REVISION OF THE GENERA *MERIDIALARIS* AND *MASSARTELLOPSIS* (EPHEMEROPTERA: LEPTOPHLEBIIDAE: ATALOPHLEBIINAE) FROM SOUTH AMERICA

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REVISION OF THE GENERA *MERIDIALARIS* AND *MASSARTELLOPSIS* (EPHEMEROPTERA:LEPTOPHLEBIIDAE:ATALOPHLEBIINAE) FROM SOUTH AMERICA

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ABSTRACT

The study includes a redescription of the genera *Meridialaris* and *Massartellopsis*, and the eggs are described for the first time.

Adults of four species of *Meridialaris*, *M. biobionica* (*Ulmer*) *M. chiloeense* (Demoulin) [=*M. penai* (Demoulin), new synonymy], *M. diguillina* (Demoulin), and *M. laminata* (Ulmer) [=*M. illapelli* (Demoulin), new synonymy], are redescribed. The nymphs of *M. chiloeense*, *M. diguillina* and *M. laminata* are described for the first time. Three new species, *M. inflata*, *M. spina*, and *M. tintinnabula* are described. *Meridialaris inflata* is described from male imago, *M. spina* from nymph, and *M. tintinnabula* from nymph and male imago.

Massartellopsis is a monotypic genus. The subimagos of *M. irrarrazavali* are redescribed, and the nymph and imagos are described for the first time.

Illustrated keys for the nymphs and imagos, and geographic distribution maps are presented for each species. Notes on the biology of the species are included. A phylogenetic analysis of *Meridialaris* is proposed.

INTRODUCTION

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

Methods of gut analysis, and descriptive terminology are the same as in Parts I, II, and III 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 use. Reared specimens are indicated by the abbreviation R following the life stages.

Depositions of specimens are abbreviated as follows: (CAS) California Academy of Sciences: (FAMU) Florida A&M University; (GEI) German Entomological Institute, Berlin-Dahlem, Germany; (ISNB) Institute royal des Sciences naturelle de Belgique; (USNM) U.S. National Museum of Natural History; (UCS) University of Chile in Santiago; (UU) University of Utah; (ZMHU) Zoologisches Museum au der Humboldt, Universitat zu Berlin, Germany.

The names of collectors are abbreviated as follows: (B) Besch, (BA) B. Akerbergs, (GB) Gerardo Barria, (WB) W. Besch, (TC) Tomas Cekalovic, (D&MD) D&M Davis, (ED) Eduardo Dominguez, (GFE) George F. Edmunds, (CMF) C.M. Flint, (OSF) Oliver S. Flint, (JI) Joachim Illies, (EAM) E.A. Michelbacher, (LEP) Luis E. Peña, (MLP) Manuel L. Pescador, (WL&JP) William L. and Janice G. Peters, (ESR) E.S. Ross, (PSJ) P.J. Spangler, (IR) I. Rottman, (SSS) S.S. Schackovsky.

Meridialaris Peters and Edmunds

Fig. 1-67, 70-75

Deleatidium Eaton, 1884:285; Ulmer, 1919:23; 1938:85; Lestage, 1931:52 partim; Demoulin, 1955b:13; 1955c:23.

Meridialaris Peters and Edmunds, 1972:1405; Pescador and Peters, 1980:43.

Type Species. — *M. laminata* (Ulmer) (originally placed in *Deleatidium*), by original designation.

Species included. — *M. biobionica* (Ulmer); *M. chiloeense* (Demoulin) [=*M. penai* (Demoulin) new synonymy]; *M. diguillina* (Demoulin); *M. laminata* (Ulmer) [=*M. illapelli* (Demoulin) new synonymy]; *M. patagonica* (Ulmer); *M. inflata* new species; *M. spina* new species and *M. tintinnabula* new species.

Distribution. — Magallanes Province (ca. 54° S) north to Coquimbo Province, Chile, with easternmost record in Tucuman Province, Argentina (ca. 26° S).

Imago. — Length: ♂ body 6.0-8.8 mm, fore wings 7.3-10.0 mm; ♀ body 7.0-10.2 mm, fore wings 7.4-11.3 mm. Eyes of male meet on meson of head, lower portion of eyes 3/4 length of upper portion; eyes of female separated on meson of head by a length 3 to 4.5 x width of eye. Wings (Fig. 1-3): vein Rs of fore wings forked 1/5 to slightly more than 1/4 distance from base to margin; vein MA forked slightly more than 1/2 distance from base to margin, fork symmetrical; distal portion of vein MA of fore wings moderately sagged (Fig. 1); vein MP_2 moderately recurved, attached at base to vein MP_1 with a cross vein more than 1/5 distance from base to margin; vein ICu_1 attached at base by a cross vein to either vein CuA or both to veins CuA and CuP. Costal margin of hind wings convex with concavity located slightly less than 1/2 from base, apex obtuse (Fig. 3); vein Sc 9/10 maximum length of hind wings (Fig. 3). Legs: length ratios of segments in ♂ fore legs, 0.76:1.00 (2.8 mm) 0.06:0.32:0.35:0.35:0.28:0.12. Claws of a pair dissimilar, one apically hooked with an opposing hook, other obtuse, pad-like (Fig. 5). Male genitalia (Fig. 6-22): length of segment 2 of forceps 1/5-1/3 of segment 1 and sub-

equal to segment 3; base of segment 1 broad, inner margin with slightly developed (Fig. 18) to well developed angular bend (Fig. 6, 12). Maximum length of styliger plate approximately 1/4-1/3 maximum width. Penes lobes fused to near apex, each lobe with apical projection. Female ninth sternum apically pointed (Fig. 4). Terminal filament longer than cerci.

Egg. — Elongate oval; polar cap absent; chorion granulate with scattered small circular ridges (Fig. 66); one oval sperm guide (Fig. 68).

Mature nymph. — Head prognathous (Fig. 23). Antennae approximately 2x as long as head; flagellar segments with fine apical hairs and small denticles, hair in variable groupings and in whorls, and denticles progressively smaller distally (Fig. 73, 74); antennae with prominent pits (Fig. 72-73). Mouthparts (Fig. 43-52); length of labrum approximately 1/4 times maximum width, angular (Fig. 43) to smoothly curve laterally (Fig. 44), dorsal hair feathery (Fig. 70); anteromedian emargination shallow U-shaped (Fig. 46) to deep V-shaped (Fig. 44-45) with short broad denticles. Clypeus narrower than labrum, lateral margins apically divergent (Fig. 43-44). Outer margin of mandible angular (Fig. 48) to smoothly curved (Fig. 47), apical half with series of short hairs and median hair tuft (Fig. 48). Galea-laciniae of maxillae broad apically with 15-22 subapical pectinate setae (Fig. 50); segments 1 and 2 of maxillary palpi subequal length, segment 3 approximately 3/5 length of segment 2; inner margin of segment 3 with long spines. Lingua of hypopharynx with well developed lateral processes (Fig. 49), paired longitudinal rows of hairs on dorsal surface, anterior margin deeply cleft; superlingua with hair along anterior margin, lateral margins obtuse. Segments 1 and 2 of labial palpi subequal length, segment 3 slightly less than 1/2 of segment 2; glossae straight, flat (Fig. 52); submentum laterally glabrous (Fig. 52). Lateral margins of pronotum glabrous. Legs: maximum width of tibiae approximately 2x that of tarsi; tibiae of fore legs in cross section ovate (Fig. 54), tarsi oblong (Fig. 55); femora with cylindrical setae (Fig. 71) setal insertion depressed (Fig. 73); denticles on claws gradually larger apically (Fig. 56). Gills (Fig. 63-65): gills on segments 1-7 alike, dorsal and ventral lamellae slender (Fig. 65) to moderately broad (Fig. 63-64), apically tapered, progressively smaller posteriorly; main tracheal trunk along median line with branches (Fig. 63-64) or without branches (Fig. 65). Posterolateral projections on abdominal segments 2-9; terga smooth with fine hairs, and short transparent needle-like setae lateral margins pilose, posterior margins with short spines (Fig. 57). Terminal filament longer than cerci; segments of caudal filaments with fine hair in groups of variable number, and broad-based apical spines closely set together (Fig. 75).

Discussion. — Peters and Edmunds (1972) established *Meridialaris* and designated *M. laminata* (Ulmer) as the type species. *Meridialaris laminata* was originally described in *Deleatidium*. All species of *Deleatidium* occurring in South America were included in *Meridialaris* by Peters and Edmunds (1972).

A Brazilian species, *Deleatidium vittatum* was described by Thew (1960) from female imagos but examination of the holotype by one of us (WLP) revealed that the species belong to an undescribed genus. Ulmer (1904) identified one female imago from South Patagonia, Punta Arenas, as *Atalophlebia chilensis* Eaton which Lestage (1931) transferred to *Deleatidium* and subsequently named it *D. patagonicum*. Although included in *Meridialaris* by Peters and Edmunds (1972), the

inadequate description and illustration by Ulmer make it impossible to identify the species with confidence. Attempts to locate the holotype were unsuccessful.

Meridialaris can be distinguished from all the other genera of Leptophlebiidae by the following combination of characters. In the imagos: (1) vein Sc of the hind wings is 9/10 of the maximum length of hind wings (Fig. 3); (2) claws of a pair are disssimilar, one is apically hooked and with an opposing hook, while the other is obtuse and pad-like (Fig. 5); (3) penis lobes are fused to near the apex and each lobe has an apical projection (Fig. 7-22); and (4) female ninth sternum is apically pointed (Fig. 4). The eggs have granulate chorion with small scattered circular ridges (Fig. 67). In the nymph: (1) clypeus is narrower than labrum and has an apically divergent lateral margins (Fig. 43-44); (2) length of labrum is approximately 1/4 times maximum width; (3) outer margin of mandibles is angular (Fig. 48) to smoothly curved (Fig. 47), and has a series of short hairs and median hair tuft; (4) submentum is laterally glabrous (Fig. 52); (5) claws have denticles which are progressively larger apically (Fig. 56); (6) posterolateral projections occurs on abdominal segments 2-9; and (7) abdominal gills 1-7 are alike, and lamellae are gradually tapered apically (Fig. 63-65).

