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The water mites of the genus Partnunia Piersig, 1896 (Acari, Actinedida, Hydryphantidae).

by **R. Gerecke**

Abstract: The variability of the external characters, the morphology of the genital skeleton and the distribution of *Partnunia angusta* (Koenike), *P.steinmanni* Walter and *P. uchidai* Imamura are discussed; *P. raetica* Bader is synonymous with *P.steinmanni*. From Italy, *P.regalis* (Sicily, Calabria) and *P.aprutina* (Abruzzo) are described as new species. The larvae of the new species parasitize on plecopteran imagines. A key for the actually known species of the genus *Partnunia* is given; a reliable determination is not possible without regard to the male genital skeleton.

Key words: Acari Actinedida – genital skeleton – systematics – *Partnunia* – springs – new species.

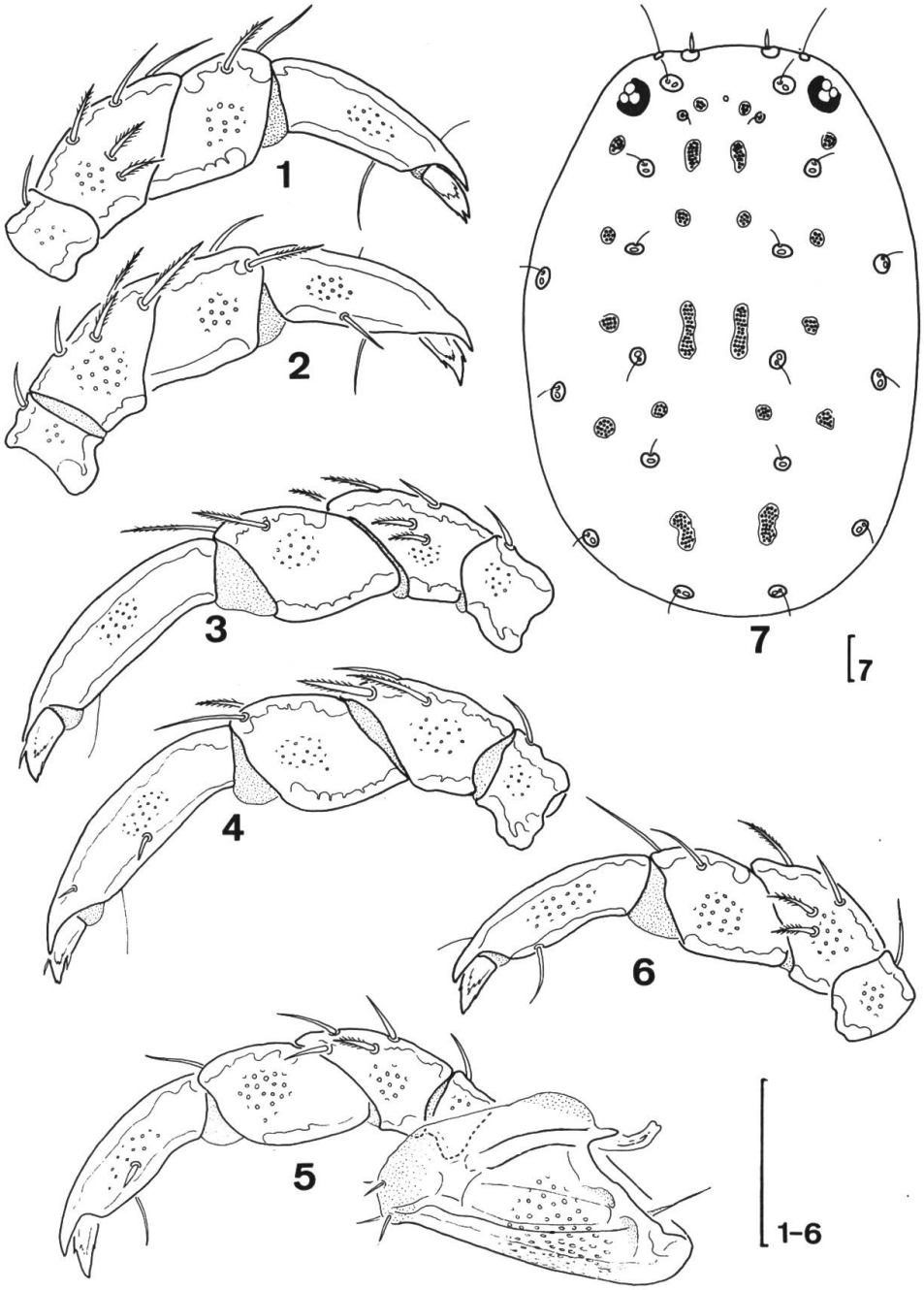
I. Introduction

The genus *Partnunia*, together with the genera *Protzia* and *Neocalonyx*, is placed in the subfamily Protziinae Koenike 1909 (COOK, 1974) of the family Hydryphantidae Piersig, 1896.

The genus was erected by PIERSIG (1896) for a species described by KOENIKE (1893) under the name «*Thyas angusta*». Three further species of *Partnunia* have since been described: *P.steinmanni* Walter, 1906 and *P.raetica* Bader, 1975 from Switzerland, and *P.uchidai* Imamura, 1950 from Japan. Whereas records of *P.raetica* are restricted to the Swiss National Park, localities for *P.angusta* have been published from Switzerland, Austria and Jugoslavia, and *P.steinmanni* has been recorded from a wide area, including central and eastern Europe, the Karpathes, southern France and the french Pyrénées (VIETS, K.O, 1978).

MÜNCHBERG (1954) communicated the finding of larvae belonging to an undetermined species of the genus *Partnunia* in the Abruzzo region (Central Italy); NEWELL (1959) made mention of the presence of the genus in North America (Oregon), but so far no description or determination of the nearctic specimens has been published.

The study of numerous Italian populations of water mites belonging to the genus *Partnunia* necessitated a revision of all described species. The results are presented in this paper.



Figs 1-7: 1, *Partnunia angusta*, male, right palp laterally; 2, male, left palp medially; 3, *P. steinmanni*, male, left palp laterally; 4, *P. steinmanni*, male, right palp medially; 5, *P.uchidai*, male, capitulum and right palp medially; 6, *P. uchidai*, male, left palp laterally; 7, *P.regalis*, female, schematic: position of dorsoglandularia and muscle insertions. Bars = 100 µm.

II. Material and Methods

Species examined in this study were obtained from the following institutions: Museum für Naturkunde der Humboldt-Universität Berlin (MNHU), Naturhistorisches Museum Basel (NHMB), Senckenberg Museum, Frankfurt (SMF), Swedish Museum of Natural History, Stockholm (SMN).

Further material was collected during trips in Austria, Southern Germany, Italy and Switzerland and remains chiefly in the authors collection (Coll. Gerecke).

Specimens were preserved in Koenike's fluid, and preparations were executed in the usual manner (COOK, 1974). All dissections were embedded in Hoyer's medium (KRAUS, 1984) on microscopic slides as permanent mounts.

III. Diagnosis of the genus

Soft-bodied; lateral eyes in capsules; external genital organ with numerous stalked acetabula, flanked by a pair of reduced genital flaps; palp chelate (P-4 with a dorsodistal projection extending beyond the base of P-5); legs without swimming hairs; claws simple, without clawlets.

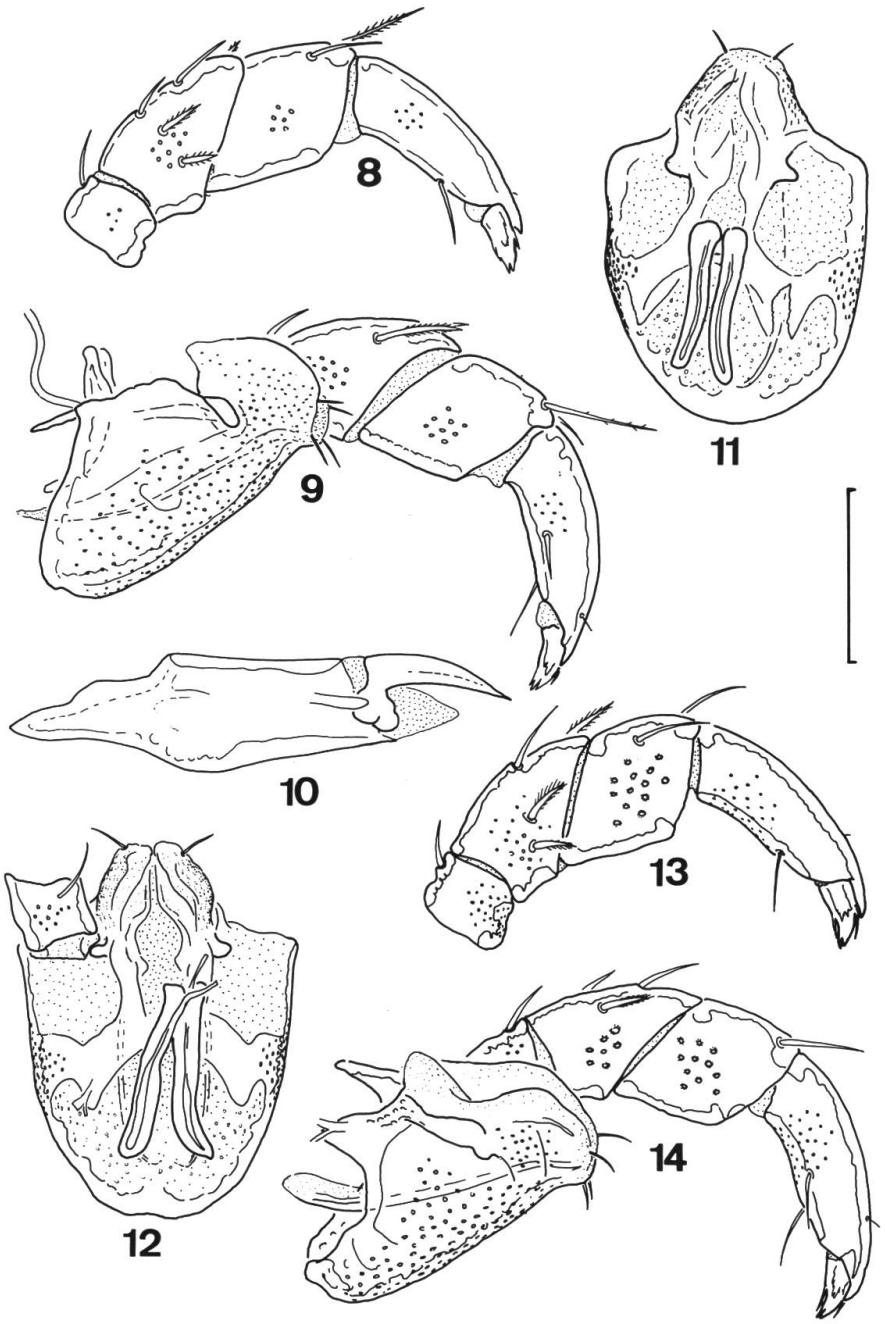
IV. General characters

Colour red, integument papillate on dorsal and ventral face (Fig. 20; diameter of papillae 7-10 µm). Arrangement of the glandularia (Fig. 7) in strict conformity with the «Thyasid-scheme» given by BADER (1975). Dorsal integument with fine granulate areas (muscle insertions), placed exactly where dorsal plates are developed in other Hydryphantid genera (Fig. 7).

Median eye on the same level with lateral eyes, but object of a high variability in all species from well developed (surrounded by a chitinous ring of 10-15 µm diameter) to totally absent.

Coxae placed in four groups, with numerous setae arranged along their margins and sutures; groupings of particularly strong and pectinate setae on the outer edges of Cx-I and Cx-II (Figs 15-20).

