.X.1986”, 1 ♀; I 503, same area, “Orto della Menta, 1250 m, VB 127 903, 11.X.1986”, 1 ♀.

First records from Italy.

Remarks

This species differs from all other species of the genus in the characteristic arrangement of the dorsal plates (males: minor anterior plate including Dgl-1 and postocularia, flanked by the pair of oval platelets DI-1, larger pos-



Figs. 68–70. *Feltria (Feltriella) menzeli*. – 68. ♀, D BGL 751, dorsum. 69. ♂, A BGL 278, dorsum. 70. ♂, A BGL 278, gnathosoma and palp laterally. – Scale bars: 100 μ m.

terior shield including Dgl-2-4 and DI-2-4; females: paired anterior plates including Dgl-1 and postocularia, flanked by the pair of oval platelets DI-1, larger posterior shield including only Dgl-2, surrounded by 5 platelets – a platelet of unclear homology, DI-2, DI-3, Dgl-3 and Dgl-4+DI-4). In the slender shape of P-4, *F. menzeli* is similar to *F. phreaticola* and *F. denticulata*, two taxonomically distant representatives of *Feltria* s. str. (with sexual dimorphism in III-leg-6). In view of the strong differences in dorsal sclerotization and palp shape, this species and *F. rubra*, the only other European representative of *Feltriella*, appear to document a very early taxonomic separation or a non-monophyletic origin of the subgenus.

Distribution

Morocco, Corsica, Alps, southern Italy.

Feltria (Feltriella) rubra Piersig, 1898

(Figs. 71–75)

Feltria rotunda Piersig, 1898: MOTAŞ (1928).

Feltria jurassica Walter, 1907: MOTAŞ (1928).

Feltria airolensis Rensburg, 1971, **n. syn.**

Feltria minutissima Bader, 1975, **n. syn.**

Material examined

Feltria rubra, syntype? ♀, NHMB 3929 (idiosoma), 3930 (gnathosoma), “Hohe Tatra, Kohlbach, coll. PERSIG”, “VIII/63–64” [on two slides].

Feltria jurassica, holotype ♀, NHMB 3947, “*Feltria jurassica* ♀ WALTER, Baulmes, 7.VIII.1905, Coll. WALTER”, “Typus Bach in Baulmes, V/19”.

Feltria airolensis, holotype ♂, NHMB 3636, “*Feltria airolensis*, Prep. 113, 17.X.1968, Foss bei Bedrina, 8 °C, ♂”.

Feltria minutissima, holotype ♀, NHMB 3869, “Ofenstrasse/Zernetz, 31.VII.1956 Coll. Ba NP 76/56”, “Holotypus”. – Paratype ♀, NHMB 3870, “Il Fuorn, FWQ II, 19.VII.1962, Coll. Ba NP 147/62”.

Further material: NHMB 3932–3933, “FWQ2, Il Fuorn, 15.VII.1955, Coll. NP 9/55”, 1 ♂, 2 ♀♀; NHMB 3871–3874 [*F. minutissima*], “Il Fuorn, FWQ I, 28.IX.1975”, 1 ♂, 1 ♀, 11.VIII.1978, 2 ♀♀.