Key to Imagos

1. Penes square-shaped (Fig. 6-7); well developed angular bend on inner margin of segment 1 of genital forceps located approximately 1/2 distance from base (Fig. 6); maculae on abdominal terga as in Fig. 24-26 ..... *M. laminata* (Ulmer)

   Penes not as above (Fig. 9, 12, 15, 18, 20); angular bend on inner margin of segment 1 of genital forceps located approximately 1/3 distance from base (Fig. 15, 20); maculae on abdominal terga as in Fig. 27-42 2

2. Penes bell-shaped with blunt finger-like apical projections (Fig. 18-19); angular bend on inner margin of segment 1 of genital forceps weakly developed (Fig. 18); maculae on abdominal terga as in Fig. 38-40 ..... *M. tintinnabula* n. sp.

   Penes cylindrical (Fig. 15, 20) or swollen (Fig. 9, 12); angular bend on inner margin of segment 1 of genital forceps well developed (Fig. 12); maculae on abdominal terga not as above (Fig. 27-29, 33-34, 35-37, 41-42) 3

3. Penes with prominent hairs between apical projections (Fig. 15, 20); maculae on abdominal terga as in Fig. 35-37, 41-45 4

   Penes glabrous between apical projections (Fig. 9, 12); maculae on abdominal terga not as above (Fig. 27-32, 33-34) 5

4. Vein ICu_1 of fore wings parallel to slightly divergent distally from vein CuA (Fig. 2); maculae on abdominal terga as in Fig. 35-37 ..... *M. chiloeense* (Demoulin)

   Vein ICu_1 of fore wings strongly divergent distally from vein CuA (Fig. 1); maculae on abdominal terga as in Fig. 41-42 ..... *M. biobionica* (Ulmer)

5. Femora lack median band; basal 3/5 of penes swollen (Fig. 9) apical projections weakly developed (Fig. 11); maculae on abdominal terga as in Fig. 33-34 ..... *M. inflata* n. sp.

Femora with dark brown median band; penes broad with well developed subapical projections (Fig. 13-14) maculae on abdominal terga as in Fig. 27-32 ..... *M. diguillina* (Demoulin)

Key to Mature Nymphs

1. Labrum with deep, V-shaped anteromedian emargination (Fig. 44-45) 2
   Labrum with broad and shallow U-shaped anteromedian emargination (Fig. 46) 4
2. Tarsi with long, needle-like spines (Fig. 60-61); lateral margins of labrum angular (Fig. 43) ..... *M. chiloeense* (Demoulin)
   Tarsi without long needle-like spines (Fig. 58-59); lateral margins of labrum smoothly curved (Fig. 44) 3
3. Outer margin of cardo with less than 25 long spines; joints of antennal flagella with reddish brown annulation; femora with 2 dorsal pale yellow spots; geographic range from Andean slopes of Chile and Argentina (Fig. 79) ..... *M. spina* n. sp.
   Outer margin of cardo with more than 25 long spines; joints of antennal flagella lack annulation; femora with 3 dorsal pale yellow spots; geographic range from mountain streams of Tucuman Prov., Argentina (Fig. 79) ..... *M. tintinnabula* n. sp.
4. Maculae on abdominal terga as in Fig. 24-26; abdominal gills moderately broad, main tracheal trunk with several well developed branches (Fig. 63) ..... *M. laminata* (Ulmer)
   Maculae on abdominal terga as in Fig. 27-32; abdominal gills slender, main tracheal trunks without or with few weakly developed branches (Fig. 65) ..... *M. diguillina* (Demoulin)

Meridialaris biobionica (Ulmer)

Fig. 15-17, 41-42

Deleatidium biobionicum Ulmer, 1938:85.
Meridialaris biobionica Peters and Edmunds, 1972:1405.

Male imago (in alcohol). — Length: body 6.0-7.0 mm, fore wings 6.0-7.0 mm. Head orange brown. Scape and pedicel of antennae orange brown, flagellum pale yellow. Upper portion of eyes orange yellow, lower portion black. Thorax: nota, pleura and sterna brown, posterior margin of scutellum darker. Wings: membrane of fore wings hyaline, pterostigma cloudy white; longitudinal and cross veins whitish except veins C, Sc, and R_1 light brown; cross veins in basal 1/2 of costal and subcostal, and cubital area weakly developed; vein ICu_1 strongly divergent distally from vein CuA as in (Fig. 1); 8-11 costal cross veins. Membrane of hind wings hyaline; longitudinal and cross veins whitish; 6-8 costal cross veins. Legs: pale yellow, coxae brown; femora with dark brown median and apical bands; dorsum of claws orange yellow, venter pale yellow. Abdomen: terga translucent yellow with broad dark brown maculae covering almost the entire surface of each tergum (Fig. 41-42); a

posterolateral black spot on terga 1-8. Sterna translucent pale yellow with broad chocolate brown maculae on sterna 1-3; maculae covers entire surface of sternum 1, reduced and scattered on sterna 2-3. Genitalia (Fig. 15-17): forceps pale yellow; angular bend on inner margin of segment 1 well developed, located approximately 1/3 distance from base; segments 2 and 3 subequal length. Styliger plate pale yellow with shallow U-shaped emargination. Penes brownish yellow, cylindrical with hairs between blade-like apical processes (Fig. 15-16). Caudal filaments pale yellow.

Female imago (in alcohol). — Length: body 6.0-7.5 mm, fore wings 6.0-7.5 mm. Similar to male imago except as follows: eyes black, longitudinal veins of fore wings brown; 17-20 costal cross veins in fore wings, 4-7 in hind wings; and abdominal terga and sterna opaque yellow.

Male and female subimagos. — Unknown.

Nymph. — Unknown.

Geographical distribution (Fig. 77). — The species has only been collected in southern central Chile.

Type specimens and deposition. — Holotype, 1♂ I, Bío Bío, CHILE, I.26, Ruiz coll.; paratypes, 3 I same data as holotype. GEI.

Additional specimens examined. — CHILE: *Bío Bío Prov.*, 1♂ I, Río Bío Bío 10 km E Santa Barbara, 4.II.1959, LEP; N, I, (♂, ♀), Río Bío Bío, Santa Barbara, 8.II.1959, LEP; I (♂, ♀), Est. Huequecura 25 km E Sta. Barbara, 24.I.1978, CMF & OSF. *Concepcion Prov.*, I (♂, ♀), Lirquen, 31.XII.1966, OSF & TC. *Linares Prov.*, I (♂, ♀) Puente Malcho, 600 m ca Longavi River, 13/15.I.1979, D & MD & BA. Specimens are deposited as follows: FAMU, USNM, and UU.

Discussion. — *Meridialaris biobionica* was described by Ulmer (1938) from a male imago and three female imagos collected from Bío Bío Prov., Chile. The male and female imagos are herein redescribed from the type series, and recently collected specimens.

Meridialaris biobionica can be distinguished from the other species of the genus by the following combination of characters. In the imagos: (1) vein ICU_1 of the fore wings is strongly divergent distally from vein CuA as in (Fig. 1); (2) femora have a dark brown median band; (3) maculae of abdominal terga is as given in the description and Fig. 41-42; (4) angular bend on inner margin of segment 1 of genital forceps is developed and located approximately 1/3 distance from base; (5) penes have hairs between blade-like apical processes (Fig. 15-17); and (6) caudal filaments lack annulation.

The adults of *M. biobionica* appear most closely related to *M. chiloeense* but can be distinguished from it by any of the following characters; (1) maculae on ab-

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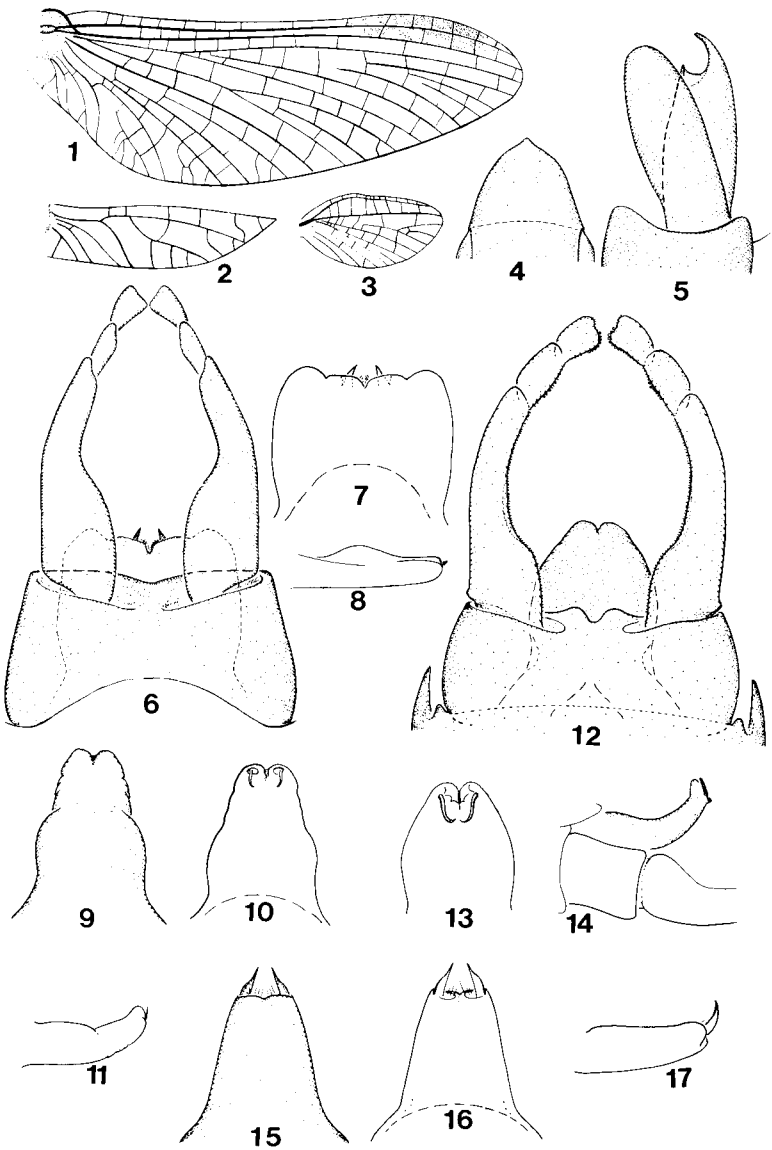
FIGURES 1-3. — Fore and hind wings of ♂ imagos 1, 3, *Meridialaris laminata*; 2, Cu-A area of fore wing of *M. chiloeense*. FIG. 4-5, *M. laminata:* 4, sternum 9 of ♀ imago; 5, fore claw of ♂ imago. FIG. 6-17. Genitalia of ♂ imago: 6-8, *M. laminata* (6, ventral; 7-8 penes, dorsal and lateral); 9-11, *M. inflata,* penes (9 ventral; 10, dorsal; 11, lateral); 12-14, *M. diguillina* (12, ventral; 13-14, penes, dorsal and lateral); 15-17, *M. biobionica,* penes (15, ventral; 16, dorsal; 17, lateral).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dominal terga are as given in the description and Fig. 41-42; (2) vein ICu_1 of fore wings is strongly divergent distally from vein CuA as in (Fig. 1); (3) fore wings are less than 7 mm long.