Gonopore flanked by a pair of slightly reduced genital flaps of por-



Figs 8-14: 8, *Partnunia regalis*, male: right palp laterally; 9, *P. regalis*, male, capitulum and left palp medially; 10, *P. regalis*, male, chelicera; 11, *P. regalis*, male, capitulum dorsally; 12, *P. aprutina*, male, capitulum dorsally; 13, *P. aprutina*, male, right palp laterally; 14, *P. aprutina*, male, capitulum and left palp medially. Bar = 100 µm.

ous chitin, bearing a row of regularly arranged setae on their medial margins. Various numbers of stalked acetabula placed in the membranous zone between the genital flaps and the gonopore, anteriorly short-stalked and arranged in a single file, posteriorly more or less long-stalked and grouped irregularly, embraced by the medially-bent caudal part of the genital flaps. Sexes can be distinguished easily, as the genital skeleton shines through the membraneous body wall in the genital region of males (BADER, 1975).

Excretory pore placed in the soft integument between the genital region and the posterior end (Fig. 20), its anterior and posterior margin sometimes being weakly sklerotized.

Capitulum robust (1./w. about 1.3) with a short rostrum (Figs 11, 12), in lateral view showing a slightly convex ventral margin, with a little concave inlet in the rostral region (Figs 5, 9, 14). Shape of the chelicerae very variable in all species (average ratio total length/height 4.2, but varying from 3.8 to 5.1, ratio length of basal segment/length of claw varying from 1.8 to 2.8), cheliceral claw weakly curved (Fig. 10).

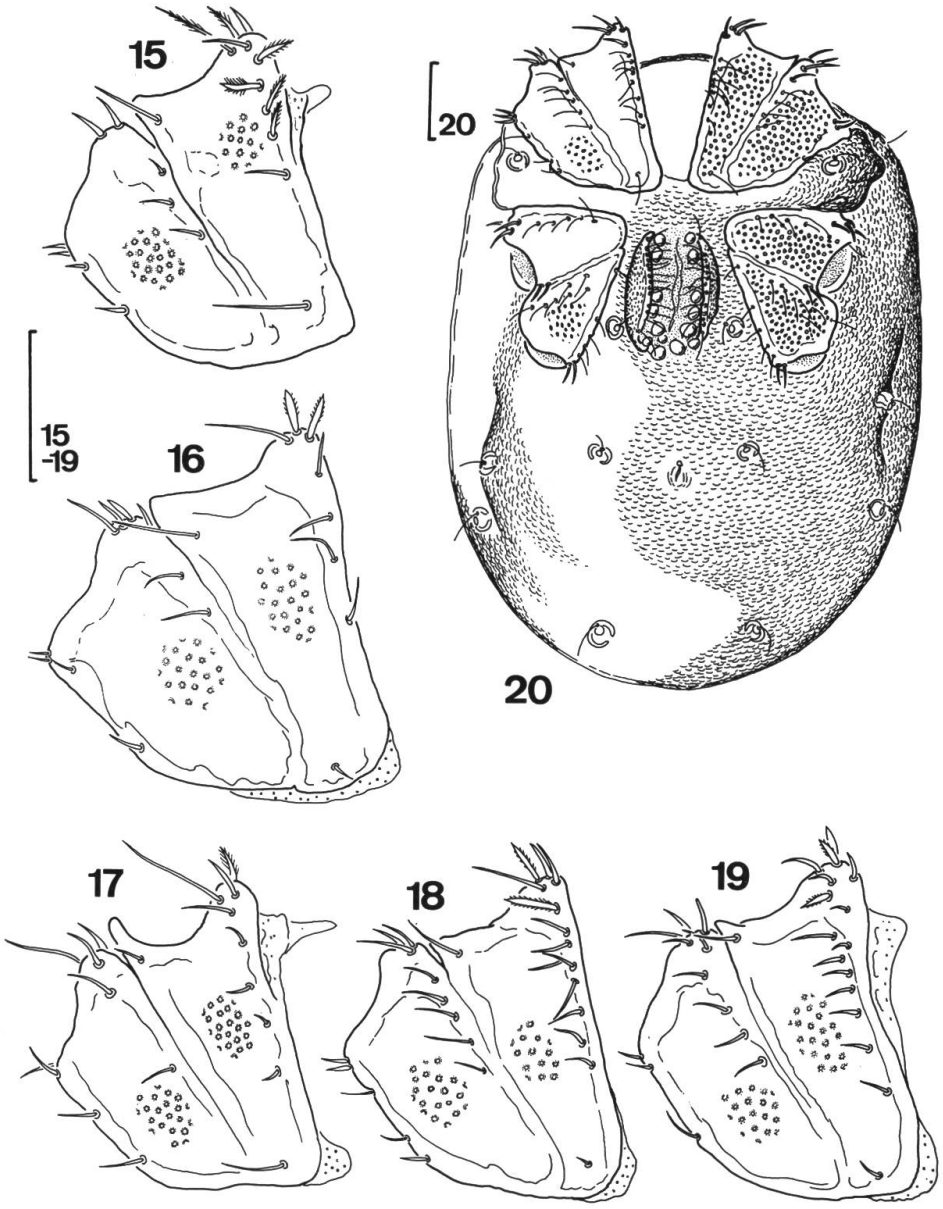
Palps generally robust, their chaetotaxy corresponding to the following scheme: P-1: 1 dorsal seta; P-2: 4 dorsal setae, the first and the third one placed somewhat medially, the second and the fourth one somewhat laterally; P-3: 2 dorsal setae, the anterior one shifted laterally, the posterior one shifted medially; P-4: a fine dorsal hair in subapical position, a somewhat stronger hair in the anterior quarter of the ventral side, a fine proximolateral hair (not always visible) and a weak medial seta in the central region of the segment. P-5: bearing a strong claw, accompained on the dorsal and ventral side by weaker clawlets.

Chaetotaxy of legs in all species known as in Figures 41-44. Ventral side of leg-I-6 and leg-II-6 with a «sole» formed by densely-placed fine hairs and setae surrounding 5 peg-like thickened setae (Figs 41, 42). Claws of all legs are simply, without clawlets.

V. Description of the species

(Terminology: Cx= coxae, h.=height, 1.=length, 1./h.= ratio length by height, P-1= palp segment 1, w.= width; for the genital skeleton, the terminology proposed in HEVERS, 1978 is used).

Measurements for all species listed in table 1 (mouthparts) and table 2 (genital region and coxae).



Figs 15-20: 15-19, Males, Cx-I+II. 15, *Partnunia angusta*; 16, *P. steinmanni*; 17, *P. uchidai; 18, P. regalis*; 19, *P. aprutina*; 20, *P. regalis*, male, ventral view. Bars = 100 µm.

5.1. Partnunia angusta (Koenike, 1893) Figs 1, 2, 22, 27, 31, 36.

Holotype: Female, «498. *Thyas angusta* KOEN., Type; Schweiz, Rhätikon, Partnuner See. Prof. Zschokke coll. 1892» MNHU (Although the preparation has partially dried up, one palp and the left side of the genital region can still be studied).

Published records: *Austria: Niederösterreich (WALTER, 1944, LUNDBLAD, 1956); *Italy: Lombardia, Piemonte (MONTI, 1910); *Jugoslavia: Mazedonia (SCHWOERBEL, 1963); *Switzerland: Berner Oberland (LUNDBLAD, 1956), Graubünden (KOENIKE, 1893, WALTER, 1907, WALTER, 1922, LUNDBLAD, 1956, BADER, 1975).

Material examined: Austria, Niederösterreich, Lunz, Bäck vid Lend, 24.V.1955 (SMN 4980) (1♀).

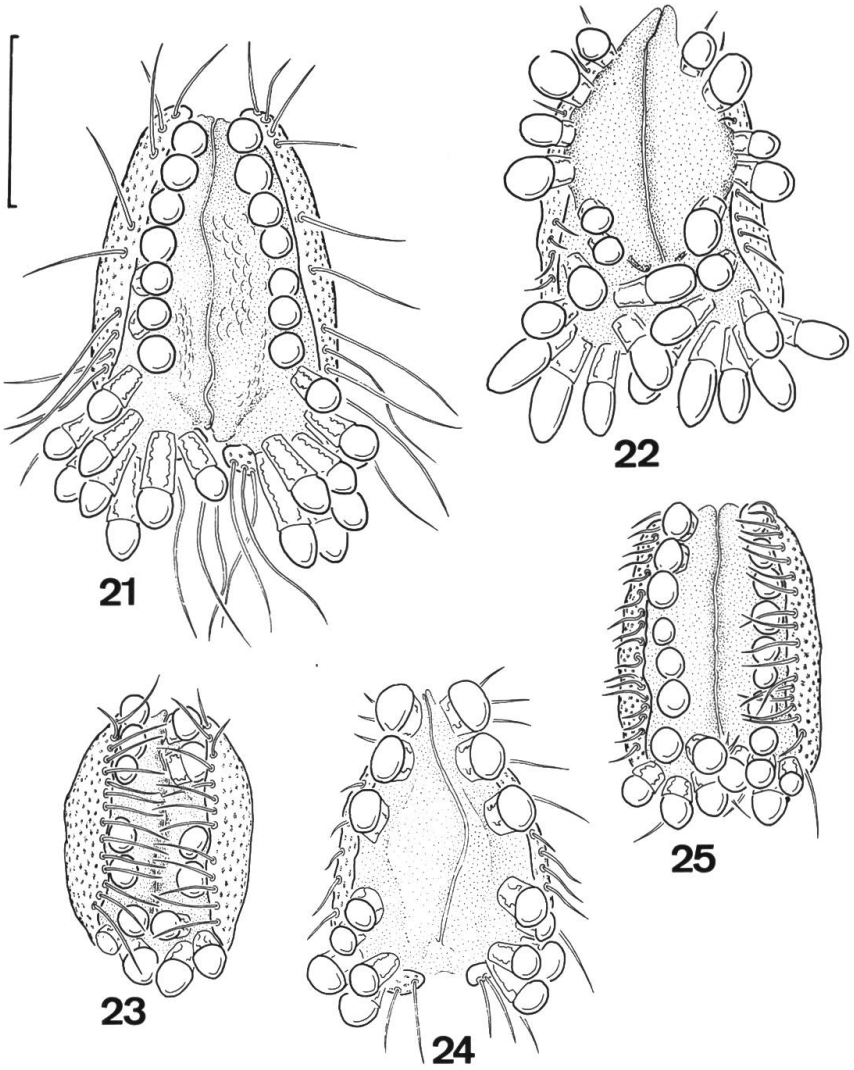
Switzerland, Berner Oberland, Källa vid Öschinensee, 12.VIII.1951 (SMF 4661) (1♀), Graubünden, Partnun, Bach b.See, 25.VII.1906, (Pr.224; NHMB V/17) (1♀), Val sinestra WALT.21/1943 (NHMB XXVIII/30), Zuort WALT.22/1943 («*Partnunia steinmanni*» NHMB) Nationalpark, il Fuorn, 22.VII.1955 (NHMB) (3♂, 3♀), same locality, 3.X.1961 (NHMB) (1 ♂, 2 ♀), same locality, 22.VII.1962 (NHMB) (1♀), same locality, FWQII-Bach, 19.VII.1962 (NHMB) (1♂, 1 ♀), same locality, FWQI-Bach, Interstitial Eisenofen, BADER leg. 13.VIII.1981 (Gerecke 24/1/1 - 24/1/14) (3 ♂, 11♀), same locality, FWQI-Bach, Interstitial (NHMB) 15.VI.1982 (1♂), Stabelchod, 17.VII.1954 (NHMB) (1♂), Murteras da Stabelchod, Parts of the type series of *Partnunia raetica*, 14.VII.1961 (7♂, 7 ♀; see below [5.2.]).