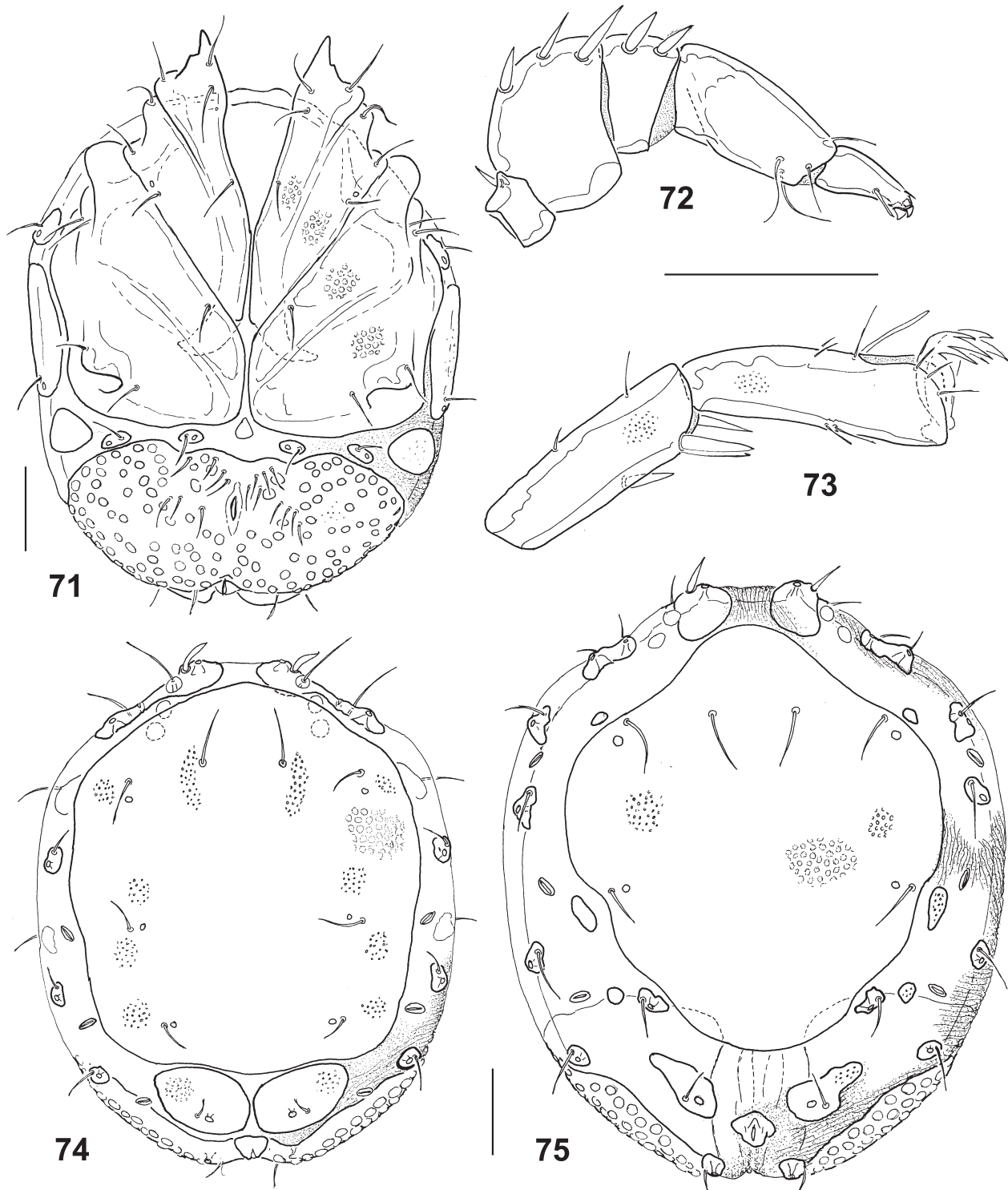
Remarks

This is the species most frequently recorded from many parts of Europe, but much data is questionable due to problems with defining its variability, especially in females. While males are clearly defined by the absence of a sexual dimorphism in III-leg-6 in combination with stout palps and a large dorsal shield excluding only Dgl-4+DI-4, females are easily confused with several species of *Feltria* s. str. In particular on the ventral idiosoma, females of *F. rubra* have rather extended sclerotized surfaces. Posterior coxal plates Cx-III+IV form an extended parallel medial margin which in its anterior quarter is formed by Cx-III, passing with a nearly right angle to the posterior margin