Biology. — The biology of *M. biobionica* is unknown. The adults had been collected in December and January.

Meridialaris chiloeense (Demoulin)

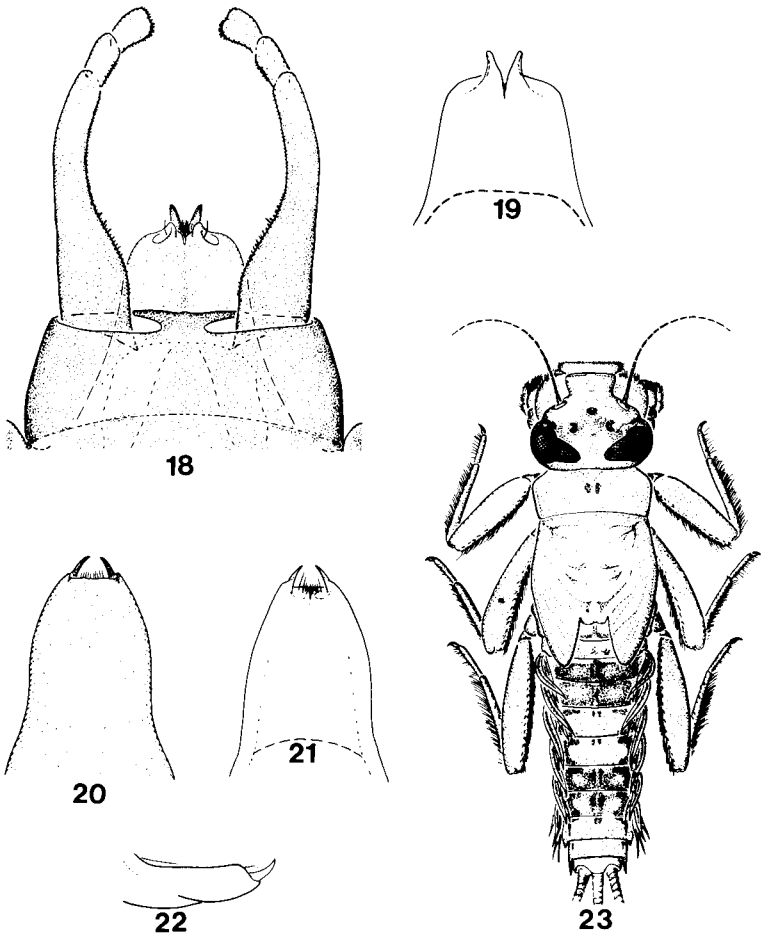
Fig. 2, 20-22, 35-37, 45, 60-61, 64, 70

Deleatidium chiloeense Demoulin, 1955*b*:23
Deleatidium penai Demoulin, 1955*b*:27, NEW SYNONYMY
Meridialaris chiloeense Peters and Edmunds, 1972:1405

Male imago (in alcohol). — Length: body 7.0-9.0 mm, fore wings 8.0-10.0 mm. Head orange yellow, black between ocelli. Scape and pedicel of antennae reddish brown, flagellum yellow. Upper portion of eyes orange yellow, lower portion black. Thorax: nota yellowish brown; basal 1/2 of outer parapsidal furrows and posterolateral corners of scutellum dark reddish brown. Pleura and sterna yellowish brown, furcasterna washed with black. Wings: membrane of fore wings hyaline, pterostigma cloudy white; longitudinal and cross veins dark brown; cross veins in basal 2/3 of costal and subcostal membranes weakly developed; vein ICu_1 parallel to slightly divergent distally from vein CuA (Fig. 2); 10-14 costal cross veins. Membrane of hind wing hyaline; longitudinal veins dark brown; cross veins pale yellow; 4-6 costal cross veins. Legs: fore legs yellow to light brown, meso- and metathoracic legs paler; apex of femora and tibiae brown; dorsum of claws shiny brown, venter pale. Abdomen: terga translucent yellow to light brown, opaque reddish brown on terga 8-10; terga with dark brown maculae, pronounced and extensive on terga 1-3 (Fig. 35-36); maculae on terga 4-5 reduced to oblique dorsolateral stripes (Fig. 36). Sterna translucent yellow, faintly washed with reddish brown; Genitalia (Fig. 20-22): forceps pale yellow often washed with brown; angular bend on inner margin of segment 1 well developed, located approximately 1/3 distance from base; segment 3 distinctly shorter than segment 2. Styliger plate yellowish brown with shallow, V-shaped posteromedian emargination. Penes yellow, cylindrical with minute hairs between pointed apical projections (Fig. 20-21). Caudal filaments yellow with reddish brown annulation at joints.

Female imago (in alcohol). — Length: body 8.0-10.0 mm, fore wings 8.0-11.0 mm. Similar to male imago except as follows: head orange yellow to reddish brown; entire costal and subcostal cross veins of fore wings well developed; 15-18 costal cross veins in fore wings, 6-8 in hind wings; and abdominal terga and sterna opaque yellow; specimens from southern range densely clouded with dark brown (Fig. 37).

Male subimago (in alcohol). — Similar to male imago except as follows: head reddish-brown, darker between ocelli; median of pronotum, 2/3 of sclerite between inner and outer parapsidal furrows, and posterolateral corners of scutellum dark brown; membrane of wings translucent pale yellow; fore legs shorter, and tarsi darker than male imago; sterna opaque yellow; and genital forceps and penes smoky yellow.



FIGURES 18-22. — Genitalia of ♂ imago. 18-19, *Meridialaris tintinnabula* (18, ventral; 19, penes, dorsal); 20-22, *M. chiloeense,* penes (20, ventral; 21, dorsal; 22, lateral). FIG. 23, Mature nymph of *M. laminata.*

Female subimago (in alcohol). — Similar to male subimgo except as follows: head yellow to light brown; antennae, ocelli and eyes as in female imago; and fore legs shorter.

Mature nymph (in alcohol). — Body length 8.0-10.0 mm. Dorsum of head brownish yellow to dark brown, venter pale yellow; base of ocelli and eyes ringed with pale yellow; a small pale yellow spot anterior to median ocellus and lateral to

lateral ocelli. Scape and pedicel of antennae dark brown, flagellum pale yellow with narrow black annulation at articulations. Mouthparts: labrum with a narrow, deep V-shaped anteromedian emargination (Fig. 45) lateral margins angular as in (Fig. 43). Maxillary palpi brown; outer margin of cardo with 21-34 long spines. Segments 1 and 2 of labial palpi yellow, segment 3 brown; outer margin of segment 1 with 11-22 long spines. Thorax: nota yellowish brown to dark brown with pale yellow markings, posterior margin of pronotum pale yellow; Sterna pale yellow; Legs: dorsum brown except tibiae and basal 1/2 of tarsi yellow, venter pale yellow; dorsum of femora with basal and apical pale yellow spots; tarsi with short, and long needle-like spines (Fig. 60-61). Abdomen: terga yellowish brown, lateral margins pale yellow; black maculae on terga as in imagos. Sterna pale yellow. Gills cloudy white, tracheae dark brown; main tracheal trunk with several branches; dorsal and ventral lamellae moderately broad (Fig. 64). Caudal filaments pale yellow with 3-4 reddish brown annulations near base.

Geographical distribution (Fig. 77). — *Meridialaris chiloeense* is widely distributed, occurring in both the eastern and western slopes of the southern South American Andes.

Type specimens and deposition. — Holotype 1 ♂ I, Dalcahue, II 1954, LEP; paratypes, 6 ♂ I, same data as holotype. ISNB.