Diagnosis: Palp robust (Figs 1, 2; l./h. P-1 0.5-0.7; P-2 1.4-1.7; P-3 0.8-1.0; P-4 3.1-3.7; P-5 2.6-3.1); ventral margin of P-3 straight, maximum height of P-4 at the proximal end; 23-26 genital acetabula in males, 21-29 in females; posterior acetabula elongated (l./w. 1.2-2.2), on 21-49 µm long stalks (stalk l./acetabular l. 0.5-1.3); genital flaps bearing short and fine hairs; genital skeleton 118-130 µm long (Figs 31, 36), brachia proximalia not longer than brachia distalia, carina anterior knob-shaped, carina posterior totally reduced.

Discussion: According to the data given by BADER (1962), the body of unprepared speciments is strikingly flattened. However, this character is of inferior value in soft-bodied water mites and cannot be verified in prepared specimens.

The length of the gonopore allows no distinction between males (168-176 µm) and females (160-230). However, in all specimens studied, the integument between the gonopore and the genital acetabula is papillate in females (Fig. 27), but smooth in males (Fig. 22).

As BADER (1962) has pointed out, the posterior genital acetabula are conspiciously elongated (average ratio l./w. 1.7, Holotype 2.0). The acetabula of specimens imbedded in Hoyer's fluid show a greyish



Figs 21-25: External genital organ of males. 21, *Partnunia steimanni*; 22, *P. angusta*; 23, *P. regalis*; 24, *P. uchidai*; 25, *P. aprutina*. Bar = 100 µm.

gleam. Posterior acetabular stalks measure 21-49 µm in length, the average ratio stalk length/acetabular length is 0.9.

The genital skeleton of *P.angusta* (Figs 31, 36) has never been figured.

Distribution and ecology: As the identity of *P.angusta* has been doubtful until the revision by BADER (1962) – e.g., LUNDBLAD (1956) held that *P.steinmanni* should be placed in synonymy with *P.angusta* – the presence of this species in Italy and Jugoslavia needs confirmation. However, it is quite likely that *P.angusta* has a much wider distribution than actually known. Since the species inhabits primarily the interstitial or the uppermost course of alpine streams, it is not easily collected (BADER, 1962, 1975). Only occasionally populations of *P.angusta* have been found in rheocrenic springs with sandy substratum.

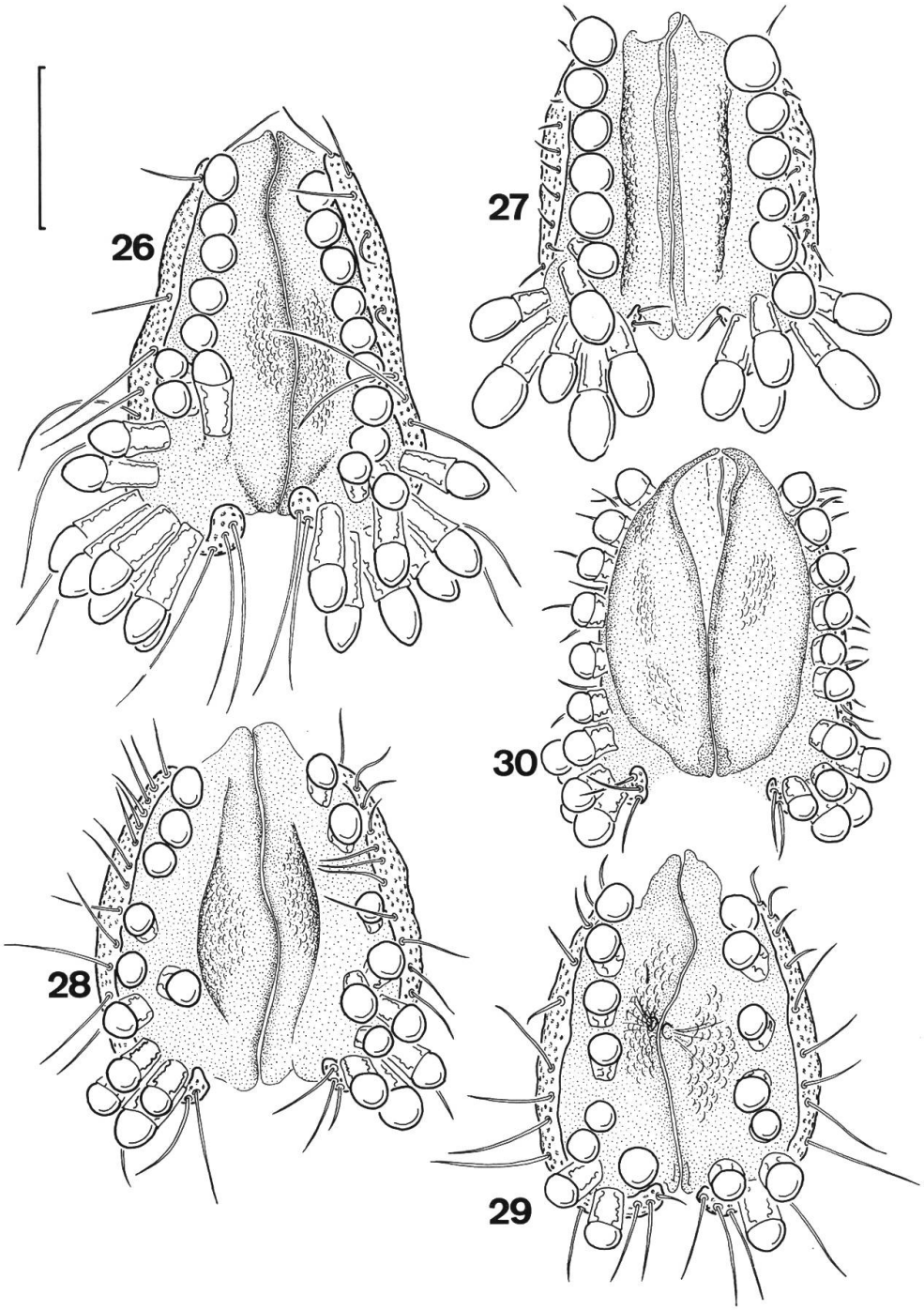
5.2 Partnunia steinmanni Walter, 1906 Figs 3, 4, 16, 21, 26, 32, 37.

Synonyms: *Calonyx simplex* VIETS,K, 1922; *Partnunia raetica* BADER, 1975, *n. syn.*

Type series: Lectotype (here designated): ♂, Steinmann. Bäche bei Zermatt. Aug. 1905. NHMB prep. V/45 (body) and V/46 (mouth parts). Paralectotypes: 1 ♀, labeled like the Lectotype, NHMB prep. V/47 (body) and V/48 (mouthparts); 2 nymphs, labeled like the Lectotype, NHMB Präp. V/49 (one specimen undissected, a further specimen without mouth parts) and V/50 (mouth parts); 1 ♂, Cotype Schweiz. Bäche bei Zermatt, 8.1905 Walter, SMF prep.2102; 1 ♀, labeled like SMF prep. 2102, SMF prep.2103.

Published records: *Austria: Niederösterreich (WALTER, 1922, VIETS, K., 1925, BREHM, 1956 «*P.angusta*» per parte LUNDBLAD, 1956), Steiermark (WALTER, 1922), Tirol (VIETS, K., 1925), Vorarlberg (WALTER, 1922); *Czechoslovakia: Moravia («*P.angusta*» LASKA, 1955e, 1963, PUNČOCHAR, 1969), Slovakia («*P.angusta*» LASKA, 1953, 1957, 1957a); *France: Hte.-Tarentaise (HUBAULT, 1927), Puy-de-Dôme (VAILLANT, 1955), Pyrénées-Orientales (MIGOT, 1926), Savoie (MOTAS, C., 1928), Vosges (SCHWOERBEL, 1959), Dauphiné (MOTAS & BLAIVE, 1935); *Germany: Baden-Württemberg (SCHWOERBEL, 1955, 1956), Bayern (BRAUN & STADLER, 1961), Niedersachsen («*Calonyx simplex*» VIETS, K., 1922, 1925), Nordrhein-Westfalen (VIETS, K., 1936), Sachsen (JÄNTSCH, 1964), Thüringen (VIETS,K., 1925); *Hungary: High Tatra (SZALAY, 1956, 1956); *Italy: Lombardia, Piemonte (MONTI, 1910), Trentino-Alto Adige (WALTER, 1922); *Poland: Pienin (BIES IADKA, 1973, 1979), Polon. Karpates (BIESIADKA, 1973); *Roumania: Southern Karpates (SOAREC, 1942); *Switzerland: Berner Oberland (WALTER, 1907, 1922), Graubünden (WALTER, 1907, 1922, «*P.angusta*» LUNDBLAD, 1956, BADER, 1975), Jura (BORNHAUSER, 1912), Wallis (WALTER, 1906, 1907, 1922).

Material examined: Austria: Burgenland, Bucklige Welt bei Hollenthon, 550 m, 29.V.1987 (Gerecke 24/3/11–24/3/20) (5♂, 5 ♀); Niederösterreich, Lunz, Källa i. Lechnergraben, 18.V.1955, *P.angusta* (Koen.) (SMN 4917) (1♂), Alte Wasserleitung, 12.V.1955, *P.angusta* (Koen.) (SMN 4918) (1♀), same lo-



Figs 26-30: External genital organ of females. 26, *Partnunia steinmanni*; 27, *P. angusta*; 28, *P. regalis*; 29, *P. uchidai*; 30, *P. aprutina*. Bar = 100 µm.

