

Biosystematics of the Genus *Massartella* Lestage (Ephemeroptera: Leptophlebiidae: Atalophlebiinae) from South America

by

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The genus *Massartella* and the species *M. alegrettae* Ulmer and *M. brieni* (Lestage) (= *M. fruhstorfferi* Ulmer, New Synonymy) are redescribed. The male subimagines of *M. alegrettae* and *M. brieni*, and the nymph of the latter are described for the first time. A new species, *M. venezuelensis* is described from nymph and female subimago. Two immature *Massartella* nymphs, unassociated with adults and not identifiable to species, have been collected in Argentina.

Illustrated keys for the nymphs and imagines are provided for the species.

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INTRODUCTION

This paper represents Part V of a series revising the cool-adapted Leptophlebiidae of South America. Part I (Pescador and Peters, 1980a), and Part II (Pescador and Peters, 1982) included descriptions of new genera and species. Part III (Pescador and Peters, 1985) discussed the biosystematics and phylogenetic relationships of the genus *Nousia*, and Part IV (Pescador and Peters, 1987) revised the genera *Meridialaris* and *Massartellopsis*.

Methods of gut analysis and descriptive terminology are the same as in previous parts of the series. Localities, stages (N for nymph, I for imago and S for subimago) and deposition of examined materials are given in the treatments of each species to facilitate access to specimens for future study. Reared specimens are indicated by the abbreviation R following the stages.

The names of the collectors are abbreviated as follows: (CGF) Claudio G. Froehlich, (ED) Eduardo Dominguez, (EJF) E.J. Fittkau, (FP) F. Plaumann, (CM & OSF) Carol M. & Oliver S. Flint, Jr., (JI) Joachim Illies, (WB) W. Besch, (WLP & JGP) William L. and Janice G. Peters, and (WS) W. Sattler.

Genus *Massartella* Lestage

Massartella Lestage, 1930:251; Ulmer, 1943:14; Traver, 1946:422; Demoulin, 1955a:227; Pescador and Peters, 1980:47

Type Species: *Atalophlebia brieni* Lestage, original designation.

Species included: *M. alegrettae* Ulmer, *M. brieni* (Lestage) (= *M. fruhstorfferi* Ulmer, New Synonymy), and *M. venezuelensis* new species.

Distribution: Disjunctly distributed in southeastern Brazil-northeastern Argentina, and the Guiana Shield along the Venezuela-Brazil border (Fig. 45). *Massartella* represents the most northern geographic limits among the ten Patagonia Shield, South Andean, cold-adapted leptophlebiid genera of the Neotropics (Savage 1987).

Imago. Length: male body 10.0-16.0 mm, fore wings 13.0-20.0 mm; female body 13.0-18.0 mm, fore wings 15.0-20.0 mm. Male eyes meet on meson of head, lower portion of eyes $3/4$ length of upper portion; female eyes separated on meson of head by a length 4-5 times width of an eye. Wings (Fig. 1-3): vein Rs of fore wings forked $1/4$ distance from base to margin; vein MA forked a little more than $1/2$ distance from base to margin, fork symmetrical, distal portion moderately sagged (Fig. 1); vein MP_2 strongly recurved, attached at base to vein MP_1 with a cross vein $1/5$ distance from base to margin; vein ICU_1 attached at base by a cross vein to veins CuA and CuP, distally parallel to vein CuA (Fig. 1). Costal margin of hind wings convex with concavity located approximately $1/2$ distance from base, apex obtuse (Fig. 2); vein Sc $9/10$ maximum length of hind wings (Fig. 2). Legs: ratios of segments in male fore legs, 0.70:1.00 (4.80 mm): 0.08:0.39:0.30:0.23:0.14; claws of a pair alike, both apically hooked each with an opposing hook (Fig. 4). Male genitalia (Fig. 5-8): segments 2 and 3 of forceps equal in length, either segment $1/10$ length of segment 1; base of segment 1 broad forming an angular bend on inner margin (Fig. 5); maximum length of styliger plate along median line $1/4$ - $1/3$ maximum width; penis lobes divided with subapical projections (Fig. 5-8). Female 9th sternum deeply cleft apically (Fig. 9). Median filament longer than cerci.

Egg. Elongate oval; polar cap absent; chorion covered with fine fibrous filaments and adorned with hexagonal ridges (Fig. 39); small circular spongy structure inside hexagonal ridges (Fig. 40); one circular sperm guide (Fig. 40).

Mature Nymph. Head prognathous. Antennae with long thick hair, and small denticles near apex of flagellar joints. Mouthparts (Fig. 20-31). Clypeus as wide as labrum, lateral margins parallel (Fig. 20). Labrum broad with 1 transverse row of fringed hair near dorsoapical margin; anteromedian emargination broad, U-shaped with 4-5 small irregular denticles (Fig. 21); lateral margins slightly expanded apically (Fig. 20). Outer margin of mandibles slightly curved, with median hair tuft (Fig. 22-23); inner margin of outer incisor with minute denticles (Fig. 24). Segments 1 and 2 of maxillary palpi equal in length, segment 3 slightly shorter with thick hairs (Fig. 25); segment 2 with simple (Fig. 27) or pectinate setae (Fig. 26). Lingua of hypopharynx with well developed lateral processes (Fig. 31). Segment 2 of labial palpi $4/5$ length of segment 1, equal to slightly shorter than segment 3; inner margin of segment 3 with comb of peg-like setae (Fig. 29-30); glossae ventrally curved; submentum with long lateral spines (Fig. 28). Thoracic pronotum with lateral spines. Legs: maximum width of tarsi approximately $1/2$ maximum width of tibiae; coxae and trochanters with thick spines (Fig. 32); dorsum of femora scaly with broad lanceolate setae (Fig. 41); denticles on claws progressively larger apically except apical denticle much

larger (Fig. 33). Abdomen: posterolateral spines on segments 2-9 (Fig. 35-36); terga scaly with long dorsal hair (Fig. 43), short lateral spines, and broad posterior spines and long feather-like setae (Fig. 42). Sterna glabrous (Fig. 34A) or with thick hair (Fig. 34B). Gills (Fig. 37-38): gills on abdominal segments 1-6, dorsal and ventral portion of lamellae plate-like with dorsal portion apically terminated in one slender process (Fig. 37-38); main tracheal trunk strongly curved towards inner margin of lamellae with developed branches on both sides. Median filament longer than cerci; caudal filaments with combination of long hairs, and large spines (Fig. 44).