of Cx-IV which is nearly perpendicular to the longitudinal axis. The genital field is extended, separated from Cx-IV by a narrow strip of membrane, the posterior part of the subtriangular genital plates distinctly extending to the posterior dorsum where also the excretory pore is positioned, anteriorly flanked by the rather small Dgl-4+DI-4 platelets. All glandularia and setae at the anterior margin of the idiosoma, prae- and postantenniformia and praeocularia, lie on a separate platelet each, Dgl-1 are fused to the dorsal shield, while DI-1, DI-2, Dgl-3 and DI-3 remain separate. The potential syntype from NHMB is in good agreement with this description. As correctly stated by BADER (1977), a relatively unspectacular detail, in undissected specimens to be observed with difficulty only, is the most important diagnostic character of *F. rubra*, not found in any other European species of the genus: the tiny rounded platelets DI-1 lying in the membrane facing the anterolateral edges of dorsal shield.

As far as a re-examination was possible, and with the limits generally valid for attribution of females in the genus, measurements taken from the holotype female of *F. jurassica* confirm the synonymization first proposed by MOTAŞ (1928): The specimen is rather large in size (idiosoma L 500), has a relatively long palp (P-4 L/H 79/30) and the genital field bears a high Ac number of 70 + 70 Ac.

Feltria minutissima was described by BADER (1975) on the base of two females only, in absence of males with uncertain subgenus ascription, but he stated a similarity in dorsal plate organization to males of *Feltria (Feltriella) rubra*. In a later paper (1977) he defined a *rubra* species group (*Feltria rubra* & *minutissima*) characterized in the female sex by having Dgl-1 fused to the dorsal shield, but the flanking DI-1 lying free in the integument as small platelets. He did not discuss further the male characters, but with the introduction of this group, he obviously accepted also the absence of a sexual dimorphism in male III-leg-6, typical for the subgenus *Feltriella*, as a common feature of the two species. This interpretation finds support by the (never published) existence of a male attributed to *F. minutissima* by BADER (NHMB 3872). BADER introduced the species on the basis of the size of the holotype and paratype only, stating that, with a total idiosoma length of 355, they should be smaller than all other species in the Swiss National Park. However, from a re-examination BADER's measurements are mistaken: With a total L (dorsal L) of 420 (390), the holotype of *F. minutissima* lies at the lower margin, but within the variability range of *F. rubra*, a species abundantly recorded from the area of the type locality. The paratype is smaller in size, 410 (360), the variability of the other females later attributed by BADER to *F. minutissima* (but excluding NHMB 3873, representing another species with DI-1 fused to the dorsal shield) is 380–430 (340–410). In view of the generally wide size variability in water mites, differences in measurements, especially with



Figs. 71–75. *Feltria (Feltriella) rubra*; ♂, *F. airoloensis* holotype NHMB 3636 (71–73); NHMB FWQ2, 15.VII.1955, ♂ (74), ♀ (75). – 71. Venter. 72. Palp. 73. III-leg-5/6. 74. Dorsum. 75. Dorsum. – Scale bars: 100 µm.

considerable overlap in range, are worthless for species discrimination and *F. minutissima* should be considered a junior synonym of *F. rubra*.

A particular case that merits reconsideration is the male NHMB 3872. Not only due to its extremely small size [idiosoma L/W 340(310)/260], but in particular, in view of

Tab. 2. (pp. 44–45). Measurements [in µm], counts (Ac) and relations of European Feltria species, females. – Abbreviations see chapter 2.

Table with columns for Species, Group, Collection (Detail), and various morphological measurements categorized by Armata, Azogolellina, Cornuta, and Dentifucata. Measurements include counts and lengths for different body parts like antennae, legs, and mouthparts.

the very reduced number of only 38 + 38 Ac, it could well represent a species not yet known to science. A description, however, can be given only when a larger series becomes available.

Distribution

Western, central and southern Europe, Caucasus, Asia Minor; numerous older, female-based records questionable.

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Author's address:

Prof. Dr. REINHARD GERECKE, Biesingerstraße 11, 72070 Tübingen, Germany;
e-mail: reinhard.gerecke@uni-tuebingen.de

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Autor(en)/Author(s): Gerecke Reinhard

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