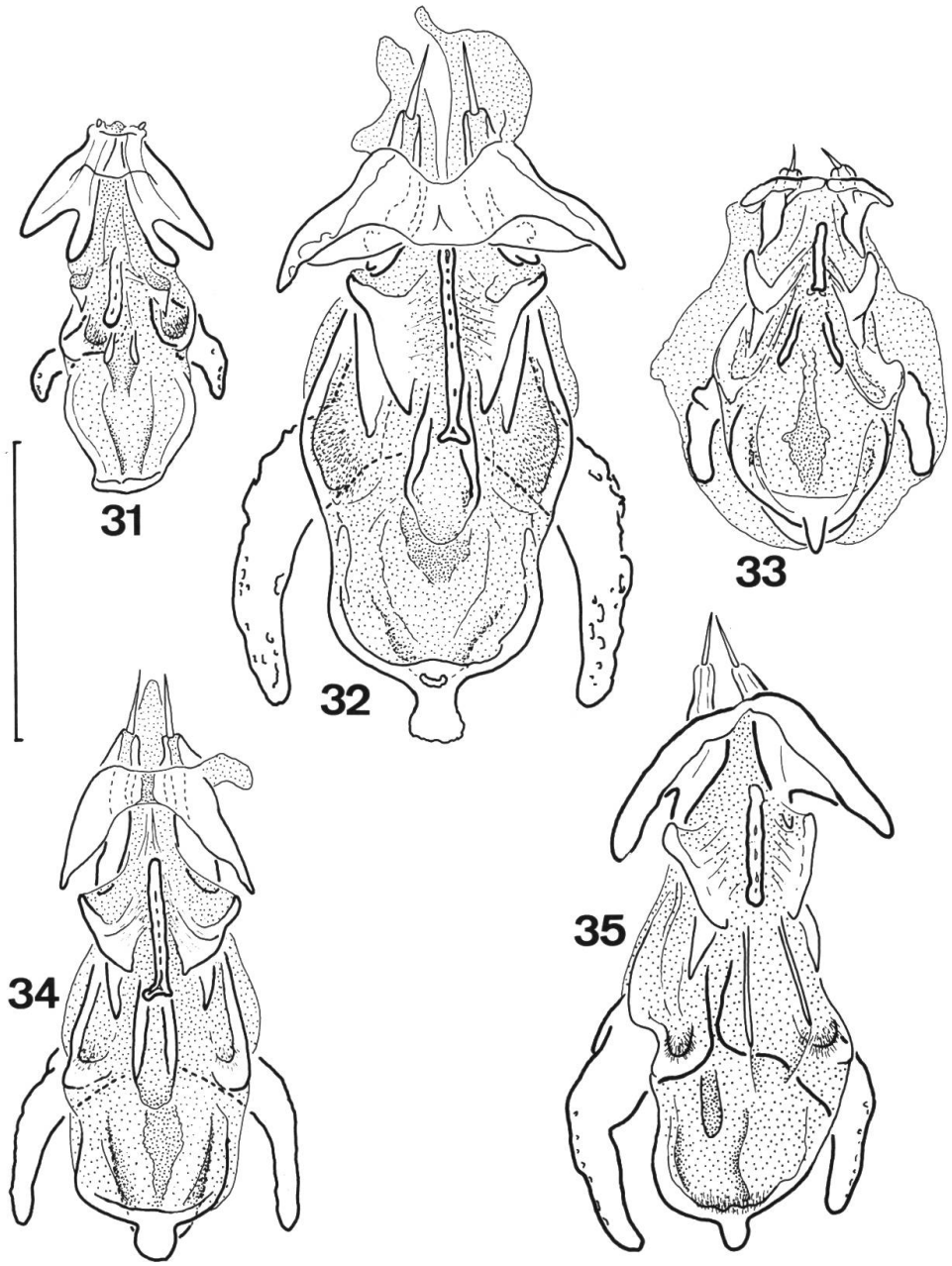
cality (SMB 4919) (1♀), Quelle am Untersee, 1.IX.1923 (SMF 3298) (1♀); Tirol, Quelle im Kasbachtal bei Penbach, 26.VIII.1923 (SMF 3254) (2sp.). Germany: Baden-Württemberg, Schwäbische Alb (Balingen). Wannental unter Böllat, 830 m, 17.V.1987 (Gerecke 24/3/1 – 24/3/10) (3♂, 6♀, 1 ny.); Bayern, Garmisch, Steigerwald, Quelle, 12.VI.1933 (SMF 5813) (2 sp.); Niedersachsen, Harz, Altenau, Quelle i.Abt.130 b. Holzschleiferei, 27.VII.1921 (SMF 2932) (1 sp.), Weserbergland, Vogler, Quelle Riehenberg 59 – Kohlhai 65, 20.VII.1920 (SMF 2751, 2756/1-3, backside: «Type von *Calonyx simplex* Viets») (4 sp.), Vogler, Breitegrund 66, Fisenke (SMF 2776, backside: «Type von *Calonyx simplex* Viets») (1 sp.), same locality (SMN 369) (1♀), Hameln, Quelle bei Hemeringen, 14.IV.1922 (SMF 3106) (1 sp.). Switzerland: Graubünden, Val sinestra, Walt. 21/1943 (NHMB XXVIII/30, 31) (1♂, 5♀), Hinterrhein, Källbäck. 1600 m, 14.VII.1953, «*P.angusta*» (SMN 4798) (1♂); National Park, Punt Periv 1972 (NHMB) (2♂, 1♀), Zernez, God d'Arduond, 31.7.1980, «*P.angusta*» (NHMB) (1♂), Ftur-Grimels, 8.VI.1983 (NHMB) (1♂), Lü-Daint, 2.X.1983 (NHMB) (2♀), God dal Fuorn, 1810 m, 25.VII.1988 (Gerecke 24/3/23 – 24/3/29) (2♂, 4♀, 1 ny.), God la Schera, 2080 m, 26.VII.1988 (Gerecke 24/3/21 – 24/3/22, 24/3/29 – 24/3/35) (6♂, 3♀, 2 ny.), Quellbach am Piz Nair ob Stabelchod, 2200 m, C. Walter (SMN 150) (1♀), Murteras da Stabelchod, 2100 m, Type series of *P.raetica* per parte, 14.VII.1961 (NHMB Ba NP 123) (3♂, 5♀), Stabelchod (NHMB NP 84/20) (4♂), Stabelchod, 2100 m, 28.VII.1988 (Coll. Gerecke 24/3/36 – 24/3/39) (2♂, 2♀) Wallis, Type series (NHMB V/45-50, SMF 2102,2103, see above), one preparation with red label scribed by Walter, without indication of the locality (NHMB I E 2d, XXX/04). Binntal, 13.VII.1911 (NHMB I/10, I/08) (1♂, 1♀). Czechoslovakia: (NHMB, without indication of locality and date, coll.Laska) (3♀).

Preparation of doubtful taxonomic status: France: Puy-de-Dôme, Massif du Sancy, Besse-en-Chandesse, 1080 m, [without date] Vaillant «*P.steinmanni*» (SMF 7747) (1 Ex.)

Diagnosis: Palp more slender than in the remaining species of the genus (1./h. P-1 0.7-1.0; P-2 1.4-1.8; P-3 0.9-1.4; P-4 3.6-4.5); ventral margin of P-3 convex, maximum height of P-4 in the middle of the segment; 23-37 genital acetabula in males, 28-55 in females; caudal acetabula generally round (1./w. 0.8-1.5, average ratio 1.1); length of caudal acetabular stalks 27-54 µm, stalk 1./acetabular 1. 1.2-2.7; marginal hairs on genital flaps long and robust; length of genital skeleton 243-255 µm, brachia proximalia much longer than brachia distalia, carinae normally developed.

Discussion: The range of the body length of the male specimens measured (680-980 µm) corresponds approximately to the data given by BADER (1962), but, as there is a wide overlap with the range of the body length in females (740-1340 µm), there is no possibility to distinguish the sexes on the base of body measurements.

The gonopore is longer in females (220-260 µm) than in males (160-206 µm), the integument between the gonopore and the genital



Figs 31-35: Genital skeleton: anterior view. 31, *Partnunia angusta*; 32, *P. steinmanni*; 33, *P. aprutina*; 34, *P. regalis*; 35, *P. uchidai*. Bar = 100 µm.

acetabula is papillate in both sexes (Figs 21, 26). In most cases, the number of genital acetabula is much higher in *P.steinmanni* (25-55) than in *P.angusta* (21-29), but obviously the number of genital acetabula does not permit the separation of the two species. The posterior genital acetabula of nearly all specimens studied are hardly longer than wide (average ratio 1./w. 1.1), but there is a single male with long caudal acetabula (1./w. 1.5; NHMB, Swiss National Park Punt Periv) which by the shape of its genital skeleton clearly belongs to *P.steinmanni*.

The posterior acetabular stalks are often elongated (32-54 µm; average ratio stalk 1./acetabular 1. 1.6 in males, 1.7 in females, Figs 21, 26); the hairs on the medial margins of the genital flaps are longer than in the other known species of the genus.

The genital skeleton of *P.steinmanni* (Figs 32, 37) has first been figured by LUNDBLAD (1956, anterior view, under the name «*P.angusta*»; BIESIADKA (1973) gives a drawing of the lateral view. In contrast to the genital skeleton of *P.angusta*, the brachia proximalia are apparently longer than the brachia distalia; they reach the posterior margin of the cella proximalis. Both carinae are well developed.

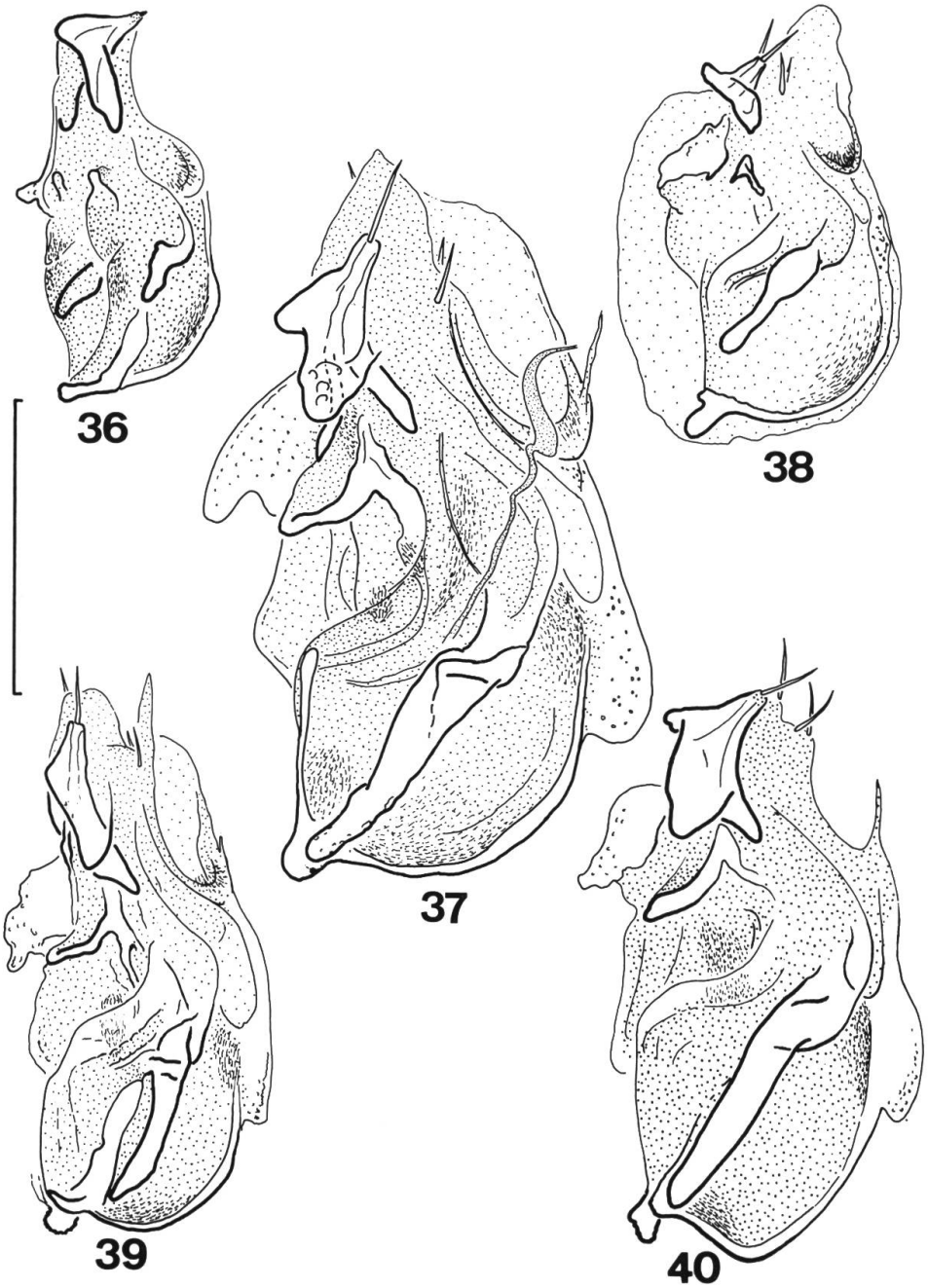
The position of the excretory pore is variable. It can be placed between, somewhat before, or somewhat behind the ventroglandulaira 2.

BADER (1962) first focussed attention on the more slender shape of the palp of *P.steinmanni* (Figs 3, 4). In the proportions of the palp segments 1-4 there are noteworthy differences between *P.steinmanni* and *P.angusta* (see table 1): The P-1 is subquadratic in lateral view, its dorsal length is 41-56 µm (*P.angusta*: 27-41 µm); the P-2 is relatively shorter (22.6-24.6 % total length) than in *P.angusta* (26.4-28.8 % total length); the ventral side of the P-3 is apparently convex (straight in *P.angusta*) and the P-4 is somewhat narrowed proximally – the maximum height is reached in the middle of the segment, not basally as in *P.angusta*.