Discussion. Lestage (1930) established *Massartella* for *M. brieni* which he earlier (1924) had placed in *Atalophlebia*. Lestage's decision to transfer the species *brieni* to *Massartella* was based on the cubital veins of the fore wings. According to him vein ICu_1 of the fore wings extends from the base to the margin of the wing, and vein Cu_1 (CuP) is short and basally attached to ICu_1 (Fig. 1). Ulmer (1943) recognized *Massartella* as a distinct genus but strongly disagreed with Lestage's generic criterion and interpretation of the cubital veins. According to Ulmer, Cu_1 (CuA) is not shortened but rather extends from the base to the wing margin and ICu_1 is basally attached to Cu_2 (CuP). Furthermore, Ulmer (1943) correctly stated that to use the cubital veins as the only character to establish the genus *Massartella* is inadequate because a few species of *Atalophlebia*, viz., *A. versicolor*, *A. dentata*, *A. nodularis*, and *A. scita*, also exhibit the same characters of the cubital veins.

Consequently Ulmer suggested other characters which are distinctive to *Massartella*, viz., the long rod-like penis lobes, and the presence of a subapical projection on the outer margin of each penis lobe (Fig. 5-8). Peters and Edmunds (1972) redescribed *Massartella* based on reared specimens, and confirmed Demoulin's (1955a) association of the nymph and adults. Having examined the holotype of each of the species, and with the recent discovery of a new species, we herein redefine the genus. We found that *Massartella* can easily be distinguished from all the other genera of Leptophlebiidae by the following combinations of characters. In the imagines: (1) hind wings lack a costal projection and length of vein Sc is 9/10 of hind wings (Fig. 2); (2) vein ICu_1 of fore wings is attached at base by a cross vein to veins CuA and CuP , and distally parallel to veins CuA and CuP (Fig. 1); (3) claws of a pair are alike, both apically hooked, each with an opposing hook (Fig. 4); (4) penis lobes are divided, and each lobe has one subapical projection (Fig. 5-8); and (5) female ninth abdominal sternum is deeply cleft apically (Fig. 9). In the nymph: (1) clypeus is as wide as the labrum (Fig. 20); (2) length of labrum is approximately 1/2 maximum width, and lateral margins are slightly expanded apically (Fig. 20); (3) mandibles have slightly curved outer margin, and median hair tuft (Fig. 22-23); (4) glossae are ventrally curved, and submentum has several long lateral spines (Fig. 28); (5) claws have denticles which are progressively larger apically except apical denticle is much larger (Fig. 33); (6) abdomina terga have series of short lateral spines (Fig. 35), and broad posterior spines and long feather-like

setae (Fig. 42); and (7) abdominal gills occur on segments 1-6, and are alike, plate-like and have well developed dorsal and ventral lamellae with the dorsal lamella apically terminated in a slender process (Fig. 37-38). The eggs have chorion covered with fibrous filaments, and are adorned with hexagonal ridges (Fig. 39-40).

Pescador and Peters (1980b) placed *Massartella* in the same phyletic line with *Penaphlebia* and *Atalophlebia* but it can be distinguished from these genera by the following combination of characters. In the imagines: (1) vein ICu₁ of fore wings is attached at base by a cross vein to veins CuA and CuP (Fig. 1); (2) segments 2 and 3 of genital forceps are short, and either segment is approximately 1/10 length of segment 1 (Fig. 5); and (3) penis lobes are divided and each lobe has a subapical projection (Fig. 4-8). In the nymph: (1) pronotum has lateral spines and hair; (2) claws have denticles which are progressively larger apically except apical denticle is much larger (Fig. 33); (3) abdominal terga have a series of short lateral spines (Fig. 35) and thick dorsal hair (Fig. 43); and (4) abdominal gills occur on segments 1-6 with main traceal trunk strongly curved towards inner margin of lamellae (fig. 37-38). The egg chorion is uniquely adorned with fibrous hexagonal ridges (Fig. 39).

Key To Species of *Massartella*

Imagines

1. Wing membrane faintly toned with brown, cross veins clouded with dark brown; Cu area of fore wings encloses a network of cross veins (Fig. 3); maculae on abdominal terga as in Fig. 15-17; penis lobes apically pointed (Fig. 8). *M. alegrettae* Ulmer
 Wing membrane hyaline except costal and subcostal membranes of fore wings toned with brownish-yellow, cross veins not clouded; Cu area of fore wings with little or no network of cross veins (Fig. 1); maculae on abdominal terga as in Fig. 10-14; penis lobes apically blunt (Fig. 5-7). *M. brieni* (Ulmer)

Mature Nymphs

1. Posterolateral spines of abdominal segments short, less than 1/2 maximum median length of a segment (Fig. 36); abdominal sterna with prominent thick hair (Fig. 34b); segment 2 of maxillary palpi with pectinate setae (Fig. 26); mandible with thin median hair tuft (Fig. 22). *M. brieni* Ulmer
 Posterolateral spines of abdominal segments long, 3/4 to equal maximum median length of a segment (Fig. 35); abdominal sterna glabrous (Fig. 35a); segment 2 of maxillary palpi with spinous setae (Fig. 27); mandible with thick median hair tuft (Fig. 23). *M. venezuelensis* sp. n.

Massartella alegrettae Ulmer

Massartella alegrettae Ulmer, 1943:21, fig. 38-40 (male); Hubbard, 1982:265.