Additional specimens examined. — CHILE: *Aconcagua Prov.*, S (♀, R) Río Blanco, El Juncal, 21Km SW Portillo, 1980 m. 20.XI.1972, MLP. *Aisen Prov.*, N, Puerto Ibanez, 12/17.I.1961, LEP; N, Lago Frio, Coyhaique, 21/22.I.1961, LEP. *Bío Bío Prov.*, S (♀), El Abanico, 30.XI.1950, ESR & AEM; N, trib. of Río Bío Bío, Santa Barbara, 6/8.XII.1972, MLP & LEP. *Cautin Prov.*, N, El Radal, 900 m, 28/30.XI.1957, LEP; N, nr. Pucon, I.1966, OSF & TC; N, I (♂, R), Río Claro, Pucon, 146 m, 10/11.XII.1972, MLP; N, Fundo El Coique, 500 m ca 29Km NE Villarica, 3.III.1979, D&MD & BA. *Chiloé Prov.*, N, I (♂), Dalcahue, II.1954, I.1962, LEP; N, I (♂), Río Quichitue, Dalcahue, 16.XII.1972, MLP; N. Río Butalcura, Dalcahue, 16.XII.1972, MLP; N, small stream in Dalcahue, 16.XII.1972, MLP. *Curico Prov.*, N, Cord. Curico, IX.1959, LEP; N, El Coigo, 1960, LEP. *Linares Prov.*, N, Romehual, Parral, 5/10.XI.1960; N, Cubillo, 2/11.X.1960, LEP; N, Río Longavi, San Pablo Parral, 425 m, 28.XI.1972, MLP & GB. *Llanquihue Prov.*, I (♂), stream in Llanquihue, 15.XII.1957, JI; N, a stream near Pargua, 15.XII.1972, MLP; N, I, S (♂, ♀, R) Río Tupe, Ensanada, 17.II.1957, LEP; N, a small stream 1 Km E El Jardin, Maullin, 17.XII.1972, MLP; I (♂, ♀), Lago Todos Los Santos, Petrohue 18.XII.1972, MLP & LEP; N, Lago Llanquihue, Ensanada, 19/21.XII.1972, MLP & LEP; I (♂, R), Río Tupe, Ensanada, 19/21.XII.1972, MLP & LEP; N, I (♂, R), Río El Canelo, Hornohuinco, Correntoso, 22/23.XII.1972, MLP & LEP; N, an Estero 1Km N Río El Canelo on Rd. to Lago Chapo, 23.XII.1972, MLP; N, Río Tenio, 3Km W Lago Chapo, 23.XII.1972, MLP. *Magallanes Prov.*, N, Río Tres Pasos, 30Km N Puerto Bories, 5.I.1958, LEP; N, Río Chuelo Cuchara nr. Puerto Bories, 7.I.1958, JI; N, Río de Cerro Payne, 9.I.1958, JI; N, S (♀), Río de los Ciervos, 12.III.1960, TC; N, Río Las Minas, S Punta Arenas, 2/4.X.1960, LEP; N, S (♀), Chorillo Tres Puentes, 15.XI.1960, TC; N, Cameron, S Bahia Inutil, Tierra del Fuego,14/15.XI.1960, LEP; N, Rusjin, Tierra del Fuego, 20/21.XI.1960, LEP; N, Tres Vientos, W Tierra

del Fuego, 27.XI.1960, LEP; N, 35Km W Coleta Josefina, Bahia Inutil, Tierra del Fuego, 9.XII.1960; S (♀), Seno Otway, Punta Prat, 10.I.1962, TC; N, Chorillo Lynch, 15.IX.1963, TC; N, Chorillo de la Piedra, 22.IX.1962, TC; N, Río Tres Brazos, 30.XII.1962, TC; N, Chorillo la Guenia, Seno Otway, 20.II.1963, TC; N, Peninsula Brunswick, Bahia San Nicolas, 9.X.1969, OSF; N, I. Wellington, Pto. Eden, 23.IX.1969, OSF; Fiordo Peel Cta. Amelia, 1.X.1969, OSF. *Malleco Prov.*, S (♀), Lago Laguna, 23/25.I.1959, LEP; S (♂), Río Blanco, Curacautin, 1/5.II.1959, LEP; S (♂), Curacautin, 18.XII.1959, LEP; S (♀), N, Sierra Nevada, Lonquimay, 2.I.1962, LEP; 30Km E Victoria, 8.XII.1963, GFE; N, Cord. las Raices, 1700 m, an estero ca. Sierra Nevada Lonquimay, 8.XII.1963, GFE; Río Lonquimay, 9.XII.1963; N, Lago Galletué, ca, Marimenuco, 10.XII.1963, GFE; N, S (♂, R), Estero Huemul, trib. Lago Galletué ca. Marimenuco, 11.XII.1963, GFE; N, Río Cautin, Manzanas, 18.XII.1963, GFE; N, I (♂, R), Río Piquiquen, El Manzano, 35Km W Angol, 8/9.XII.1972, MLP; N, Nahuelbuta Nat. Park, Pichinahuel, 1350 m, 5.II.1979, D&MD & BA; N, Nahuelbuta Nat. Park ca. Los Gringos Camp. 29.I/5.II.1979, D&MD & BA; N, Cord. de las Raices 40Km E Curacautin 6/7.II.1979, D&MD & BA. *Nuble Prov.*, N, Las Trancas, Cord. Chillan, 1/9.XII.1964, LEP; N, S, I (♂, ♀, R), Río Niblinto, Niblinto, 230 m, 25/26.XI.1972, MLP & GB; N, S, I (♂, R), 26.XI.1972, MLP; N, I (♂, ♀), Cascada Las Trancas, Recinto, 1,120 m, 27.XI.1972, MLP; N, Las Trancas, 1300 m, 21Km, E Recinto, 17.I.1979, D&MD & BA; N, Shangrila on Volcan Chillan, 1600 m, 18/21.I.1979, D&MD & BA; N, Las Trancas, 1300 m, 21Km E Recinto ca waterfall, 17.I.1979, D&MD & BA. *Osorno Prov.*, N, trib. of Río Golgol 10Km E Puyehue, 23.XI.1963, GFE; N, a small stream ca. Termas de Puyehue, 22.XI.1963, GFE; N, S, I (♂, ♀), Río Chanlelfu, Puyehue, 500 m, 11/12.XII.1972, MLP; N, Río El Gringo, Puyehue, 2000 m, 13.XII.1972; N, S (♂, ♀), Río Golgol, Puyehue, 850 m, 13.XII.1972, MLP; I (♀), Río Pescadero near Antillanca, Puyehue, 12.XII.1972, MLP; I (♀), P.N. Puyehue, Río Golgol, 2.II.1978, CM&OSF; N, Puyehue Nat. Park, Anticura, 3550 m, N, Puyehue Nat. Park, Aguas Callientes, 6.II.1978, CM&OSF; I (♀), P.N. Puy Río Chanlelfu, 1Km S Agua Callientes, 8/9.II.1978, CM&OSF; N, Puyehue Nat. Park, Playa Puyehue, 10.II.1978, CM&OSF; I (♀), P.N. Puyehue, Santo El Indio, 1/12.II.1978, CM&OSF; N, I (♂), P.N. Puyehue, Río Anticura, 31.I/13.II.1978, SM&OSF; N, Puyehue, Nat. Park, Puyehue, Estero El Gringo, 13.II.1978, CM&OSF. *Santiago Prov.*, N, S, I (♂, ♀, R), El Canelo, 30.IX/2.XII.1972, MLP & GB; N, Melocoton, San Jose de Maipo, 2.XII.1972, MLP & GB; N, I (♀), El Alfalfa, 21.I.1978, CM&OSF. *Talca Prov.*, N, I (♂, R), Río Lircay, Altos de Vilches, 800 m, 22.XI.1972, MLP & GB; N, I (♂, ♀, R), Estero de Vilches, Laguna de los Patos, 1030 m, 22/24.XI.1972, MLP & GB; N, S (♂, R), Estero de Vilches, Piedra de las Tazas, 950 m, 22/24.XI.1972, MLP & GB. *Valdivia Prov.*, N, Enco, 6.III.1955, LEP; N, Fundo Koch near Valdivia, 22.XI.1957; I (♂, ♀), Rincon de Piedra, 200 m, ca 23Km SE Valdivia, 22.II.1979, D&MD & BA. ARGENTINA: *Chubut Prov.*, N, Lago Nahuelhuapi near Bariloche, 23.IX.1957, JI; N, Arroyo Negro, San Carlos de Bariloche, 25/27.XII.1972, MLP; N, 8Km S Hoyo de Epuyen, 10.II.1974, OSF. *Neuquen Prov.*, N, Pucara, 1/10.IV.1957, SSS; N, Lago Lolog, 850 m, 29.III.1957, SSS; S, I (♂, ♀), Nireco, near Bariloche, 31.XII.1957, JI; N, a stream 2Km SE Lago Lolog, 27.I.1974, OSF;

N, Ao. Rucu, Huechulafquen, 26.I.1974, OSF; S, I (♂, ♀), Río Northue, Est. of Pucara, 28/31.I.1974, OSF; N, Ao. Culebra, 20Km S S.M.L. Andes, 2.II.1974, OSF; N, Ao. La Estrada, 13Km S Va. La Angostura, 4.II.1974; N, Los Totoros 23Km NW Va. La Angostura, 20.II.1978, CM&OSF; N. Río Bonito, SE Va. La Angostura, 21.II.1978, CM&OSF; N, Trib. Ao. Trumpul, W S.M. d.l. Andes, 23.II.1978, CM&OSF; N, Ao. Purumeco, NW Lago Alumine, 11.II.1978, CM&OSF; N, Lago Rucachoroi, W Alumine 1/2.III.1978, CM&OSF; N, a stream 5Km E Lago Meliquina, 3.III.1978, CM&OSF. *Río Negro Prov.*, N, 8Km N Río Villegas, 7.II.1974, OSF.

Discussion. — Demoulin (1955*b*) described *M. chiloeense* from male imagos collected from Dalcahue, Chilóe Prov., Chile. In the same paper, Demoulin described *M. penai* from female imagos and subimagos from Las Cabras, Colchagua Prov., and Hacienda Los Cipreces, Cord. de Nuble, Nuble Prov., Chile. Based on reared, male and female imagos, and comparison of the holotype and paratypes of *M. penai* and *M. chiloeense,* the two species are the same. We herein synonymize *M. penai* with *M. chiloeense,* the latter species becoming the senior synonym by priority.

Meridialaris chiloeense is redescribed based on the type specimens and recently collected materials including reared adults. The nymph is described for the first time.