The cheliceral claws in *P.steinmanni* are a bit stronger (average ratio basal segment/claw 2.1 in males and females) than in *P.angusta* (average ratio basal segment/claw in males 2.5, in females 2.4), but there is a high variability in both species, and a large overlap in females.

Distribution and ecology: *P.steinmanni* is a very common species in the European Alps and at higher elevations in the eastern European mountains. The presence of this species in the southern Karpates (SOAREC, 1942) needs confirmation (actually, speciments from that region are not available).

Numerous populations of *P.steinmanni* have been collected in the lower mountains of Central Europe, the northermost locality being si-



Figs 36-40: Genital skeleton, lateral view. 36, *Partnunia angusta*; 37, *P. steinmanni*; 38, *P. aprutina*; 39, *P. regalis*; 40, *P. uchidai*. Bar = 100 µm.

tuated in the Weserbergland, Germany. The species is obviously lacking in Scandinavia and in England.

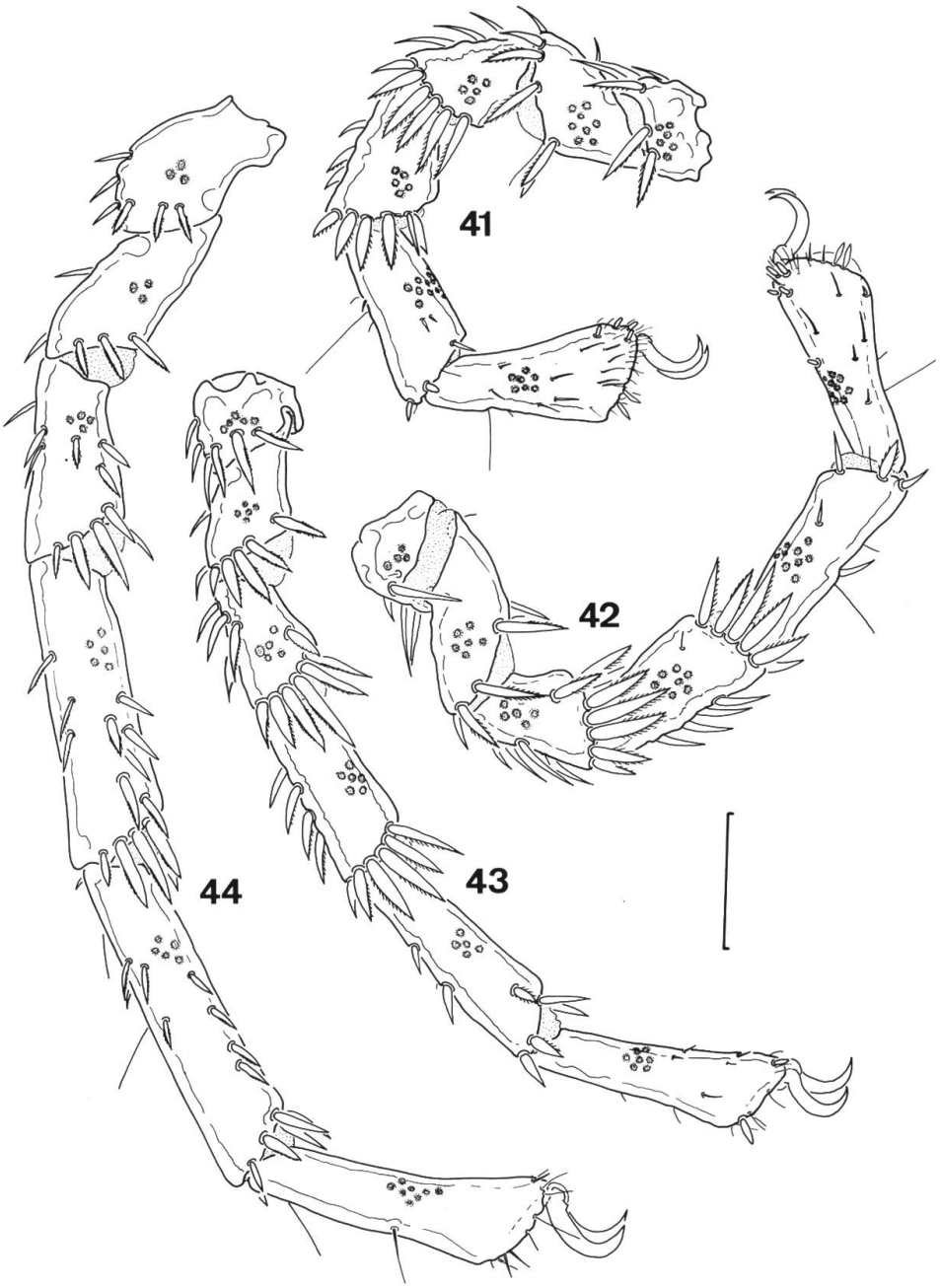
Neither preserved specimens from previous authors, nor more recent collections confirm the presence of *P.steinmanni* in Northern Italy, in the Dauphiné, and in the Pyrénées. The palp of a specimen from the Dauphiné region (French Alps, figured in MOTAS & BLAIVE, 1935) and that of a female specimen collected by Vaillant in the Massif Central (Central France, SMF 7747, published in VAILLANT, 1955) show a very short P-1 (29 resp. 24 µm). Consequently, the presence of *P.steinmanni* in Central and Southeastern France must be doubtful at present. The presence of *P.steinmanni* in the Pyrénées, which was published by MIGOT (1926) at a time when the knowledge concerning the specific characters of *P.steinmanni* was very limited, should likewise be verified by future collecting.

P.steinmanni inhabits cold springs with constant discharge. In Central Europe the species is found in shaded rheocrenic springs with a substratum of sand and gravel, in the central alps it can be found in all types of muddy rheohelocrenic springs, under stones and in mosses. *P.steinmanni* is not restricted to higher elevations. Even in the southern part of the actually known range the species occurs in springs at middle and lower elevations (Burgenland: 550 m, High Tatra: 730 m [SZALAY, 1956], Piemonte: 800 m [MONTI, 1910]). The highest locality of the species actually known is situated in the Swiss National Park at 2350 m (Döss dal Termel; BADER, 1975).

On the identity of Partnunia raetica Bader, 1975

From the information given by Bader, the diagnosis of the species is as follows: Body flattened (body height 220-250 µm); capitulum longer than in *P.angusta* and in *P.steinmanni* (males 190-220 µm, females 180-240 µm); gonopore longer than in the two other species (males 160-220 µm, females 180-250 µm); sexual dimorphism in the shape and the number of genital acetabula (males with 22-31 acetabula, caudal acetabula longish, females with 36-45 acetabula, caudal acetabula roundish); P-2 relatively longer (males: 28 %total length, females 26 % total length) than in *P.steinmanni*.

Discussion: A comparison with the data given in tables 1 and 2 shows that the measurements of the capitulum and the gonopore are



Figs 41-44: *Partnunia regalis*, male. 41, leg-I, 42, leg-II; 43, leg-III; 44, leg IV. Bar = 100 µm.

not suitable for a caracterization of *P.raetica* – they lie within the range of variability of both *P.angusta* and *P.steinmanni*. As in soft-bodied water mites the body height might be influenced by physiological conditions, and in view of the impossibility of determining the body height in prepared specimens, this cannot be considered as a reliable character for the delimitation of the species. The number of genital acetabula corresponds in males of *P.raetica* with the range of variability in *P.angusta*, in females with the range of variability in *P.steinmanni*. The relative length of P-2 lies within the order observed in *P.angusta*.

A reexamination of the type-material of *P.raetica* yielded the following results (Holotype: ♀, and paratypes: 10 ♂, 16 ♀, NHMB Ba NP 123):

1) There is no sexual dimorphism regarding the shape of the caudal acetabula. Among the speciments with roundish acetabula, segnalated as females, there were also males, among the specimens with longish acetabula, segnalated as males, there were also females.

2) The specimens can be divided in two groups, according to the morphology of their caudal acetabula:

	males n = 7	females n = 7	males n = 2	females n = 5
Acetabulum:				
length	32-51	41-59	24-27	22-32
width	19-24	22-30	22-27	22-30
length/width	1,6-2,1	1,4-2,2	1,0-1,1	1,0-1,2
Stalk, length	27-43	35-49	35-38	35-51
Stalk length/ acetabular length	0,7-1,1	0,6-1,2	1,4-1,5	1,3-1,6

These results suggest that *P.raetica* might ba a mixture of populations of *P.angusta* and *P.steinmanni*. This is confirmed by the morphology of the palp and the genital skeleton of two representative males studied.

The Holotype is a female specimen that shows typical characters of *P.steinmanni* (roundish acetabula, a slender palp). Consequently, *P.raetica* is here synonymized with *P.steinmanni*.

5.3 Partnunia uchidai Imamura, 1950 Figs 5, 6, 17, 24, 29, 35, 40.

Type series: Holotype, ♂, Prep.348, and allotype, ♀, Prep. 326 in Coll.Imanura, Tokio; Paratypes: numerous ♂,♀, nymphs and larvae in Coll.Imamura, Tokio, 16♂, 16♀, 1 nymph, Präp.24/6/1 – 24/6/24 in Coll. Gerecke and in NHMB.

Published records: Japan: Hokkaido, cold spring (6 °C) 750 m above the sea-level in Kamikoshi, Kamikawa-gun, June 29, 1947, July 16, 1948 (only known locality, IMAMURA 1950).

Material examined: 33 Paratypes (16♂, 16♀, 1 ny.)

Diagnosis: Palp robust (Figs 5, 6; l./h. P-1 0.5-0.6: P-2 1.5-1.6; P-3 0.9-1.0, P-4 3.3-4.0; P-5 2.6-3.5), ventral margin of P-3 straight or weakly convex, maximum height of P-4 at the proximal end; file of anterior genital acetabula (14-19 in males, 16-21 in females) with one or two gaps (Figs 24, 29); posterior acetabula enlarged (l./w. 0.6-0.9), on relatively short stalks (14-33 µm, stalk length/ acetabular length 0.9-2.1); genital flaps bearing long marginal hairs; length of the genital skeleton 190-220 µm (Figs 35, 40), brachia proximalia longer than brachia distalia, with their apical parts directed towards the median line, brachia distalia in rectangular or obtuse-angled position, in lateral view (Fig. 40) of noteworthy anterior-posterior expansion, carinae well developed; Cx-I bearing 8-11 setae (Fig. 17).

Discussion: In comparison with *P.angusta* and *P.steinmanni*, the body measurements of *P.uchidai* (total length 740-1000 µm in males, 910-1150 µm in females) show no constant differences. Except for the genital skeleton, the sexes differ in the total length of the palps (348-373 µm in males, 379-404 µm in females) and in the length of the gonopore (140-160 µm in males, 170-206 µm in females). The integument between the gonopore and the genital acetabula is papillate in females (Fig. 29), but smooth in males (Fig. 24).

The external genital organ of the male is relatively narrow in its rostral part, and somewhat broadened caudally. In both sexes the number of genital acetabula (14-21) is lower than in *P.angusta* or *P.steinmanni*, with a minimal overlap with *P.angusta* (21-29). The anterior acetabula form a loose file, usually with one or two gaps; they are often enlarged in rostrocaudal direction. Among the group of caudal acetabula there is always one weaker acetabulum in anterolateral position. Generally the caudal acetabula are strikingly enlarged (average ratio l./w. 0.6 in males, 0.7 in females); they are broadly rounded, while those of *P.steinmanni* are often a bit pointed. Mostly the acetabular stalks are shorter (14-33 µm) than in *P.steinmanni* (27-54 µm).