Male imago (pinned). Length: body 9.0 mm, fore wings 11.3 mm. Head yellowish-brown. Scape and pedicel of antennae reddish-brown, flagellum brown, lighter toward apex. Ocelli translucent white. Upper portion of eyes greyish red, lower portion black. Thorax: nota brownish-yellow, pronotum

slightly paler with a pair of submedian longitudinal black stripes. Pleura yellow, postcoxal sutures and katepisterna black. Sterna brownish-yellow. Wings: membrane hyaline, faintly toned with brown particularly pronounced on costal and subcostal membranes; longitudinal and cross veins brown, cross veins clouded with dark brown; intercalaries of Cu area of fore wings divergent with network of cross veins (Fig. 3); costal cross veins of fore wings 30, hind wings 13. Legs: pro- and one mesothoracic legs missing, remaining legs brownish-yellow, joints of tarsal segments darker; femora with broad transverse postmedian and an apical black brown bands. Abdomen: terga dark yellow with black maculae as in Fig. 15-17; Sterna dark yellow, washed with black, particularly pronounced on margins of each sternite (Fig. 17). Genitalia: forceps brown. Styliiger plate purplish-brown with shallow, U-shaped posteromedian emargination. Penes yellow, gradually becoming dark brown apically: penis lobes apically pointed, each lobe with 1 subapical spine (Fig. 8). Caudal filaments: broken off and missing.

Female imago. Unknown.

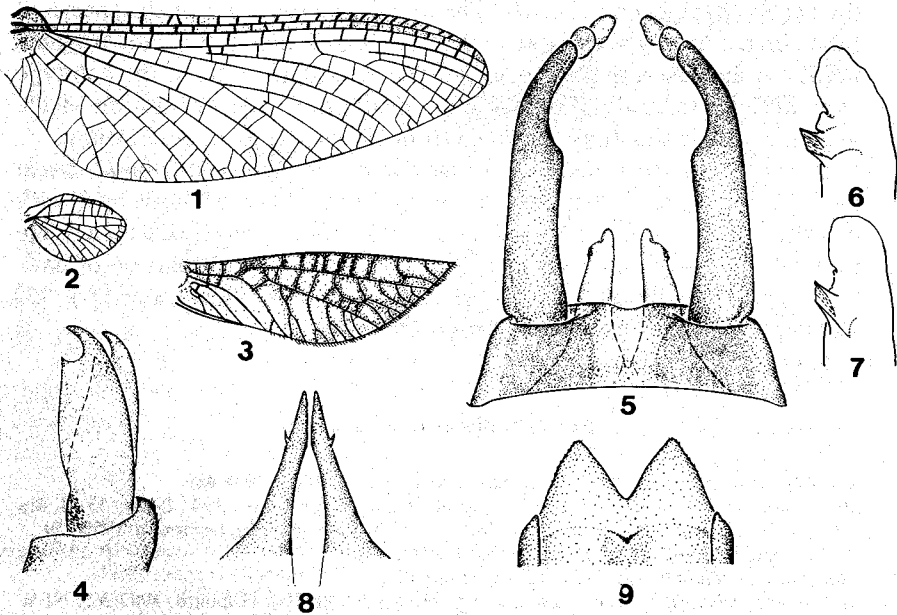


Fig. 1-9 Imago and subimago of *Massartella*. 1-2, fore and hind wings of *M. brieni* ♂ imago; 3, Cu-A area of *M. alegrettae*, ♂ subimago; 4-7, *M. brieni*, ♂ imago (4, fore claw; 5, genitalia, ventral; 6-7, penis lobes, lateral); 8, *M. alegrettae*, penes, ventral; 9, 9th sternum of *M. brieni*, ♀ imago.

Male subimago (in alcohol). Similar to imago except as follows: head pale yellow, margins brown; thoracic nota yellow, pronotum washed with purplish-brown near lateral margins; mesonotum yellow, purplish-brown between inner and outer parapsidal furrows, and posterolateral corners; pleura and sterna washed with smoky brown; wing membranes pale yellow, faintly washed with brown, longitudinal and cross veins of fore and hind wings thickly clouded with dark brown; genital forceps and penes pale yellow, washed with purplish-brown; caudal filaments consist of 3 dark brown segments alternated with a pale yellow segment.

Nymph. Unknown.

Type locality. Alegrete, Rio Grande do Sul State, Brazil. Deposition of type. Zoologisches Museum für Naturkunde, Berlin, Germany (DDR).

Geographical distribution (Fig. 45). *Massartella alegrettae* is apparently not as common as *M. brieni*. One of us (WLP) was able to collect only one male subimago during a collecting trip to Brazil.

Brazil, Rio Grande do Sul: Alegrete; S (♀) Parana State. Rio Marumbi, Marumbi, 500 m, 15/16-II-1969, WLP & JGP.

Discussion. *Massartella alegrettae* was originally described from a male imago by Ulmer (1943). Since then neither the nymphs nor female adults of the species have been collected. The above redescription of the species is based on the holotype and one recently collected male subimago. We must point out, however, that the dried and shrivelled genitalia of the holotype were difficult to study. Therefore, the description and illustration of the genitalia used in the study are taken from Ulmer's original description.

The adults of *Massartella alegrettae* can be distinguished from *M. brieni* by the following adult characters: (1) wing membranes are faintly toned with brown, and the cross veins are clouded with dark brown; (2) Cu area of the fore wings encloses a network of cross veins (Fig. 3); (3) pattern of dark brown maculae on the abdominal terga and sterna is as illustrated (Fig. 15-17); and (3) penis lobes are apically pointed (Fig. 8).

Biology. Unknown.

Massartella brieni (Lestage)

Atalophlebia brieni Lestage, 1924:22; (male, female, egg); Lestage, 1930:439.

Massartella brieni Lestage, 1930:251 fig. 1 (male, female, egg); Ulmer, 1943:19, fig. 33-34, 41a (male, female, egg); Demoulin, 1955a:14, fig. 8-10 (female, nymph); Demoulin, 1955b:59; Peters and Edmunds, 1972:1404; Hubbard, 1982:265.

Atalophlebia axillata Navas, 1934:163, Fig. 39 (male).