Meridialaris chiloeense exhibits morphological and color variations. The thoracic pleura of the imagos range from dark yellow to brown. Some imagos have the abdominal terga 4-5 and 7-10 faintly washed with dark brown which obfuscates the pattern of brown maculae on these terga. A few female imagos have the basal 1/3 of the antennal flagella washed with reddish brown. Such color variations occur throughout the geographic range of the species. Some color differences of both the nymph and adults are geographically restricted. The nymphs and adults collected from Magallanes Prov., are generally darker, and have dark brown maculae on the abdominal terga similar to Fig. 37, while specimens north of Magallanes Prov., are lighter, and have abdominal maculae similar to Fig. 35-36. The size of pale yellow spots on the dorsum of nymphal femora is quite variable. Most nymphs have the basal and apical pale yellow spots of the femora widely separated compared to elongated and almost connected to each other among specimens from Río Renegado, Linares Prov., to reduced and almost indiscernible from Chilóe Province. In addition, the nymphs exhibit variable number of needle-like tarsal spines. The nymphs from Magallanes Prov., generally have 2-3 long needle-like tarsal spines (Fig. 61) compared to one from the other localities (Fig. 60).

Meridialaris chiloeense can be distinguished from the other species of the genus by the following combination of characters. In the imagos: (1) vein ICu_1 of the fore wings is parallel to slightly divergent from vein CuA (Fig. 2); (2) femora lack median band; (3) maculae on the abdominal terga are as given in the description and Fig. 35-36; (4) well developed angular bend on the inner margin of segment 1 of the genital forceps is located approximately 1/3 distance from the base; and (5) penes have minute hairs between the blade-like apical processes (Fig. 20-21). In the nymph: (1) labrum has a narrow and deep V-shaped anteromedian emargination (Fig. 45), and angular lateral margins; (2) antennal flagella are annulated; (3) pro- and mesonota have pale yellow spots; (4) tarsi have needle-like spines (Fig. 60-61);

and (5) abdominal gills are moderately broad, and the main tracheal trunk has well developed tracheal branches (Fig. 64).

Meridialaris chiloeense appears most closely related to *M. biobionica* but can be distinguished from it by any of the following characters of the adults: (1) maculae on the abdominal terga are as given in the description and Fig. 35-37; (2) vein ICu_1 of the fore wings is parallel to slightly divergent to vein CuA (Fig. 2); (3) fore wings are more than 7.0 mm long; and (4) femora lack median band.

Biology. — The nymphs were collected between stones and small rocks in swift areas of streams and rivers. In lakes, the nymphs were found under rocks near the shoreline.

The nymphs have been collected from September till March and the adults in November through March. The adults emerged in the field between 1600—1800 hrs. Reared adults emerged anytime during the day. A small group of adults was observed by one of us (MLP) swarming at 1630 hrs. above an isolated shrub on the bank of Rio Claro, Pucon, Cautin Prov., and collected specimens were mostly female imagos.

Meridialaris chiloeense has a wide altitudinal distribution. The nymphs were collected from 100 m to 2,250 m above sea level.

Nymphs collected in certain localities were parasitized by a chironomid, *Symbiocladius wygodzinski* Roback (?). Localities for these nymphs were Río Tupe, 12Km W Ensanada, Llanquihue Prov., Río Chanlelfu, Puyehue, Osorno Prov., El Canelo, Santiago Prov., and Chorillo de la Piedra, Magallanes Prov., Chile. The head of the parasite was attached underneath the host's metathoracic wing pads and the body rested laterally on the host.

Dissected nymphs revealed the gut contents as detritus (18.84%), mineral particles (37.26%), diatoms (2.07%) and a few filamentous algae (1.0%). Identified diatoms include the naviculoid group and the genus *Eunotia*.

Meridialaris diguillina (Demoulin)

Fig. 12-14, 27-32, 58, 65

Deleatidium diguillinum Demoulin, 1955*c*:23
Meridialaris diguillina Peters and Edmunds, 1972:1405

Male imago (in alcohol). — Length: body 6.0-8.0 mm, fore wings 6.0-8.0 mm. Head yellow. Scape and pedicel of antennae brown, flagellum pale yellow. Upper portion of eyes orange yellow, lower portion black. Thorax: nota yellow to brown, pronotum paler. Pleura yellow to brown, episterna and epimera dark brown. Sterna brown, basisterna and median of basisternum paler. Wings: membrane of fore wings hyaline, pterostigma translucent cloudy white; longitudinal veins pale yellow, weakly developed cross veins whitish; vein ICu_1 strongly divergent distally from vein CuA as in Fig. 1; 16-19 costal cross veins. Membrane of hind wings hyaline; longitudinal and weakly developed cross veins whitish; 5-7 costal cross veins. Legs pale yellow, profemora and protibiae darker; femora with prominent dark brown median and apical bands; dorsum of tarsal claws orange brown, venter pale. Abdomen: terga translucent pale yellow, opaque yellow on terga 8-10; terga either with dark brown maculae (Fig. 27-29) or without maculae (Fig. 30). Sterna whitish to

translucent pale yellow, sterna 1-2 washed with brown; Genitalia (Fig. 12-14): forceps pale yellow; developed angular bend on inner margin of segment 1 of genital forceps located approximately 1/3 distance from base, segments 2 and 3 subequal length. Styliger plate pale yellow with shallow V-shaped posteromedian emargination. Swollen penes with a pair of slender apical projections (Fig. 13-14). Caudal filaments pale yellow.

Female imago (in alcohol). — Length: body 7.0-8.5 mm, fore wings 7.0-9.0 mm. Similar to male imago except as follows: head pale yellow; eyes black; cross veins of fore and hind wings well developed; 15-18 costal cross veins in fore wings, 5-7 in hind wings; abdominal terga opaque yellow with maculae as in Fig. 30; and sterna 1 and 8-9 washed with reddish brown.

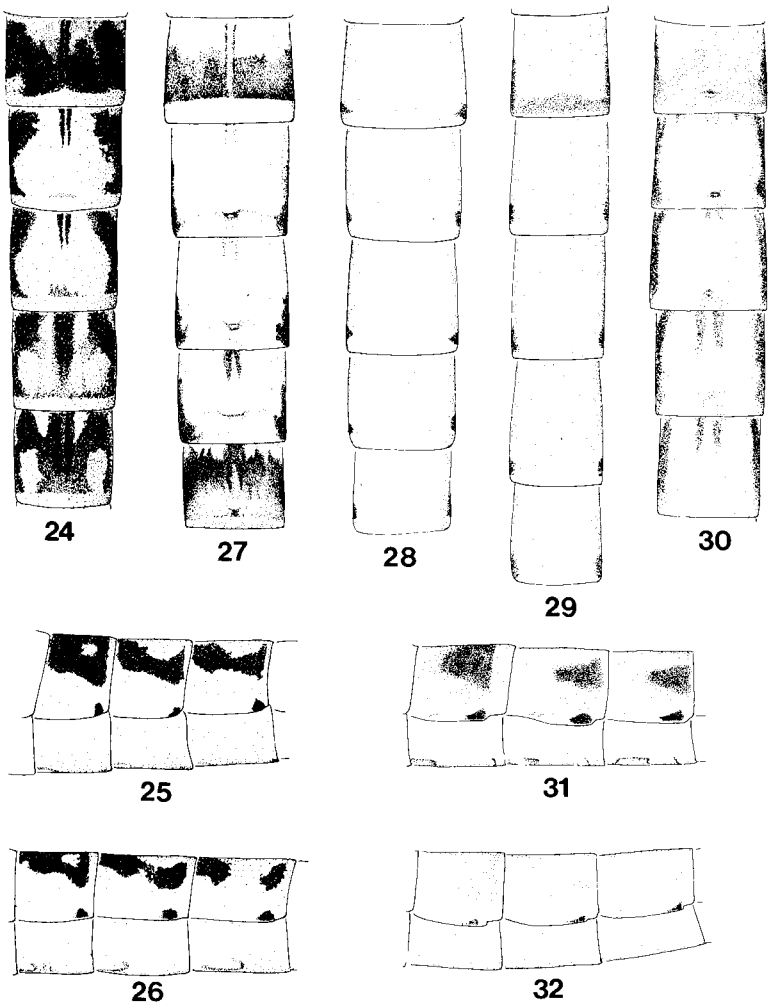
Male subimago (in alcohol). — Similar to male imago except as follows: thoracic nota pale yellow, anterior 1/2 and posterolateral corners of scutellum, inner 1/2 of sclerite between parapsidal furrows reddish black; thoracic pleura yellow, episterna and epimera brown; sterna yellow, probasisternum and metasternum yellow; and abdomen opaque yellow.

Female subimago (in alcohol). — Similar to male subimago except as follows: antennae, ocelli and eyes as in female imago; cross veins of fore and hind wings more developed; abdominal terga grayish yellow with maculae as in female imago; and caudal filaments smoky pale yellow.

Mature nymph (in alcohol). — Body length 6.0-8.5 mm. Dorsum of head yellow to light brown, venter whitish to pale yellow; eyes basally ringed with pale yellow; a small pale yellow spot anterior to median ocellus and lateral to lateral ocelli. Scape and pedicel of antennae reddish brown, flagellum yellow with basal 1/3 faintly washed with brown. Mouthparts: labrum with a broad, shallow U-shaped anteromedian emargination as in Fig. 46 and angular lateral margins as in Fig. 43. Maxillary palpi pale yellow; outer margin of cardo with 20-25 long thick spines. Segments 1 and 2 of labial palpi pale yellow, segment 3 light brown; outer margin of segment 1 with 18-21 long, thick spines. Thorax: nota brown with pale yellow markings, pronotum light brown. Sterna pale yellow. Legs: dorsum brownish yellow to brown, tibiae yellow, venter whitish; dorsum of femora with a broad basal, median, and a small apical pale yellow spots; tarsi with short blunt spines (Fig. 58). Abdomen: terga yellowish brown to dark brown with black maculae as in imagos; terga 4-5 and 8-10 with broad pale yellow spots; a small black spot near base of gills. Sterna pale yellow. Gills cloudy white, tracheae dark brown; main tracheal trunk either with few weakly developed branches or without branches (Fig. 65); dorsal and ventral lamellae long and slender (Fig. 65). Caudal filaments yellow with 2-3 prominent reddish brown annulations near base, and followed alternately by narrow brown annulation at joints.