The genital skeleton of *P.uchidai* (Figs 35, 40) is longer than that of *P.angusta*, but shorter than that of *P.steinmanni*. It shows some similiarities to the genital skeleton of *P.steinmanni* (Figs 32, 37), but it differs in the shape of the brachia proximalia (internal margin bent in *P.uchidai*, gradually rounded in *P.steinmanni*), the brachia distalia (position more obtuse-angled and with a larger ramus anterior in *P.steinmanni*), the carina anterior (with a concave margin in *P.uchidai*, with a convex margin in *P.steinmanni*) and the cella proximalis (in lateral view the posterior margin rounded in *P.steinmanni* (Fig. 37), bluntly pointed in *P.uchidai* (Fig. 40).

The palp (Figs 5, 6) is robust and similiar to that of *P.angusta*. Generally, P-4 is a bit more slender (1./h. 3.3-3.8 in males, 3.5-4.0 in females; in *P.angusta* 3.1-3.3 in males, 3.2-3.7 in females). The cheliceral claw is short like in *P.steinmanni*: ratio basal segment/claw in males 1.9-2.1, in females 2.0-2.3.

Ecology: IMAMURA (1950a) observed parasitism of the larvae of *P.uchidai* on plecopteran imagines at the type locality in june. Infested specimens belonged to the species *Alloperla jezoënsis* M.Kohno, *Arcynopteryx jezoënsis* Okamoto, and to species of the genera *Protonemura* and *Nemoura*, while *Megarcys ochracea* Klapalek and *Dictyogenus japonicus* Okamoto had not been attacked by the water mite larvae. Imamura found up to 46 larvae attached on a single plecopteran imago.

5.4 Partnunia regalis n. sp. Figs 8, 9, 18, 23, 28, 34, 39.

Type series: Holotype, ♂, prep. 24/5/11, allotype, ♀, prep. 24/5/57 (Sicily, Serra del Re) in NHMB; paratypes, 29♂, 59♀, 15 ny., 1 nymphophan, 9 teleiophans, 25 larvae, prep. 24/5/1 – 24/5/10, 24/5/12 – 24/5/56, 24/5/58 – 24/5/84 in coll. Gerecke.

Locality records: Italy, Sicily, Nebrody mountains, ME, Serra del Re, northern slope, 1650 m, U.T.M. –coordinates: VC 805 000, rheopsammocrenic spring, 20.XI.1985 (2♂, 6♀), 25.VI.1986 (3♂, 11♀, 6 ny.), 4.IX.1987 Karaman-Chappuis-dig (16♂, 3♀, 2 ny., 4 Teleiophans), 22.VI.1988 (7♀, 25 larvae). Calabria, Aspromonte, RC, Montalto, northwestern slope, 1750 m, rheohelocrenic spring, 1.VIII.1986 (1♂, 1♀, 1 ny.); Pollino mountains, CS Cerchiara di Calabria, Casino Toscano, 1700 m, U.T.M.–coordinates XE 04 20, 29.IX.1990, rheohelocrenic spring (1♂) and rheopsammoncrenic spring (4♂, 15♀, 1 nymphophan, 5 ny., 2 teleiophans); same date and region, Portella del Pollino, 1800 m, U.T.M.–coordinates XE 04 20, rheohelocrenic spring (1 teleiophan); Pellegrino mountains, CS, Saracena, Fonte Cannello, m 1450, U.T.M.–coordinates WE 902 040, 8.X.1990, rheopsammocrenic spring (1♂, 5♀) and spring brook at 1385 m (1♂); Pellegrino mountains, CS, Orsomarso, Mare piccolo, 930 m, WE 867 047, 9.X.1990, rheopsammocrenic spring (1♂). Basilicata, Pollino mountains, PZ, Terranova di Pollino, Contrada Ruggeri, 1450 m, U.T.M.–coordinates XE 067 227, 1.X.1990, rheopsammocrenic spring (2♀); same region and date, N of Lago Fondo, 1450 m, U.T.M.–coordinates XE 052 228, rheopsammocrenic spring (8♀, 1 ny., 2 teleiophan).

Diagnosis: Palp robust (Figs. 8, 9; 1./h. P-1 0.5-0.8; P-2 1.4-1.8; P-3 0.8-1.1; P-4 2.9-4.2; P-5 2.4-3.4), ventral margin of P-3 straight, maximum height of P-4 at the basal end; 13-21 genital acetabula in males, 16-27 in females; file of anterior genital acetabula generally with a gap (Figs. 23, 28); posterior acetabula roundish (1./b. 0.6-1.2), acetabular stalks short (length 12.31 µm, ratio stalk length/acetabular length 0.6-1.9); genital flaps bearing long hairs; genital skeleton (Figs 34, 39) 184-220 µm long; brachia proximalia longer than brachia distalia, not bended, in their apical part parallel to the median line; brachia distalia in acute-angular position, in lateral view (Fig. 39) flattened; carinae well developed, with irregularly-shaped anterior margin; Cx-I bearing 9-16 setae (Fig. 18).

Description: With regard to body measurements, *P.regalis* agrees well with *P.angusta*, *P.steinmanni*, and *P.uchidai* (among the females, however, there are some particularly large specimens: males 690-930 µm, females 830-1510 µm).

There are apparent differences between the two sexes regarding the length of the gonopore (135-164 µm in males, 192-245 µm in females) and the total length of the palp (356-394 µm in males, 435-497 µm in females).

The integument between the gonopore and the acetabula is papillate in females, but smooth in males.

The external genital organ of the male (Fig. 23) is not enlarged caudally, the number of genital acetabula is 13-21 in males, 16-27 in females (Fig. 28). The file of the anterior genital acetabula shows a gap in the middle, usually separating 2-3 pairs of anterior acetabula from the rest of the file. Among the caudal acetabula there is always a weakly-developed acetabulum in anteriolateral position. The caudal acetabula are roundish (average ratio 0.9 in males, 0.8 in females).

The length of the genital skeleton (Figs 34, 39) is 184-220 µm. The brachia proximalia are equally rounded in their basal part, apically they are parallel with the median line. The brachia distalia are in an acute-angled position and are largely fused in the region of the ramus anterior. In lateral view (Fig. 39) they are flattened. The margin of the carina posterior is weakly convex, the carina anterior is somewhat irregular in shape, the cella proximalis shows in lateral view a rounded posterocaudal margin.

The palp is robust (Figs 8, 9). All mouthparts correspond to the description given for *P.uchidai*, except for the generally larger total length of the palps (435-497 µm) and the chelicerae (203-249) in females.

Discussion: *P.regalis* shows a striking similiarity to *P.uchidai* from Japan. As the position of the genital flaps in the soft integument may change easily, the shape of the external genital organ of the male (narrowed in the rostral part, enlarged caudally in *P.uchidai*, parallel in *P.regalis*) is of low value for the discrimination of the two species.

The posterior acetabula in *P.uchidai* (average ratio 1./w. 0.6 in males, 0.7 in females) are shorter than in *P.regalis* (average ratio 1./w. 0.9 in males, 0.8 in females). The Cx-I in *P.regalis* bear generally a higher number of setae (males 8-15, females 10-15) than in *P.uchidai* (males 7-9, females 7-10). In regarding the mouthparts, only the total length of the palps of the females show a clear difference between the two species (*P.regalis* 435-497 µm, *P.uchidai* 379-404 µm).

A clear discrimination between *P.uchidai* and *P.regalis* is impossible without the study of the male genital skeleton (Figs. 34/35, 39/40): The brachia proximalia in *P.uchidai* show a kink, in that their apical parts are bent towards the median line, while they are equally rounded and in the apical part parallel to the median line in *P.regalis*. The brachia distalia in *P.uchidai* are in a rectangular or obtuse-angled position, with a small area of fusion in the ramus anterior, whereas in *P.regalis* they are in an acuteangled position with a large area of fusion in the anterior ramus. In lateral view, the brachia distalia are elevated in posterio-anterior direction in *P.uchidai*, while they are flattened in *P.regalis*; the cella proximalis is rounded in *P.regalis*, while the posterior tip is bluntly pointed in *P.uchidai*.

Ecology and distribution: The type locality of *P.regalis* is situated in the highest zone of springs on Sicily with a strong water outflow all over the year. Intensive collecting in spring biotopes all over Sicily, and particularly in the Nebrodi mountains, failed to produce other localities for *P.regalis*. Therefore it seems probable, that in Sicily the species is restricted to the type locality.

This group of springs is also the type locality for the caddis fly *Chaetopteryx trinacriae* Botosaneanu & al., 1986, which is endemic to the Nebrodi mountains (the indications regarding the locality given by the authors are erroneous). Many other cold-stenothermous aquatic invertebrates on Sicily are restricted to springs and current waters waters in the beech-forests of the upper Nebrodi mountains (GERECKE & BRANCUCCI, 1990, RAVIZZA & GERECKE, 1992). This area is the nucleus of a projected Natural Park «Monti Nebrodi».

The habitat at the northern slopes of M. Serra del Re forms a first-order-stream with sandy and stony substratum and, in tracts where the current is weak, with accumulations of leaf litter, which originates from a series of rheocrenic and rheohelocrenic springs.

The water appears with a temperature of 4.7° C, the highest temperature measured in the first-order-stream (distant about 100 m from the source) was 11.5° C (4.IX.1987).

P.regalis can be found in a distance of 100 m to 200 m from the source, primarily under stones and in sandy substratum (Karaman-Chappuis-dig, 4.IX.1987). In the immediate surroundings of the source no specimens of *P.regalis* were ever found.

Like in *P.uchidai*, larvae of *P.regalis* parasitize adult stone flies (Plecoptera). At the end of June 1988, only a few adults could be found, but a big number of larvae parasitizing imagines of *Brachyptera calabrica* Aubert, *Leuctra inermis* Kempny, *Nemoura palliventris* Aubert and *Siphonoperla torrentium* (Pictet). As a difference to *P.uchidai*, whose larvae were found primarily on the dorsal side of thorax and abdomen (IMAMURA, 1950a), the larvae of *P.regalis* were attached chiefly in the cervical region and at the thoracal pleura of their hosts. No mite larvae were found on adults of *Protonemura ruffoi* Consiglio, probably because this species hatches before the breeding period of *P.regalis* begins.

In Calabria, *P.regalis* was found mainly in rheopsammocrenic springs (for a definition, see GERECKE, 1991) completely shadowed by beech- or fir forests at a temperature from 6° C to 11° C. The species is obviously confined to the upper ranges of the Calabrian Appennines; the collecting site near Orsomarso, in the Argentino Natural Reserve with its beech forests at exceptional low elevation, probably marks the lower altitudinal limit (930 m a.s.l.) of *P.regalis*. It would be interesting to know the northern boundary of the distribution of *P.regalis* in continental Italy.

5.5 Partnunia aprutina n. sp. Figs 12, 13, 14, 19, 25, 30, 33, 38.

Type series: Holotype, ♂, prep. 24/4/12; allotype, ♀, prep. 24/4/19 in NHMB; Paratypes, 13 ♂, 15♀, 3 ny., 1 larva, Präp. 24/4/1 – 24/4/11, 24/4/13 – 14/4/18, 24/4/20 – 24/4/33 (in Coll. Gerecke, and in Coll.Cicolani & Di Sabatino, L'Aquila, Italy).

Locality records: Italy: Abruzzo, Gran Sasso, TE, Pietracamela, 1130 m, U.T.M. –coordinates UH 80 08, springs, Cicolani & Di Sabatino, 3.VI.1987.