Massartella fruhstorfferi Ulmer, 1943:20, fig. 41b (male, female). Hubbard, 1982:265. NEW SYNONYMY

Male imago (in alcohol). Length: body 14.0-16.0 mm, fore wings 16.0-20.0 mm. Head yellow with black lines near base of antennae. Scape and pedicel of antennae orange brown, flagellum yellow. Ocelli white. Upper portion of eyes purplish-gray, lower portion black. Thorax: nota dark brown,

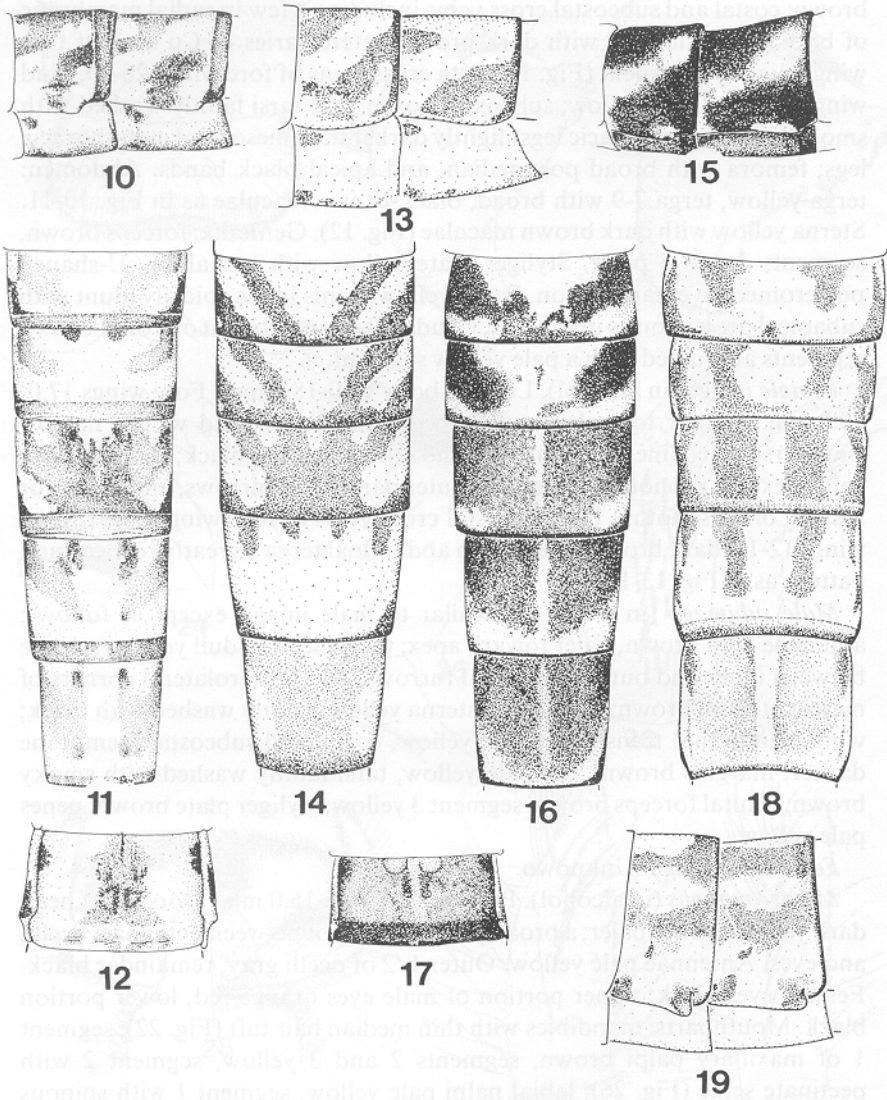


Fig. 10-19. Abdominal color patterns of *Massartella* imagines and subimagines. 10-14, *M. brieni*: 10-12, ♂ imago (10, pleura 6-7; 11, terga 4-8; 12, sternum 6); 13-14, ♀ imago (13, pleura 6-7; 14, terga 4-8). 15-17, *M. alegrettae*, ♂ subimago (15, pleura 6-7; 16, terga 4-8; 17, sternum 6). 18-19, *M. venezuelensis*, ♀ subimago (18, terga 4-8; 19, pleura 6-7).

pronotum pale yellow, margins black; pronotum with a pair of broad, submedian longitudinal black lines. Pleura brown, postcoxal sutures black. Sterna yellow, mesofurcasternum brown. Wings: membrane hyaline, costal and subcostal membranes of fore wings toned with light brown; veins dark

brown; costal and subcostal cross veins including a few in radial membrane of both wings clouded with dark brown; intercalaries of Cu area of fore wings slightly divergent (Fig. 1); costa cross veins of fore wings 28-30, hind wings, 10-12. Legs: yellow; subcoxae, coxae, and tarsi faintly washed with smoky brown; prothoracic legs slightly darker than meso- and metathoracic legs; femora with broad postmedian, and apical black bands. Abdomen: terga yellow, terga 7-9 with broad, black-brown maculae as in Fig. 10-11. Sterna yellow with dark brown maculae (Fig. 12). Genitalia: forceps brown, segments 2 and 3 paler. Styliiger plate yellow with a shallow, U-shaped posteromedian emargination. Penes yellow, penis lobes apically blunt with subapical projection as in Fig. 5-7. Caudal filaments consist of 3 dark brown segments alternated with a pale yellow segment.

Female imago (in alcohol). Length: body 15.0-18.0 mm. Fore wings 17.0-20.0 mm. Similar to male imago except as follows: head with a narrow transverse black line between ocelli and antennae; eyes black; thoracic nota yellow except pronotum, inner and outer parapsidal furrows, and posterior margin of mesonotum brown; costal cross veins of fore wings 28-31, hind wings 12-15; dark brown maculae on abdominal terga 8 greatly reduced and pattern as in Fig. 13-14.

Male subimago (in alcohol). Similar to male imago except as follows: antennae light brown, paler toward apex; thoracic nota dull yellow, sclerite between inner and outer parapsidal furrows, and posterolateral corners of mesoscutellum brown; pleura and sterna yellow, faintly washed with black; wing membranes translucent pale yellow, costal and subcostal membrane darker, margins brown; legs pale yellow, tarsi faintly washed with smoky brown; genital forceps brown, segment 3 yellow; styliiger plate brown; penes pale yellow.

Female subimago. Unknown.