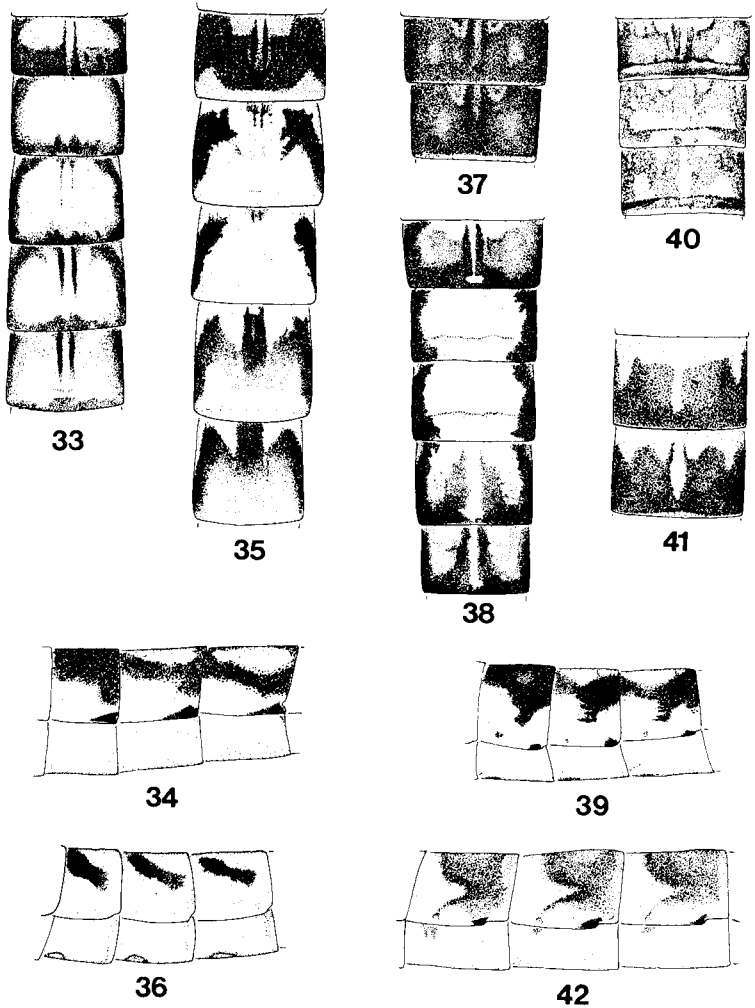
Geographical distribution (Fig. 78). — *Meridialaris diguillina* occurs in the western and eastern slopes of the southern Andes, southward to the low lying streams of Puerto Aisén, Aisén Prov., Chile.

Type specimens and deposition. — Holotype ♂ I, allotype ♀ I, Atacalco, Río Diguillin, 600 m, Nuble Prov., Chile, LEP. Paratypes, 2 ♂ I, same data as holotype; 3 ♂ I, 1 ♀ I,2 ♂ S, 2 ♀ S, Cordillera de Nuble, Hacienda Los Cipreces, 1100 m, Nuble Prov., Chile, 17.I.1955, LEP, ISNB.



FIGURES 24-32. — Abdominal color pattern of imagos: 24-26, *Meridialaris laminata* (24, terga 3-7; 25, pleura 3-7; 26, pleura 3-7); 27-32, ♂ *M. diguillina* (27-29, terga 3-7; 30, ♀ terga 3-7; 31-32, ♂ pleura 3-5).

Additional specimens examined. — CHILE: *Aisén Prov.*, S, I (♀), Río Simpson nr Coyhaique, 24.I.1958, N, I (♂), Puerto Aísen, 25 I 1958, JI; I (♀), Chico, 24/31.XII.1960, LEP. *Arauco Prov.*, S (♂, ♀), Est. Peral, Contulmo, 1/2.I.1966, OSF & TC. *Bío Bío Prov.*, I (♂), 5Km W Tucapel, 28.II.1950, ERS & AEM; N, I (♂, ♀, R), trib. of Río Bío Bío, Santa Barbara, 8.II.1959, LEP; N, Río Mulchen, Mulchen, 130 m, 8.XII.1963, GFE; N, I (♂, ♀, R) trib. of Río Bío Bío, Santa Barbara, 6/8.XII.1972, MLP & LEP; N, I (♂, ♀), El Radal, 200 m 2.XI.1957, LEP. *Cautin Prov.*, I (♂), 20 Km E Tenuco, 8.I.1951, ESR & AEM; I (♂, ♀), NE Pucon, 12.I.1951, ESR & AEM; N, a small mountain stream of Lungoico nr Pillaifa, 16.II.1958, JI; I(♀), Lago Villarica, 26.II.1958, JI; N, S (♂, R), Río Claro Pucon, 146 m, 10/11.XII.1972, MLP; N, Río Pedrogoso, N Villarica, 235 m, 11.XII.1972, MLP & GB; N, Fundo El Coique, ca 29Km NE Villarica, 3.III.1979, D&MD & BA. *Chiloé Prov.*, N, Dalcahue, I.1962, LEP; N, a small stream in Dalcahue, 16.XII.1972, MLP & LEP; N, Río Butalcura, Dalcahue, 16.XII.1972, MLP & LEP; N, Río Quichitue, Dalcahue, 16.III.1972, MLP & LEP. *Coquimbo Prov.*, N, Río Illapel, Santa Virginia, El Bato, Hda. Illapel, Illapel, 18.XI.1972, MLP & GB; N, Río Caren, Caren, Hda. Illapel, Illapel, 18.XI.1972, MLP & GB. *Curico Prov.*, N, I (♀), El Coigo, X.1960, & 20/26.I.1964, LEP; N, Río Claro, 500/600 m, 26.XI.1957, LEP; N, S, I (♂, ♀, R), Río Los Morongos, Bajo Los Morongos, 650 m, 21/22.XI.1972, MLP & GB; N, El Coigo, 825 m, 22.XI.1972, MLP. *Linares Prov.*, N, I (♂, R), Río Longavi, San Pablo, Parral, 425 m, 28.XI.1972, MLP & GB; I (♂), Puente Malcho, 600 m, ca Longavi, 13/15.I.1979, D&MD & BA; S, I (♂, ♀), Tranque de Bulileo, 10/12.I.1979, 800 m, D&MD & BA. *Llanquihue Prov.*, I (♂), Lake Shore, 2.III.1958, JI; N, a small stream near Pargua, 15.XII.1972, MLP; N, I (♂, ♀), Río Penon, Maullin, 17.XII.1972, MLP; N, I (♀), Lago Llanquihue, Ensanada,19/21.XII.1972, MLP & LEP; N, Río Canelo, Hornohuinco, Correntoso, 22/23.XII.1972, MLP & LEP; N, Río Tenio, 3Km W Lago Chapo, 23.XII.1972, MLP; N, I (♀, R), Estero Hornohuinco, Correntoso, 21.XII.1972, MLP. *Magallanes Prov.*, N, S Bahia Inutil, Tierra del Fuego, 14/15.XI.1960, LEP. *Malleco Prov.*, I (♀), Río Blanco, Curacautin, 27/28.I.1959, LEP; I (♂, R), Lago Laguna, 23/25.I.1959, LEP; I (♂), Pichinahuel, Cordillera Nahuelbuta, 1/10.I.1959, LEP; S, I (♂, ♀). Lago Galletué, 22.I.1962, LEP; S (♀), Río Piquiquen, El Manzano, 35Km W Angol, 600 m, 8/9.XII.1972, MLP. *Maule Prov.*, N, Río Maule, 10/11.II.1956, LEP. *Nuble Prov.*, I (♀), 50Km E San Carlos, 26.XII.1950, ESR & AEM; N, Río Diguillin, Atacalco, 600 m, 21.I.1955, LEP; I (♀), estero del Cerro del Rodeo baja Piedras, Cordillera de Nuble, Hda. Los Cipreces, 17.I.1955, LEP; N, Río Chillan, Chillan, 550 m, 6.III.1967, LEP; N, I (♂) Río Niblinto, Niblinto, 230 m, 25/26.XI.1972, MLP GB; N Río Renegado at Pte. Marchant, Recinto, 940 m, 26.XII.1972, MLP; I (♀), Las Trancas, 500 m, 21Km E Recinto, 17.I.1979, D&MD & BA. *Osorno Prov.*, I (♂), Lago Puyehue, 16.II.1957, LEP; N, Río Rahue, 250 m, 20.XI.1963, GFE; N, Río Tolten, Villarica 250 m, 26.XI.1963, GFE; N, a small stream near Villarica, 26.XI.1963, GFE; N, I (♂), Río Pedrogoso, 8Km N. Villarica, 26.XI.1963, GFE; N, Río Chanlelfu, Puyehue, 500 m, 11/12.XII.1972, MLP & LEP; S (♂, ♀), a small stream 1Km SE Puyehue Nat. Park, Puyehue, 12.XII.1972, MLP & LEP; N, P.N. Puyehue, 10.II.1978, CMF & OSF; N, Pucatrihue, 26/30.I.1978, CMF & OSF. *Santiago*



FIGURES 33-42. — Abdominal color patterns of imagos: 33-34, *Meridialaris inflata* (33, ♂ terga 3-7; 34, ♂ pleura 3-5); 35-37, *M. chiloeense* (35, ♂ terga 3-7; 36, ♂ pleura 3-5; 37, ♀ terga 4-5); 38-40, *M. tintinnabula* (38, ♂ terga 3-7; 39, ♂ pleura 3-5; 40, ♀ terga 4-6); 41-42, *M. biobionica* (41, ♂ terga 4-5; 42, ♂ pleura 3-5).