Diagnosis: Palp robust (Figs. 13, 14; l./w. P-1 0.6-0.7; P-2 1.4-1.7; P-3 0.8-1.0; P-4 3.0-3.8; P-5 2.3-3.1), ventral margin of P-3 straight, maximum height of P-4 at its proximal end; number of genital acetabula 19-27 in males, 24-35 in females; row of anterior acetabula without gap; posterior acetabula roundish (l./w. 0.7-1.1), on short acetabular stalks (12-27 µm, stalk length/acetabular length 0.8-1.5); genital flaps bearing long hairs; genital skeleton (Figs. 33, 38) short (120-143 µm in length) and compact; brachia proximalia much longer and stronger than brachia distalia the latter in an extremely obtuse-angled position, in lateral view higher than long; carina anterior weakly developed, carina posterior completely reduced.

Description: *P.aprutina* is a comparatively small species (body length in males 610-810 µm, in females 690-1130 µm). A discrimination between males and females based upon the total length of the palps (366-379 µm in males, 369-473 µm in females) is not possible, but here is no overlap in the measurements of the gonopore between the two sexes (130-155 µm in males, 182-268 µm in females). The integument between the acetabula and the gonopore is smooth in males, but papillate in females.

The Cx-1 bear numerous setae (13-18 in males, 16-20 in females; Fig. 19). In both sexes, the external genital organ is not enlarged in its caudal part (Figs 25, 30); the number of genital acetabula is 19-27 in males, and 24-35 in females. The anterior acetabula are arranged in a continuous row. The caudal acetabula are roundish (average ratio l./w. 0.9 in males, 0.8 in females), placed on short stalks (12-27 µm, average ratio stalk length/acetabular length is 1.0 in both sexes).

The genital skeleton is remarkably small and compact (Figs. 33, 38). As it is firmly enclosed in masses of connective tissue and muscles, it appears as a little ball that can easily escape the observers notice during preparation. The brachia proximalia are shortened, and are well overtopped by the posterior margin of the cella proximalis; the brachia distalia are developed as minute platelets, and their proximal projections are somewhat stronger than the brachia themselves. In lateral view, the carina anterior is a little, hardly elevated protuberance; the carina posterior is completely reduced. The mouthparts agree with the description given for *P.angusta*. In a few cases the maximum height of the P-4 is reached in the middle, not at the basis of the segment.

Discussion: *P.aprutina* differs from *P.steinmanni* in the robust

shape of the palp and in the reduced length of the posterior acetabular stalks, from *P.angusta* in the roundish shape of the posterior acetabula. Unlike in *P.uchidai* and *P.regalis*, the file of the anterior acetabula is without a gap and the length of the genital skeleton is less than 150 µm. The aberrant shape of the genital skeleton differs noteworthy from all species of *Partnunia* so far known.

The only *Partnunia*-species with a similiarly shortened genital skeleton is *P.angusta* (Figs 31, 36). While in *P. angusta* the proximal part of the organ is more reduced than the distal one (with the brachia distalia longer than the brachia proximalia), in *P.aprutina* (Figs 33, 38) the distal part is narrowed, and the brachia proximalia are longer than the brachia distalia.

Ecology and distribution: The adults of *P.aprutina* were collected from mosses in a rheocrenic spring, shadowed by a beech-forest; one larva was found parasitizing a plecopteran imago.

A further locality for *Partnunia* water mites in the Abruzzo region has been published by MÜNCHBERG (1954) from the province of L'Aquila, based on a series of larvae which had been found parasitizing plecopteran imagines of the genus *Leuctra*.

VI. Conclusions

In considering the variability of the external characters in the five known species of the genus *Partnunia*, a determination of these speces exclusively based on external morphology is problematic. Often a character which might serve to distinguish two species, overlaps widely in a third species with both of the other species in comparison.

The discovery of two new species in high altitude-springs in Southern Italy supports expectation as to the presence of further undescribed species of the genus, e.g., in the largely unstudied mountains of the eastern and western mediterranean region.

In view of the high variability of the external characters of *Partnunia*, it seems probable that the discovery of every new species will render more difficult the classification of the species based exclusively upon the external morphology.

As long as the water mite – fauna of large parts of the palaearctic region, for example, the mountains of Central Asia, is so poorly known, it cannot be decided if the genus *Partnunia* shows indeed an eastasian-european disjunct distribution.

VII. Key

1. Caudal acetabula usually elongated (l./w. 1.2-2.2; Figs. 22, 27); palp robust (l./h. P-1 0.5-0.7, P-4 3.1-3.7; Figs. 1, 2), maximum height of P-4 at the basis of the segment; genital skeleton short (118-130 µm, Figs. 31, 36).

P.angusta (Koen.)

– Caudal acetabula usually round (l./w. 0.6-1.2 µm; Figs. 21, 23-25) (if the caudal acetabula are elongated [l./w. up to 1.5], palp siender [l./h. P-1 0.7-1.0, P-4 3.6-4.5; Figs. 3, 4], with maximum height of P-4 in the middle of the segment, and genital skeleton longer [198-243 µm; Figs. 32, 37]); shape of palp and genital skeleton various 2

2. Palp slender (l./h. P-1 0.7-1.0; Figs. 3, 4), ventral margin of P-3 convex, maximum height of P-4 at the middle of the segment; caudal acetabular stalks long (27-54 µm, Figs. 21, 26; generally 35 µm).

P.steinmanni Walt.

– Palp robust (l./h. P-1 0.5-0.8; Figs. 5, 6, 8, 9, 13, 14), ventral margin of P-3 normally straight, maximum height of P-4 generally at the basis of the segment; caudal acetabular stalks short (12-33 µm; Figs. 23-25, 28-30) 3

3. Row of anterior genital acetabula continous (Figs. 25, 30); genital skeleton shortened (120-143 µm; Figs. 33, 38).

P.aprutina n.sp.

– Row of anterior genital acetabula with one or two gaps (Figs. 23/24, 28/29); genital skeleton longer (184-220 µm; Figs. 34/35, 39/40) 4

4. Number of setae on Cx-I 9-11 in males, 9-12 in females (Fig. 17); total length of the female palp 379-404 µm; brachia distalia of the genital skeleton in rectangular or obtuse-angled position (Fig. 35), in lateral view (Fig. 40) elevated in anterioposterior direction, cella proximalis caudally bluntly protruding.

P.uchidai Imamura

– Number of setae on Cx-I 11-18 in males, 13-19 in females (Fig. 18); total length of the female palp 435-497 µm; brachia distalia of the genital skeleton in acute-angled position (Fig. 34), largely fused in the ramus anterior, flattened in lateral view (Fig. 39); cella proximalis in lateral view rounded.

P.regalis n.sp.

VIII. Riassunto

L'autore discute la variabilità dei caratteri esterni, la morfologia dello scheletro genitale e la geonemia delle specie *Partnunia angusta* (Koen.), *P.steinmanni* Walter e *P.uchidai* Imamura; viene messo in sinonimia *P.raetica* Bader 1975 con *P.steinmanni*. Vengono descritte ed illustrate due specie nuove d'Italia, *P.regalis* (Sicilia, Calabria, Basilicata) e *P.aprutina* (Abruzzo), le cui larve sono parassite di plecotteri. Viene fornita una chiave per la determinazione delle specie di *Partnunia* attualmente conosciute; una loro coretta determinazione risulta impossibile senza il controllo dello scheletro genitale maschile.

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X. Literature

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Table 1: Water mites of the genus Partnunia**, mouthparts.**

Males	P. angusta		P. steinmanni		P. uchidai		P. regalis		P. aprutina	
Palp, dorsal length:										
P–1	29,0	(27 - 31;3)	43,0	(41 - 48;8)	29,8	(29 - 31;9)	31,7	(27 - 42;22)	32,4	(28 - 38;10)
P–2	106,3	(105 - 108;3)	102,4	(95 - 108;8)	100,0	(96 - 104;9)	106,7	(97 - 125;22)	100,8	(95 - 110;10)
P–3	59,7	(57 - 64;3)	71,0	(66 - 75;8)	62,6	(57 - 68;9)	63,3	(56 - 70;22)	60,8	(54 - 67;10)
P–4	140,7	(140 - 141;3)	169,3	(158 - 176;8)	136,4	(128 - 143;9)	137,2	(122 - 143;22)	143,2	(138 - 148;10)
P–5	42,0	(42 - 42;3)	46,4	(44 - 54;8)	35,4	(33 - 37;9)	40,6	(38 - 44;22)	42,6	(40 - 46;10)
Palp, total length	377,7	(375 - 383;3)	432,0	(406 - 445;8)	364,2	(348 - 373;9)	379,5	(356 - 394;22)	379,8	(366 - 397;10)
Dorsal length [% total length]:										
P–1	7,7	(7,2 - 8,1;3)	10,0	(9,5 - 10,8;8)	8,2	(7,8 - 8,6;9)	8,3	(7,1 - 10,7;22)	8,5	(7,4 - 9,9;10)
P–2	28,2	(27,4 - 28,8;3)	23,7	(23,3 - 24,3;8)	27,5	(27,0 - 27,9;9)	28,1	(26,6 - 32,1;22)	26,5	(25,3 - 27,9;10)
P–3	15,8	(15,2 - 16,7;3)	16,4	(15,8 - 17,4;8)	17,2	(16,3 - 18,2;9)	16,7	(15,1 - 18,3;22)	16,0	(14,1 - 17,6;10)
P–4	37,2	(36,8 - 37,6;3)	39,2	(38,3 - 39,8;8)	37,5	(36,8 - 38,4;9)	36,2	(34,3 - 37,7;22)	37,7	(36,6 - 38,5;10)
P–5	11,1	(11,0 - 11,2;3)	10,7	(9,9 - 12,2;8)	9,7	(8,8 - 10,3;9)	10,7	(9,6 - 11,8;22)	11,2	(10,5 - 12,2;10)
Height:										
P–1	52,7	(48 - 58;3)	51,6	(48 - 56;8)	51,7	(47 - 56;9)	51,9	(46 - 60;22)	50,3	(42 - 54;10)
P–2	70,3	(68 - 75;3)	62,3	(58 - 70;8)	65,6	(63 - 68;9)	71,0	(65 - 77;22)	69,2	(60 - ,75;10)
P–3	70,3	(68 - 75;3)	68,0	(62 - 70;8)	66,1	(62 - 69;9)	69,8	(65 - 75;22)	70,0	(65 - 73;10)
P–4	44,0	(43 - 45;3)	40,9	(35 - 43;8)	38,1	(36 - 41;9)	42,3	(38 - 48;22)	44,1	(40 - 46;10)
P–5	15,0	(15 - 15;3)	15,8	(15 - 17;8)	13,4	(12 - 15;9)	14,9	(14 - 17;22)	15,7	(14 - 18;10)
Dorsal length/height:										
P–1	0,6	(0,5 - 0,6;3)	0,8	(0,7 - 0,9;8)	0,6	(0,5 - 0,6;9)	0,6	(0,5 - 0,7;22)	0,6	(0,6 - 0,7;10)
P–2	1,5	(1,4 - 1,6;3)	1,6	(1,5 - 1,7;8)	1,5	(1,5 - 1,6;9)	1,5	(1,4 - 1,8;22)	1,5	(1,4 - 1,7;10)
P–3	0,8	(0,8 - 0,9;3)	1,0	(1,0 - 1,1;8)	0,9	(0,9 - 1,0;9)	0,9	(0,8 - 1,0;22)	0,9	(0,8 - 1,0;10)
P–4	3,2	(3,1 - 3,3;3)	4,1	(4,0 - 4,5;8)	3,6	(3,3 - 3,8;9)	3,3	(2,9 - 3,6;22)	3,3	(3,0 - 3,6;10)
P–5	2,8	(2,8 - 2,8;3)	2,9	(2,7 - 3,4;8)	2,7	(2,5 - 3,0;9)	2,7	(2,4 - 3,0;22)	2,7	(2,3 - 3,1;10)
Capitulum, length	186,0	(186 - 186;3)	192,0	(168 - 208;8)	197,9	(180 - 210;4)	183,9	(156 - 204;14)	192,6	(180 - 206;7)
Rostrum, length		–		–	49,5	(46 54;8)	45,1	(40 - 54;14)	50,3	(36 60;7)
Chelicera, length	197,3	(194 - 203;3)	207,4	(194 - 218;9)	186,1	(172 - 203;22)	188,8	(178 - 200;5)	191,5	(171 - 216;10)
Height	46,7	(45 - 50;3)	47,6	(44 - 52;9)	43,4	(41 - 48;5)	42,5	(38 - 50;19)	44,8	(42 - 47;10)
l./h.	4,2	(3,9 - 4,5;3)	4,4	(3,8 - 4,8;9)	4,4	(3,9 - 4,8;5)	4,4	(4,0 - 5,0;19)	4,3	(3,8 - 4,7;10)
Basal segment, l.	141,7	(137 - 147;3)	140,9	(134 - 148;9)	125,4	(120, - 136;5)	129,9	(117 - 146;22)	128,4	(120 - 138;10)
Claw, l.	55,7	(53 - 58;3)	67,7	(60 - 73;9)	63,4	(58 - 66;5)	56,3	(46 - 65;22)	62,0	(51 - 73;10)
Basal segment/claw	2,5	(2,4 - 2,7;3)	2,1	(1,9 - 2,3;9)	2,0	(1,9 - 2,1;5)	2,3	(1,9 - 2,8;22)	2,1	(1,8 - 2,4;10)