Mature nymphs (in alcohol). Body length 14.0-16.0 mm. Dorsum of head dark yellow, venter paler; a broad pale yellow spot between antennae, ocelli, and eyes. Antennae pale yellow. Outer 1/2 of ocelli gray, remainder black. Female eyes black; upper portion of male eyes orange red, lower portion black. Mouthparts: mandibles with thin median hair tuft (Fig. 22); segment 1 of maxillary palpi brown, segments 2 and 3 yellow, segment 2 with pectinate setae (Fig. 26); labial palpi pale yellow, segment 1 with spinous setae, and long hair, inner margin of segment 3 with 2 rows of peg-like setae (Fig. 29). Thoracic nota yellow with scattered dark brown markings along margins; pronotum with 2 elongated pale yellow spots near midposterior margin; sterna yellow. Legs yellow except coxae dark brown; femora with basal and apical brown bands; tibiae with a narrow basal, and broad postmedian dark brown bands; tarsi with dark brown basal band, much broader on protarsi; claws with 10-14 denticles. Abdomen: terga yellow with dark brown to black maculae (Fig. 36). Sterna yellow with prominent thick hairs (Fig. 34b); length of posterolateral spines of abdomen less than

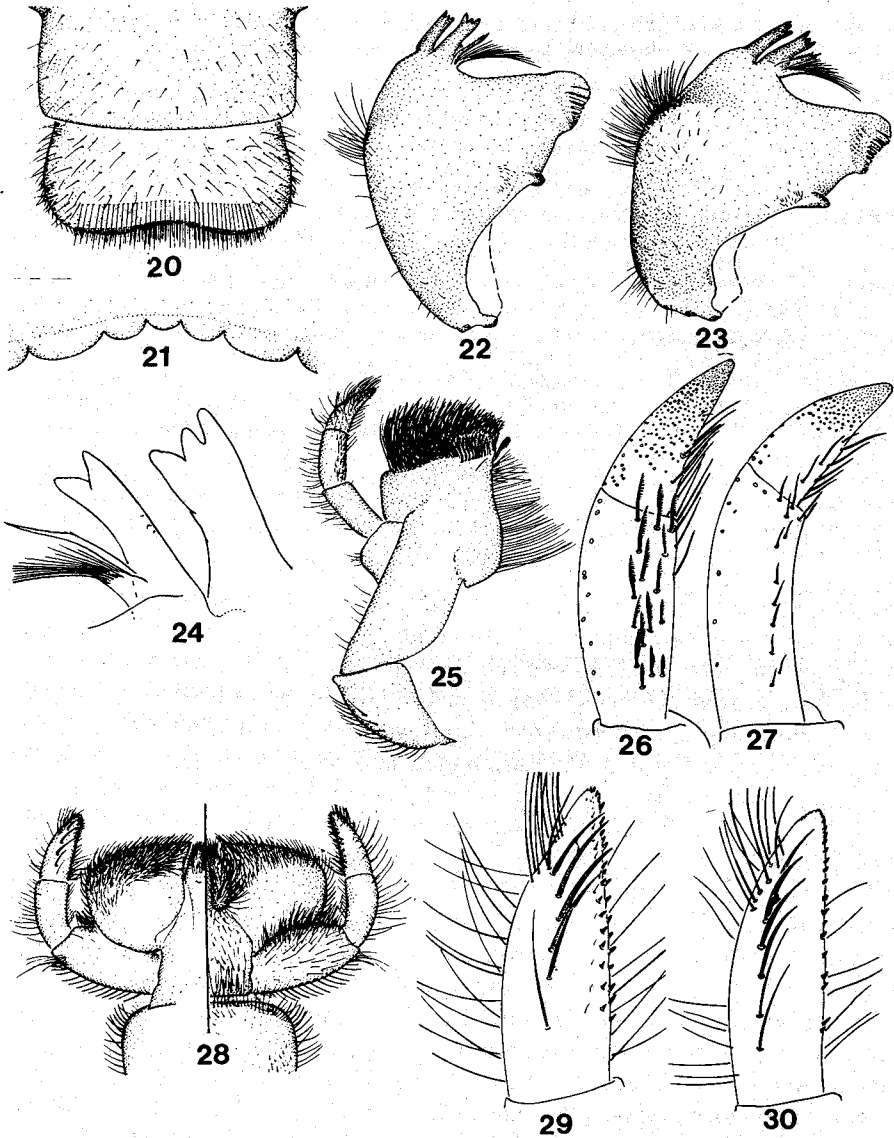


Fig. 20-30. Mouthparts of *Massartella*, mature nymphs. *M. brieni* (20-22, 24-26, 28-29). *M. venezuelensis* (23, 27, 30). 20-21, dorsal view of labrum, 22-23 left mandibles; 24, mandibular prostheca and incisor; 25-27, maxilla (25, right maxilla, ventral; 26-27, maxillary palpi); 28-30, labium (28, labium, dorsal [left], ventral [right]; 29-30, enlarged 3rd segment of labial palpi, dorsal).

1/2 maximum median length of segment (Fig. 35). Gill membrane greyish, trachae dark brown; dorsal portion of gill lamellae with well developed apical process (Fig. 37). Caudal filaments yellow with shiny brown annulations at every 4th joint.

Type locality. A torrential stream in a big virgin forest in Marumbi, Paraná State, Brazil.

Deposition of type. Zoologisches Institut und Zoologisches Museum, Hamburg, Germany (BRD).

Geographical distribution (Fig. 45). *Massartella brieni* is presently known from the high mountainous rivers and streams of southeastern Brazil.

Brazil: *Minas Gerais State*, N. Levantina, "Minhoca" stream, 16.VIII/1.X.1963, WS. *Paraná State*, N, a torrential stream in a big virgin forest in Marumbi, 1,090 m 1922, WB; S (♂, ♀), Rio Marumbi, Marumbi, 1,600 m, 15/16. II. 1969, JGP & WLP; N, Rio das Lontras, Palmas. 26° 27' B. 52° 03' L, 1200 m, III.1963, FP; N, Guapuava, Rio das Montes, 25° 20' B. 51° 27' L, 1100 m, III.1963, FP; N, small stream on property of Dr. H. Jacobi, 7 km W Curitiba, 18.II.1969, WLP&JGP; N, small stream, 1/2 km SE Estrada du Itupava, 750 m, 23.II.1969, WLP&JGP. *Rio Grande do Sul State*, N, I (♂, ♀), Municipio Bom Jesus, Bom Jesus Creek, 23/24.X.1961, E.J.F. N, Nova Teutonia 27° 11' B. 52° 23' L, III.1962/XI. 1963, FP. *São Paulo State*, N, I (♂), small stream in *Boraceia*, 12/13.VI.1958, JI; N. Campos do Jordao, Serra da Mantigueira, 29.I.1959, CGF; I (♀), stream, 50 km SE São Paulo on camino do Mar, 5.XI.1961, CGF; N, Colia, W São Paulo, Reserva D.A.E. 13.I.1961, CGF; N, Rio Turvo, São Miguel, 800 m, XI.1963, FP; N. S. I. (♂, ♀, R). Estacao Biológica Paranápiaçaba, nr. Paranápiaçaba, 19/VII/22/23.III.61, 23.VII/9.VIII.1962, 19.VIII/17/23.IX/15.X.1963, 22/23.III.1964, 19/20.V.1966, CGF; I (♀), Monte do Jaragua, 24.X.1965, CGF; N. Rio Guaratuba, Estacao Biológica de Boraceia, nr. Salesópolis, 27.V/10.VI.1966, CGF; N. Ribeirao Venerando, Estacao Biológica de Boraceia, nr. Salesópolis, 23.IX.1966, CGF; N.S.I (♂, ♀), Corrego da pedreira, Estacao Biológica de Boraceia, nr. Salesópolis, 23.IX/7.X.1966, CGF; N. Caverna do diablo, nr. Eldorado, 23.X.1966, CGF; I (♀), Monte do Jaragua, São Paulo, 2.III.1967, CGF; N, 850 m, EST. Biol. Boraceia, Rib. Venerando, 3.IV.1976, CM & OSF.