Prov., N, El Canelo near Santiago, 1000 m, 9.XI.1954, LEP; I(♂), a small stream above Mapocho, 2000 m, 1.III.1958, JI; N, S, I (♂, ♀, R), El Canelo GFE; N, S, I (♂, ♀, R), El Canelo, 4.XII.1963, MLP; N Melocoton, San Jose de Maipo, 2.XII.1972, MLP & GB. *Talca Prov.*, I (♂), Río Diguillin, Atacalco, 21.V.1955, LEP; N, Altos de Vilches, 30.I.1964, LEP; I (♂, ♀), Los Cipreces, 1000 m, 14.I.1968, LEP; N, Estero Vilches, Laguna de los Patos, Altos de Vilches, 1030 m, 22/24.XI.1972, MLP & GB; N, I (♂), Río Lircay, Altos de Vilches, 800M, 28.XI.1972, MLP & GB. *Valdivia Prov.*, S (♂, ♀), a small stream 30Km S Valdivia, 13.I.1951, ERS & AEM; I (♂), Lago Rinihue, 25.II.1955, LEP; S (♀), ENCO, 700 m, 28.II.1955, LEP; I (♂, ♀), Río Calle Calle, 9.XI.1958, EB; S (♀), a small stream near Fundo Walper, 16.II.1958, JI; N, S, I (♂, ♀), Rincon de Piedra, 200 m, ca, 23Km, SE Valdivia, 23/25.II.1979, D&MD & BA. ARGENTINA: *Chubut Prov.*, arroyo Negro, San Carlos de Bariloche, 26.XII.1972, MLP; N, I (♂, ♀), Ao. Golondrinas, 6Km N Lago Puelo, 8.II.1974, OSF; I (♂, ♀), Río Epuyen, Hoyo de Epuyen, 10.II.1974, OSF. *Neuquen Prov.*, S, I (♂, ♀), a small stream near Bariloche, 31.X.1955, & 12.II.1958, JI; S, I (♂, ♀), Nireco near Bariloche, 11.XII.1958, JI; N, S, I (♂, ♀), Río Quilquihue at Quilquihue, 26.I.1974, OSF; I (♂), Río Quilquihue at Lago Lolog, 22/23.I.1974, OSF; S (♀), Lago Lacar, Estero Pucara, 29/30.I.1974, OSF; I (♂), Ao. Chapelco Grande, S. M. d. L. Andes, 25.II.1978, CMF & OSF; I (♂, ♀), Río Litron, 5m Lago Alumine, 1.III.1978, CMF & OSF; I, Río Totoros 24Km NW Va. La Angustora, 20.II.1978, *Río Negro Prov.*, S, I (♂, ♀), 5Km S Río Villegas, 7.II.1974, OSF; N, S (♂, ♀), Cascada Mallin, Ahogado, El Bolson, 9.II.1974, OSF; N, 7Km N Río Villegas, 11.II.1974, OSF.

Discussion. — Demoulin (1955*c*) described *M. diguillina* from male and female imagos, and subimagos from Río Diguillin, Atacalco, Nuble Province, Chile. This redescription is based on the type series and recently collected specimens including reared adults. The nymph is described for the first time.

The nymph and adults of *M. diguillina* exhibit marked color variations which include the pale yellow spots on the pro- and mesonota, color pattern of the nymphal femora, and pattern of the abdominal maculae. Nymphs from Río Longavi, Linares Prov., have smaller pale yellow spots on the thoracic nota than those from the other localities. The femora of nymphs from Coquimbo Prov., to Linares Prov., Chile including a few from Chubut and Neuquen Prov., Argentina, have a narrow U-shaped light brown median mark and apical light brown band. Nymphs from Bío Bío Prov., Chile have a greatly enlarged femoral light brown mark which covers almost the entire dorsum. The maculae on the abdominal terga of nymphs and adults collected from Coquimbo to Linares Prov., are greatly reduced to almost absent (Fig. 28-29) while those from Bío Bío to Chilóe Prov., Chile, and Chubut and Neuquen Prov., Argentina have much more prominent maculae, and particularly extensive on terga 1-3 and 7-9 (Fig. 27). Female imagos typically have maculae on the abdominal terga similar to Fig. 30 but few have the entire abdominal terga faintly washed with brown obfuscating the pattern of the tergal maculae. This variation occurs throughout the geographic range of the species.

Meridialaris diguillina can be distinguished from the other species of the genus by the following combination of characters. In the imagos: (1) vein ICu_1 of the fore wings is strongly divergent distally from vein CuA as in Fig. 1; (2) femora have dark

brown median band; (3) maculae on the abdominal terga are as given in the description and Fig. 27-32; (4) well developed angular bend on the inner margin of segment 1 of the genital forceps is located approximately 1/3 distance from the base (Fig. 12); (5) penes have developed slender apical projections (Fig. 13-14); and (6) caudal filaments uniformly pale yellow. In the nymph: (1) labrum has a broad, shallow U-shaped anteromedian emargination as in Fig. 46, and angular lateral margins (Fig. 43); (2) antennal flagella uniformly pale yellow; (3) tarsi have short blunt spines (Fig. 58); and (4) slender abdominal gills have main tracheal trunk either with a few weakly developed branches (Fig. 65) or without branches.

Meridialaris diguillina appears most closely related to *M. inflata* but can be distinguished from it by any of the following characters: (1) maculae on the abdominal terga are as given in the description and Fig. 27-32; (2) femora have dark brown median band; and (3) penes have a pair of slender apical processes (Fig. 13-14).

Biology. — The nymphs of *M. diguillina* occur in streams of various sizes, as well as in rivers and lakes. Compared to *M. laminata* and *M. chiloeense,* the nymphs of *M. diguillina* extend their habitat near the mid-streams where the current is swift and almost inaccessible for collecting. The nymphs were found to be most abundant however, in shallow areas of streams and rivers.

The nymphs and adults of *M. diguillina* were collected in September through March, and November through February respectively. One of us (MLP) had observed the adults swarming late in the afternoon through early evening hours. The swarms occurred in Río Niblinto, Niblinto, Nuble Prov. Interestingly, the adults of *M. laminata* were simultaneously swarming nearby. However, the flight pattern, and site, duration and size of swarms of both species were noticeably different. The adult swarms of *M. diguillina* flew up and down in a spiral fashion, compared to the straight upstream and downstream flight of *M. laminata. M. diguillina* adults swarmed above the vegetation along the river bank, while those of *M. laminata* occurred above water near mid-river. The swarms of *M. diguillina* were enormous. Several hundreds of adults were collected by net sweeping in 30 minutes. The swarm lasted at approximately three hours. The water temperature during the swarm was 10C, and it was calm and partly cloudy. Several adults were also collected at light traps.

Meridialaris diguillina appears to have the same altitudinal range as *M. laminata* and *M. chiloeense.* The nymphs have been collected at elevations 130m-2000m above sea level.

Dissected nymphs revealed the dominant gut contents as detritus (20.99%), mineral particles (78.57%) and a few filamentous algae (0.44%). Identified algae belong to the genus *Oedogonium.*

Meridialaris inflata new species

Fig. 9-11, 33-34

Male imago (in alcohol). — Length: body 6.0-7.0 mm, fore wings 7.0-8.0 mm. Head orange brown, flagellum yellow. Upper portion of eyes orange yellow, lower portion black. Thorax: nota dark brown, paler near base of wings. Pleura dark

brown, mesokatepisternum black. Sterna dark brown, probasisternum and metasternum paler. Wings: membrane of fore wings hyaline, pterostigma cloudy pale yellow; longitudinal veins yellow, cross veins pale white; cross veins in basal 2/3 of costal and subcostal membranes weakly developed; vein ICu_1 strongly divergent distally from vein CuA (Fig. 1); 17-19 costal cross veins. Membrane of hind wings hyaline; longitudinal veins pale yellow, cross veins paler; 5-7 costal cross veins. Legs: dark yellow profemora and apex of femora and tarsi darker. Abdomen: terga translucent yellow, terga 7-10 opaque yellow, posterior margins washed with black; dark brown maculae on terga as in Fig. 33-34, pronounced on terga 1-3. Sterna translucent yellow, opaque yellow on sterna 7-10; sterna washed with brown. Genitalia (Fig. 9-11); angular bend on inner margin of segment 1 of genital forceps well developed, located approximately 1/3 distance from base (Fig. 12); segment 3 distally shorter than segment 2. Styliger plate pale yellow with shallow U-shaped posteromedian emargination. Penes with basal 3/5 swollen, glabrous between weakly developed apical projections (Fig. 11). Caudal filaments dark yellow.

Female imago. — Unknown.

Male and female subimago. — Unknown.

Nymph. — Unknown.

Geographical distribution (Fig. 78). — *Meridialaris inflata* has only been collected from Malleco Prov., Chile.

Holotype ♂ *imago.* — CHILE: Malleco Prov., a small stream near Lonquimay, 5.IV.1958, JI. Paratypes, 7 ♂ imagos, same data as holotype. All types are preserved in alcohol. Types are deposited as follows: holotype, and 4 ♂ imaginal paratypes, UU; 3♂ imaginal paratypes, FAMU.

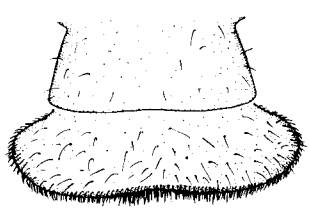
Etymology. — inflatus, L., meaning swollen.

Discussion. — *Meridialaris inflata* can be distinguished from all other species of the genus by the following combination of imaginal characters: (1) vein ICu_1 of the fore wings is strongly divergent distally from vein CuA as in Fig. 1; (2) femora lack median band; (3) maculae on abdominal terga are as given in the description and Fig. 33-34;(4) well developed angular bend on the inner margin of segment 1 of the genital forceps is located approximately 1/3 distance from base (Fig. 14); (5) basal 3/5 of the penes are swollen (Fig. 9), and glabrous between the apical projections and (6) caudal filaments lack annulation.

Meridialaris inflata appears most closely related to *M. diguillina* but can be distinguished from it by any of the male imaginal characters: (1) maculae on the abdominal terga are as given in the description and Fig. 33-34; (2) femora lack median band; and (3) basal 3/5 of penes is swollen (Fig. 9-10).

Biology. — The biology of *M. inflata* is unknown. The adults were collected in April.