Females	P. angusta		P. steinmanni		P. uchidai		P. regalis		P. aprutina	
Palp, dorsal length:										
P–1	35,8	(30 - 41;12)	48,2	(42 - 56;11)	32,6	(30 - 36;8)	39,0	(30 - 46;18)	36,1	(30 - 42;11)
P–2	115,2	(105 - 122;12)	113,3	(106 - 122;11)	106,8	(102 - 110;8)	126,4	(114 - 140;18)	119,5	(99 - 132;11)
P–3	69,9	(62 - 77;12)	82,5	(73 - 89;11)	67,6	(65 - 70;8)	76,1	(67 - 87;18)	69,3	(60 - 77;11)
P–4	157,4	(140 - 172;12)	186,9	(178 - 204;11)	145,9	(140 - 154;8)	170,8	(162 - 188;18)	164,5	(140 - 178;11)
P–5	45,1	(42 - 48;12)	48,4	(44 - 54;11)	37,9	(35 - 42;8)	46,3	(40 - 50;18)	45,5	(40 - 51;11)
Palp, total length	423,3	(379 - 451;12)	479,2	(443 - 520;11)	390,8	(379 - 404;8)	458,6	(435 - 497;18)	434,7	(369 - 473;11)
Dorsal length [% total length]:										
P–1	8,4	(7,5 - 9,4;12)	10,0	(9,0 - 11,5;11)	8,3	(7,8 - 9,0;8)	8,5	(6,6 - 10,1;18)	8,3	(6,7 - 9,2;11)
P–2	27,2	(26,4 - 27,7;12)	23,6	(22,6 - 24,6;11)	27,3	(26,2 - 28,5;8)	27,6	(26,2 - 29,1;18)	27,5	(26,5 - 28,5;11)
P–3	16,5	(15,7 - 17,1;12)	17,2	(15,2 - 18,5;11)	17,3	(16,5 - 17,8;8)	16,6	(15,3 - 17,7;18)	15,9	(15,0 - 16,4;11)
P–4	37,2	(35,3 - 38,3;12)	39,0	(37,8 - 40,2;11)	37,3	(36,6 - 38,2;8)	37,2	(36,2 - 38,6;18)	37,8	(37,3 - 38,5;11)
P–5	10,7	(10,1 - 11,1;12)	10,1	(9,3 - 10,8;11)	9,7	(9,2 - 10,4;8)	10,1	(8,9 - 11,0;18)	10,5	(9,3 - 11,5;11)
Height:										
P–1	57,1	(50 - 66;12)	54,2	(50 - 60;11)	56,8	(51 - 62;8)	58,9	(53 - 65;18)	57,4	(51 - 65;11)
P–2	70,1	(63 - 76;12)	70,6	(60 - 77;11)	69,5	(66 - 75;8)	79,1	(70 - 95;18)	78,8	(70 - 91;11)
P–3	72,1	(63 - 79;12)	73,4	(63 - 84;11)	70,3	(66 - 74;8)	80,6	(70 - 93;18)	79,2	(70 - 90;11)
P–4	45,8	(43 - 50;12)	44,5	(42 - 46;11)	40,1	(37 - 44;8)	46,4	(40 - 52;18)	47,1	(42 - 50;11)
P–5	15,7	(14 - 17;12)	16,7	(14 - 20;11)	13,1	(11 - 14;8)	15,9	(14 - 18;18)	17,0	(14 - 20;11)
Dorsal length/height:										
P–1	0,6	(0,5 - 0,7;12)	0,9	(0,8 - 1,0;11)	0,6	(0,5 - 0,6;8)	0,7	(0,5 - 0,8;18)	0,6	(0,6 - 0,7;11)
P–2	1,6	(1,6 - 1,7;12)	1,6	(1,5 - 1,8;11)	1,5	(1,5 - 1,6;8)	1,6	(1,4 - 1,8;18)	1,5	(1,4 - 1,7;11)
P–3	1,0	(0,9 - 1,0;12)	1,1	(1,0 - 1,4;11)	1,0	(0,9 - 1,0;8)	0,9	(0,8 - 1,1;18)	0,9	(0,8 - 0,9;11)
P–4	3,4	(3,2 - 3,7;12)	4,2	(4,0 - 4,4;11)	3,6	(3,5 - 4,0;8)	3,7	(3,3 - 4,2;18)	3,5	(3,2 - 3,8;11)
P–5	2,9	(2,6 - 3,1;12)	2,9	(2,5 - 3,3;11)	2,9	(2,6 - 3,5;8)	2,9	(2,6 - 3,4;18)	2,7	(2,4 - 2,9;11)
Capitulum, length	204,0	(190 - 230;8)	233,0	(223 - 240;5)	212,9	(198 - 235;10)	229,8	(192 - 245;15)	227,3	(206 - 247;10)
Rostrum, length	48,8	(45 - 56;9)			50,5	(46 - 60;4)	54,9	(46 - 65;15)	60,2	(50 - 73;10)
Chelicera, length	207,2	(196 - 218;9)	231,4	(214 - 247;9)	199,0	(190 - 211;6)	223,7	(203 - 249;15)	225,5	(199 - 244;12)
Height	48,4	(45 - 56;9)	53,6	(50 - 61;9)	49,3	(47 - 51;6)	49,0	(42 - 56;15)	51,2	(48 - 55;12)
l./h.	4,3	(3,7 - 4,6;9)	4,3	(3,9 - 4,6;9)	4,0	(3,8 - 4,3;6)	4,6	(4,1 - 5,6;15)	4,4	(4,0 - 4,9;12)
Basal segment, l.	146,1	(137 - 153;9)	155,3	(144 - 164;10)	135,3	(128 - 147;6)	150,4	(138 - 164;15)	151,3	(136 - 164;12)
Claw, l.	61,1	(58 - 65;9)	75,4	(70 - 84;10)	63,7	(58 - 66;6)	71,4	(65 - 85;15)	72,6	(63 - 83;12)
Basal segment/claw	2,4	(2,3 - 2,6;9)	2,1	(1,8 - 2,2;10)	2,1	(2,0 - 2,3;6)	2,1	(1,9 - 2,4;15)	2,1	(1,9 - 2,5;12)

Table 2: Partnunia**, genital region and coxae**

Males	P. angusta		P. steinmanni		P. uchidai		P. regalis		P. aprutina	
Genital acetabula, number	25,0	(23 - 26;3)	29,0	(25 - 37;11)	16,0	(14 - 19;15)	16,0	(13 - 21;21)	22,0	(19 - 27;11)
Caudal acetabulum, length	38,4	(30 - 51;18)	27,1	(22 - 38;11)	14,8	(13 - 18;14)	18,2	(16 - 21;13)	15,8	(14 - 18;9)
Caudal acetabulum, width	22,3	(19 - 30;18)	24,2	(22 - 29;11)	23,2	(21 - 25;14)	20,3	(17 - 23;13)	18,9	(13 - 24;9)
Caudal acetabulum, l./w.	1,7	(1,5 - 2,2;18)	1,1	(0,8 - 1,5;11)	0,6	(0,6 - 0,8;14)	0,9	(0,7 - 1,2;13)	0,9	(0,7 - 1,1;9)
Acetabular stalk, length	32,7	(21 - 43;18)	41,9	(35 - 52;11)	18,5	(15 - 23;14)	15,2	(12 - 22;10)	15,3	(12 - 27;9)
Stalk, l./acetabulum, l.	0,9	(0,5 - 1,2;18)	1,6	(1,2 - 1,8;11)	1,3	(0,9 - 1,6;14)	0,9	(0,6 - 1,4;8)	1,0	(0,8 - 1,5;9)
Gonopore, length	171,3	(168 - 176;3)	183,2	(160 - 206;5)	154,1	(140 - 160;8)	148,3	(135 - 164;13)	143,2	(130 - 155;9)
Genital flaps, hairs, n.	27,0	(25 - 28;3)	30,0	(25 - 37;11)	23,0	(19 - 28;13)	30,0	(23 - 37;23)	33,0	(26 - 40;11)
Genital skeleton, length	122,7	(118 - 130;3)	207,4	(180 - 230;8)	204,4	(190 - 214;9)	202,1	(184 - 220;18)	132,2	(120 - 143;6)
Coxae-I, hairs, n.	12,0	(11 - 14;3)	10,3	(9 - 11;6)	9,7	(9 - 11;13)	13,2	(10 - 17;22)	15,0	(12 - 17;11)
Females	P. angusta		P. steinmanni		P. uchidai		P. regalis		P. aprutina	
Genital acetabula, number	26,0	(21 - 29;12)	37,0	(29 - 55;11)	19,0	(16 - 21;14)	20,0	(16 - 27;20)	28,0	(24 - 35;13)
Caudal acetabulum, length	42,8	(32 - 62;26)	27,4	(21 - 35;25)	15,9	(12 - 19;12)	20,7	(16 - 24;17)	18,8	(14 - 22;12)
Caudal acetabulum, width	25,6	(21 - 34;26)	25,3	(21 - 30;25)	23,0	(18 - 26;12)	25,4	(21 - 30;17)	22,4	(18 - 25;12)
Caudal acetabulum, l./w.	1,7	(1,2 - 2,2;26)	1,1	(0,8 - 1,5;25)	0,7	(0,6 - 0,9;12)	0,8	(0,6 - 1,0;17)	0,8	(0,7 - 1,0;12)
Acetabular stalk, length	38,2	(29 - 49;26)	44,9	(32 - 54;25)	22,2	(14 - 33;12)	23,9	(16 - 31;13)	17,9	(12 - 23;12)
Stalk, l./acetabulum, l.	0,9	(0,6 - 1,3;26)	1,7	(1,3 - 2,5;25)	1,4	(0,9 - 2,1;12)	1,2	(0,8 - 1,9;11)	1,0	(0,8 - 1,1;12)
Gonopore, length	209,4	(160 - 230;12)	239,2	(220 - 260;10)	187,6	(170 - 206;8)	214,5	(192 - 245;20)	216,0	(182 - 268;12)
Genital flaps, hairs, n.	29,0	(22 - 39;12)	29,0	(27 - 32;11)	26,0	(22 - 29;10)	31,0	(26 - 38;20)	36,0	(28 - 42;13)
Coxae-I, hairs, n.	12,0	(10 - 14;11)	11,0	(10 - 12;11)	10,4	(9 - 12;15)	15,0	(12 - 18;28)	17,0	(15 - 19;13)