Discussion. The original description of *Massartella brieni* was based on a male imago and five female imagines. With additional specimens available, Ulmer (1943) subsequently refined Lestage's description of the species with illustrations. Furthermore, Ulmer (1943) described two other species in the genus, *M. alegrettae* and *M. fruhstorfferi*. After careful examination of the type materials of *M. brieni* and *M. fruhstorfferi*, and recently collected specimens including reared adults we were convinced that these two species are the same. Ulmer's (1943) diagnostic characterization of the male genitalia of *M. fruhstorfferi* of having the subapical projection of the penis lobes located approximately three times its length from the apex of penes compared to two times in *M. brieni* is variable. Actually, the distance of the subapical projections from the apex of the penes varies from two to almost five times the length of the projection. The penes are membranous (Fig. 6-7), and postmortem contractions of extensions of the lobes undermine the distance of the projections from the apex. Further we found that the pattern of maculae on the abdominal terga is variable and an unreliable character to distinguish the two species. Therefore we herein synonymize *Massartella fruhstorfferi* with *M. brieni*, and designate the latter species as the senior synonym. The redescription of the species is based on two males which Ulmer (1934) used to redefine the species, and additional specimens collected by Dr. Claudio G. Froehlich, and Dr. and Mrs. William L. Peters. Male subimago and nymphs are described for the first time. Association of nymph and imagines is by rearing.

The adults and nymphs of *M. brieni* exhibit a few minor color and morphological variations which occur throughout the distributional range of the species. The color of the median area of the mesonotum of the male subimagines ranges from yellow to dark reddish-brown. A few nymphs have a

narrow, median longitudinal pale yellow line on the abdominal terga. Denticles on the claws of a few nymphs are blunt while sharply pointed in others.

The imagines of *Massartella brieni* can be distinguished from *M. alegrettae* by the following combination of characters: (1) Cu area of fore wings lacks network of cross veins (Fig. 1); (2) pattern of maculae on the abdominal terga and sterna is as in Fig. 10-14; (3) penis lobes are apically blunt and each lobe has short subapical projection (Fig. 5). The subimagines differ from *M. alegrettae* and *M. venezuelensis* by the pattern of maculae on the abdominal terga (Fig. 10-14). The nymphs can be distinguished from *M. venezuelensis* by the following combination of characters: (1) mandibles have a thin median hair tuft (Fig. 22); (2) segment 2 of maxillary palpi has pectinate setae (Fig. 26); (3) segment 3 of labial palpi has two rows of short peg-like setae (Fig. 29); (4) abdominal sterna have thick hair; (5) dorsal portion of gill lamellae has well developed apical process (Fig. 37); and (5) posterolateral spines on abdominal segments are short, less than 1/2 the maximum median length of the segment (Fig. 36).

Biology. Knowledge of the biology of *M. brieni* is limited. One of us (WLP) spent a few months in Brazil and observed that the nymphs occur on rocks in swift reaches of small streams to large rivers. Last instar nymphs migrate to side-pools and climb out of the water unto dry rocks in or around the stream to emerge.

The nymphs have been collected from June to April, and the adults from September to March. The imagines mate in midmorning in small companies approximately 10 m above the river.

Massartella brieni has a wide altitudinal distribution. The nymphs have been collected from 800 m - 1,600 m.

The nymphs are primarily detritivores. Dissected nymphs revealed the dominant gut contents of detritus (66.22%), mineral particles (13.78%), diatoms (6.72%) and a few fragments of filamentous algae (13.28%). Identified diatoms include the naviculoid group and the genus *Eunotia*.

Massartella venezuelensis sp.n.

Male and female imagines. Unknown.

Male subimago. Unknown.

Female Subimago (in alcohol). Length: body 15.0 mm, fore wings 16.0 mm. Head pale yellow, washed with dark brown on vertex and around ocelli. Antennae mutilated and missing. Ocelli white. Eyes black. Thorax: nota yellow, mesonotum darker; pronotum with broad dark brown submedian and marginal linings; outer parapsidal furrows dark brown. Pleuron pale yellow with broad dark brown markings between subcoxae and base of wings. Sternum yellow, washed with dark brown on prosternum and anterior half of mesosternum. Wings: membrane translucent, dusty white; longitudinal and cross veins brown. Legs: missing except right mesothoracic leg; mesothoracic leg yellow with dark

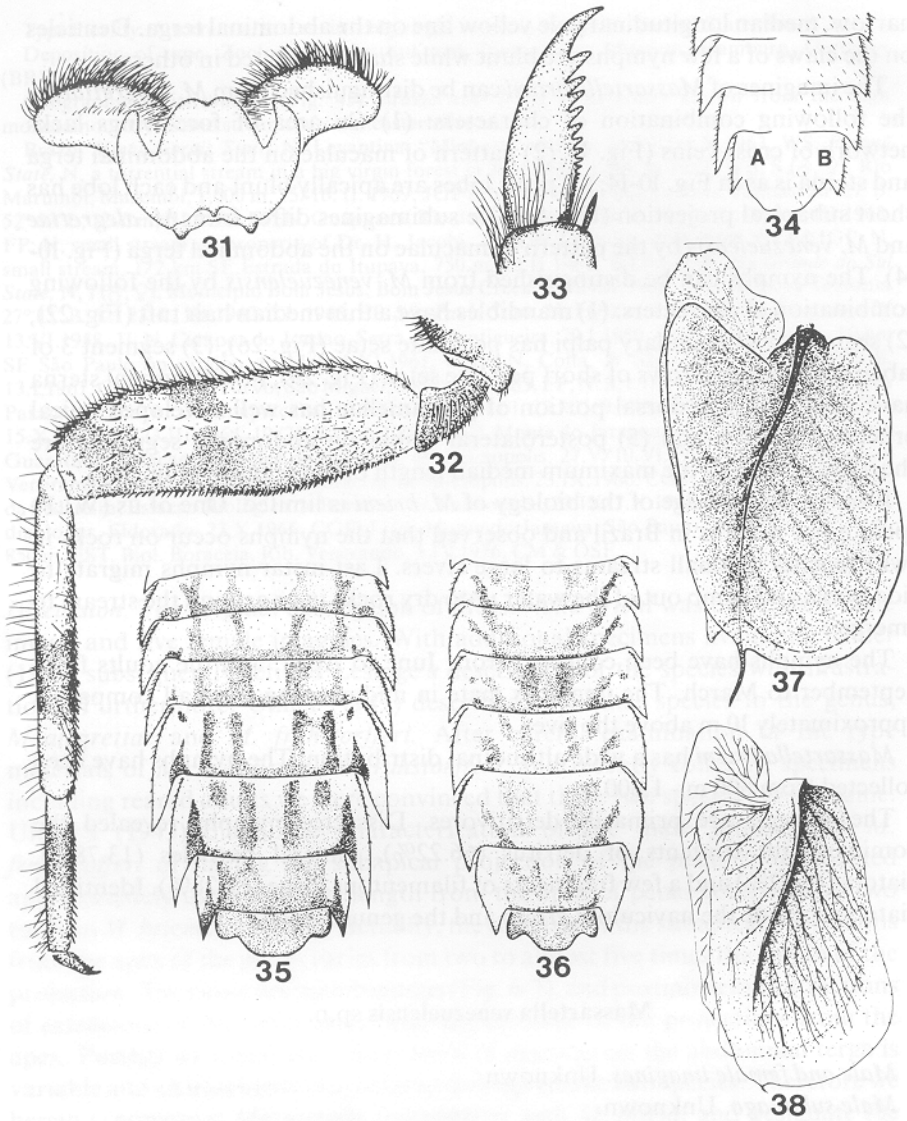


Fig. 31-38. *Massartella* mature nymphs: *M. brieni* (31-33, 34B, 36, 37), *M. venezuelensis* (34A, 36, 38). 31, hypopharynx; 32-33, fore leg and fore claw; 34-36, abdominal segments; 37-38, gill 4.

brown median and apical bands. Abdomen: terga yellow with dark brown maculae (Fig. 18-19); sterna pale yellow, median faintly washed with brown. Caudal filaments mutilated and missing.

Mature nymph (in alcohol). Body length 14.0-19.0 mm. Dorsum of head dark brown, venter pale yellow; a longitudinal pale yellow band from anterior base of

eyes extended to dorsum of mandible; a narrow longitudinal pale yellow stripe between median ocellus mid-distal margin of clypeus. Antennae yellowish-brown except pedicel brown. Outer 1/2 of ocelli gray, remainder black. Female eyes black; upper portion of male eyes reddish-brown, lower portion black. Mouthparts (Fig. 23, 27, 30): mandible with thick median hair tuft (Fig. 23); maxillary palpi yellow, segment 2 with spinous setae (Fig. 27); labial palpi pale yellow, segment 2 of labial palpi with long, thick hair, segment 3 with 1 row of peg-like setae (Fig. 30). Thoracic nota brown with scattered black markings, and irregular pale yellow spots; pronotum with 10-14 pale yellow spots, mesonotum with a broad yellow spot near anterolateral corners and a smaller yellow spot on base of fore wing pads. Sterna brownish-yellow, prosternum and anterior margin of metasternum washed with greyish-black. Legs: yellow except trochanters dark brown; femora with broad transverse median and apical dark brown bands; tibiae and tarsi with broad transverse median dark brown bands, tarsal band occupying almost entire length of segment. Abdomen: terga yellow with dark brown maculae (Fig. 35); sterna glabrous (Fig. 34a), yellow with brown markings along margins; posterolateral spines of segments long, more than 1/2 maximum median length of segment. Gills: membrane gray, tracheae black; dorsal portion of gill lamellae with weakly developed apical process (Fig. 38). Caudal filaments yellow, brown at base, brown annulation at every 4th joint.

Geographical distribution (Fig. 45). *Massartella venezuelensis* has only been collected in the high mountain region of Venezuela. Holotype mature nymph, VENEZUELA: Bolivar, Escalera, 108 km. S Río Cuyuni 11/12.II.1976, CM & OSF; paratypes, 1 female subimago and 5 nymphs, same data as holotype. The female subimago and nymphs were associated by color pattern and collection locale.

All types are preserved in alcohol. Holotype and paratypes are deposited in the collections of the U.S. National Museum of Natural History, Washington D.C.

Etymology. Species named for Venezuela.

Discussion. The nymphs of *Massartella venezuelensis* can be distinguished from *M. brieni* by the following combination of characters: (1) mandible has thick median hair tuft (Fig. 23); (2) segment 2 of maxillary palpi has spinous setae (Fig. 27); (3) segment 3 of labial palpi has 1 row of short peg-like setae (Fig. 30); (4) abdominal sterna glabrous (Fig. 34a); and (5) dorsal portion of gill lamellae has weakly developed apical process (Fig. 38); and (6) posterolateral spines of abdominal segments long, more than 1/2 to equal maximum length of segment (Fig. 35).

Biology. According to Dr. Oliver S. Flint, Jr., who collected the specimens, the nymphs were found in a tumbling and fast flowing cold stream with a mixture of gravel-rubble and bedrock substratum. The stream was approximately 10 meters wide with a depth of approximately 10-30 cm.

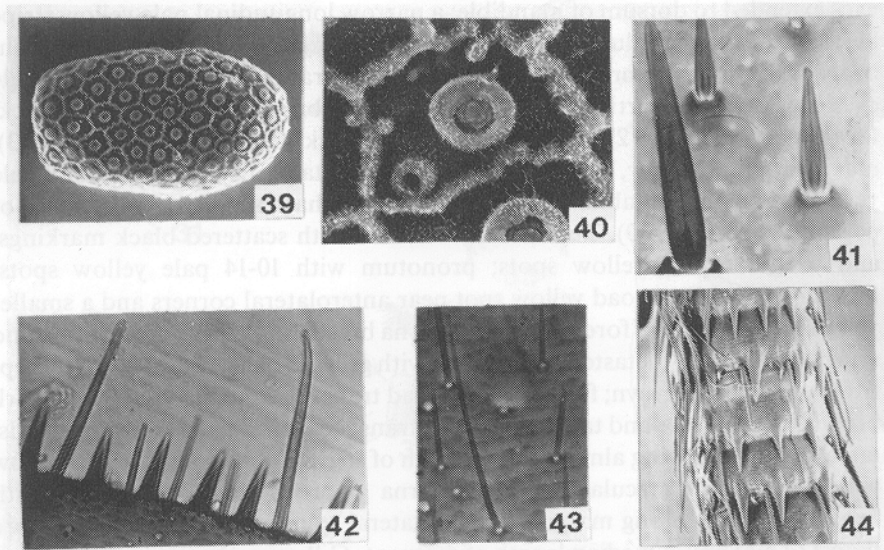


Fig. 39-40. Scanning electron micrographs of *Massartella brieni* egg (500x) and micropyle (3550x).
 Fig. 41-44. Photomicrographs and scanning electron micrographs of nymphal structures of *M. brieni*: 41, femoral setae, dorsal (400x); 42, posterior margin of tergite 6 (400x); 43, setae on abdominal terga (400x); 44, caudal filaments (265x).

Massartella sp.

Two immature nymphs from Argentina which are unassociated with adults, we are unable to assign to any particular species. The locality of the nymphs is as follows: ARGENTINA: Misiones Prov. 30.XI.86, INTA San Vicente, E. Dominguez.

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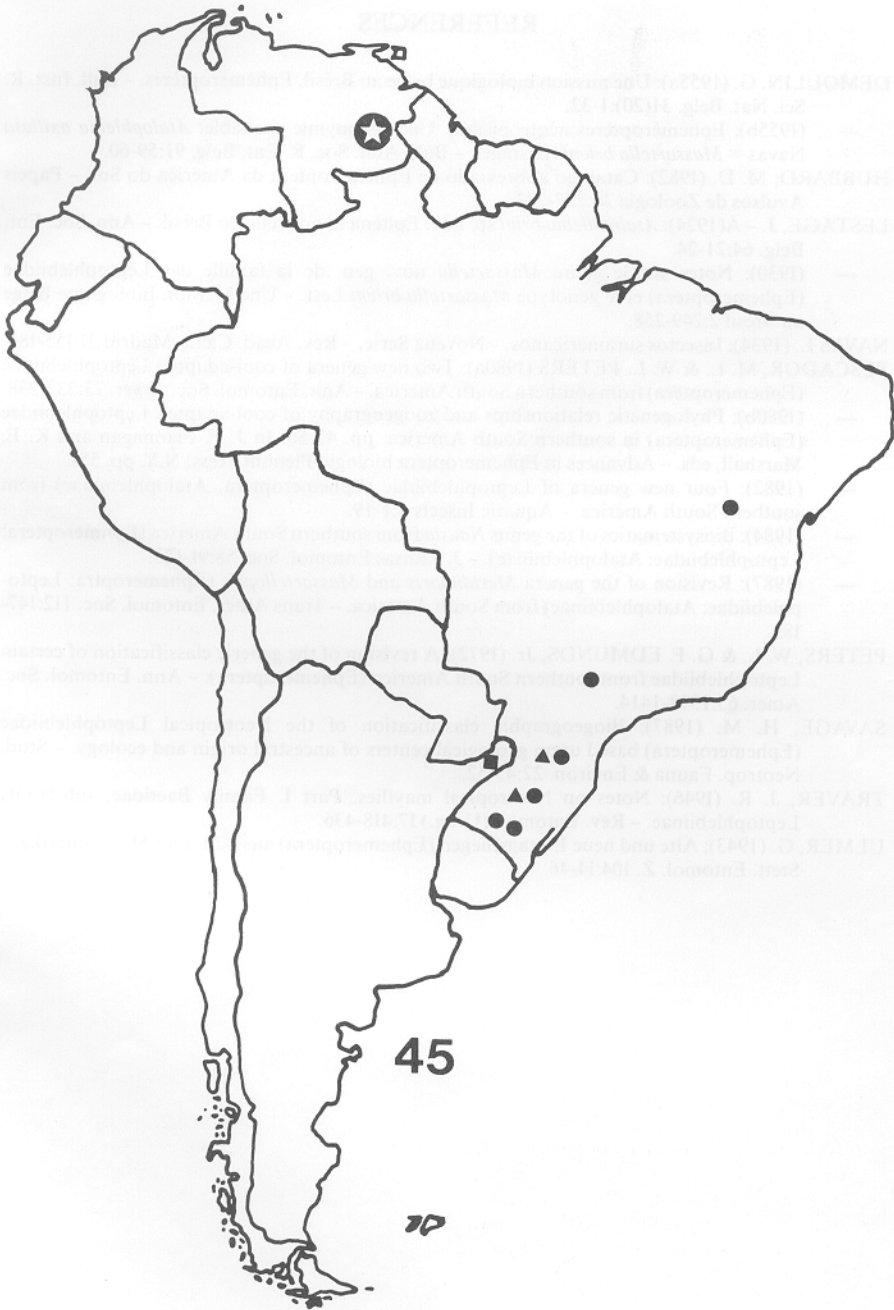


Fig. 45. Geographic distribution of *Massartella brieni* (circle), *M. alegrettae* (triangle), *M. venezuelensis* (star), and *Massartella* sp. (square).

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