FIGURES 43-52. — Mouthparts of mature nymph. 43-44, dorsal view of labrum (43, *Meridialaris laminata,* 44, *M. tintinnabula,* outline); 45-46, anteromedian emargination of labrum (45, *M. chiloeense;* 46, *M. laminata*); 47-48, left mandible (47, *M. tintinnabula,* outline of outer margin; 48, *M. laminata*); 49-52, *M. laminata* 49, hypopharynx; 50, right maxilla, ventral; 51, enlarged third segment of labial palpi, dorsal; 52, labium, dorsal (left), ventral (right).



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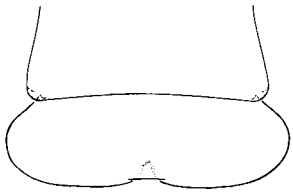

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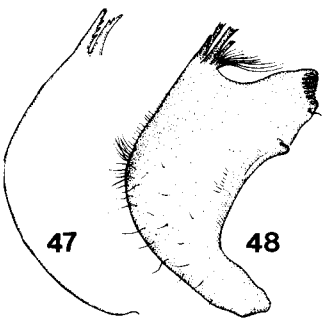

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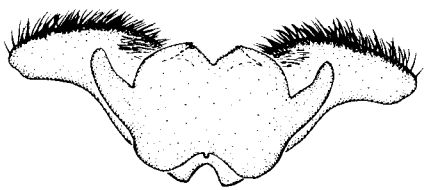

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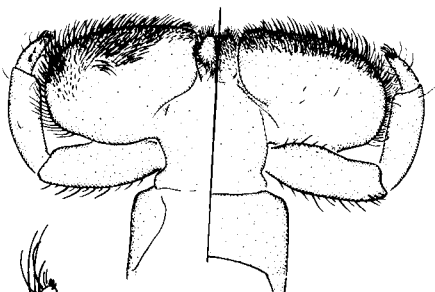

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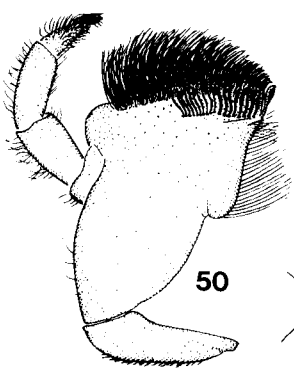

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Meridialaris laminata (Demoulin)

Fig. 1, 3-8, 23-26, 43, 46, 48-57, 63, 66-67, 71-75

Deleatidium laminatum Ulmer, 1919:23
Deleatidium illapeli Demoulin, 1955:26, NEW SYNONYMY
Meridialaris laminata Peters and Edmunds, 1972:1405

Male imago (in alcohol). — Length: body 7.0-8.0 mm, fore wings 7.0-9.0 mm. Head yellow. Scape and pedicel of antennae reddish brown, flagellum yellow, progressively paler apically. Upper portion of eyes orange yellow, lower portion black. Thorax: nota orange yellow; outer parapsidal furrows and posterolateral corners of scutellum reddish brown. Pleura yellow with black markings near base of subcoxae; anapisterna dark reddish brown. Sterna yellow, metasternum paler. Wings: membrane of fore wings hyaline, pterostigma cloudy white; longitudinal veins light brown, dark brown toward apex of veins C, Sc, and R_1; cross veins pale yellow, weakly developed in basal 1/2 of costal membrane; vein ICu_1 strongly divergent distally from vein CuA (Fig. 1); 16-20 costal cross veins. Membrane of hind wings hyaline; longitudinal and cross veins brown; 6-10 costal cross veins. Legs pale yellow, femora and tibiae darker; femora with a broad dark brown median transverse band, apex dark brown; dorsum of claws reddish brown, venter pale. Abdomen: terga translucent yellow with black maculae, extensive on terga 1-3, reduced to irregular sublateral stripes on terga 4-5 (Fig. 24-26); a black posterolateral spot on terga 2-7. Sterna translucent yellow, sterna 7-9 opaque yellow. Genitalia (Fig. 6-8): forceps pale yellow; angular bend on inner lateral margin of segment 1 well developed, located approximately 1/2 distance from base, segments 2 and 3 subequal in length. Styliger plate pale yellow with a deep, V-shaped posteromedian emargination. Square-shaped penes with minute hairs between short blade-like apical processes (Fig. 6-7). Caudal filaments yellow with narrow reddish brown annulation at joints; annulations progressively faded distally.

Female imago (in alcohol). — Length: body 7.0-9.0 mm, fore wings 7.0-9.0 mm. Similar to male imago except as follows: head pale yellow, thickly covered with whitish granulations; eyes black; thoracic sterna mostly covered with whitish granulations; 18-20 costal cross veins in fore wings, 7-10 in hind wings; and fore legs shorter.

Male subimago (in alcohol). — Similar to male imago except as follows: head dull yellow; antennae brown; outer parapsidal furrows, anterior 1/2 of median of mesonotum, and posterolateral corners of scutellum dark brown; membrane of fore and hind wings translucent pale white; longitudinal veins of fore wings brownish yellow, cross veins grayish brown; longitudinal and cross veins of hind wings dusty yellow; fore legs shorter; abdomen translucent yellow except sterna 7-10 opaque yellow; genital forceps brown; penes light brown; and caudal filaments brown.

Female subimago (in alcohol). — Similar to male subimago except as follows: color of ocelli and eyes as in female imago; membrane of fore and hind wings pale yellow.

Mature nymph (in alcohol) (Fig. 23). — Body length 7.0-9.0 mm. Dorsum of head dark yellow to light brown, venter whitish; base of ocelli and eyes ringed with pale yellow; a small pale yellow spot anterior to median ocellus and lateral to lateral

ocelli. Scape and pedicel of antennae brown, flagellum pale yellow. Mouthparts: labrum with a broad, U-shaped anteromedian emargination (Fig. 46), lateral margins angular (Fig. 23, 43). Maxillary palpi dark yellow; outer margin of cardo with 19-26 long spines. Segments 1 and 2 of labial palpi pale yellow, segment 3 light brown; outer margin of segment 1 with 12-14 long thick spines. Thorax: nota dark yellow to light brown with pale yellow markings. Sterna pale yellow. Legs: dorsum yellow, venter paler; dorsum of femora with a broad basal and apical yellow spots; tarsi with short, blunt spines as in Fig. 58. Abdomen: terga yellow with dark brown maculae as in imagos; terga 4-5 and 8-9 with a broad pale yellow median spot; a broad black spot near base of gills; terga 2-7 with a pale yellow posterolateral spot. Sterna pale yellow. Gills: membrane cloudy white, tracheae greyish black; main tracheal trunk with several branches on both sides (Fig. 63); dorsal and ventral lamellae moderately broad (Fig. 63). Caudal filaments pale yellow with 2-4 prominent reddish brown annulations near base followed by narrow annulation at joints.

Type specimens and deposition. — Syntypes 4 ♂, 1 & 2 ♀ S (in alcohol), Temuco, CHILE, C. Scheding, 1♂, 23.X.1908. ZMHU.

Geographical distribution (Fig. 78). — *Meridialaris laminata* is widely distributed in Chile.

Additional specimens examined. — CHILE: *Bío Bío Prov.*, N, I (♀), Río Bío Bío El Arco, 2/6.I.1959, LEP; S (♂, ♀), Río Mulchen, Mulchen, 8.XII.1963, GFE; N, trib. of Río Bío Bío, Santa Barbara, 6/8.XII.1972, MLP. *Cautin Prov.*, El Radal, 28/30.XI.1957, LEP. *Coquimbo Prov.*, I (♀), Cespedes, Hda. Illapel, 28.XI.1959, LEP; I (♀), LEP; N, Río Illapel, Huintil, Hda. Illapel, 500 m, 12.XI.1963, GFE; N, I (♂, ♀), Río Illapel, Caren, Hda. Illapel, 1000 m, 13.XI.1963, GFE; N, Río Cenicero, Baja Piedra, Hda. Illapel, 800 m, 13.XI.1963, GFE; N, Paihuano, 10.XI.1964, LEP: N, S, I (♂, ♀), Río Illapel, Sta. Virginia, El Bato, Hda. Illapel, Illapel, 16/18.XI.1972, MLP & GB; N, I (♂, ♀), Río Caren, Caren, Hda. Illapel, Illapel, 18.XI.1972, MLP & GB. *Curico Prov.*, N, El Coigual, 20/26.I.1964, LEP. *Linares Prov.*, N, Puente, Malcho 600 m nr Río Longavi, 13/15.I.1979, D&MD & BA. *Malleco Prov.*, I (♂, ♀), Marimenuco, 10/16.XII.1957, LEP; M, Rucanuco, 9/16.I.1959, LEP; N, Río Blanco, Curacautin, 27/28.I.1959, LEP; N, Río Bío Bío ca Marimenuco, II.XII.1963, GFE; N, I (♂, ♀, R), arroyo Pehuenco, trib. of Río Bío Bío, ca Marimenuco, 15.XII.1963, GFE; N, I (♂, ♀), Río Piquiquen, El Manzano 35Km W Angol, 600 m, 8/9.XII.1972, MLP. *Maule Prov.*, I, (♀) Los Molles, Ovalle, 11.XI.1961. *Nuble Prov.*, I (♀), 50Km E San Carlos, 26.XII.1950, ESR & AEM; N, Río Chillan, 550 m, 6.III.1968, LEP; N, I (♂, ♀, R), Río Niblinto, Niblinto, 250 m, 25/16.XI.1972, MLP & GB; N, I (♂, ♀, R), Río Renegado at Pte Marchant, Recinto, 26.XI.1972, MLP; N, Cascada Las Trancas, Recinto, 1120 m, 27.XI.1972, MLP. *Osorno Prov.*, N, I (♂), Río Rahue, 250 m, 20.XI.1963, GFE; N, S I (♂, ♀), Río Chanlelfu, Puyehue, 250 m, 21.XI.1963, GFE; N, trib. of Río Golgol, 10Km E Puyehue, 23.XI.1963, GFE; N, Río Chanlelfu, Puyehue, 500 m, 11/12.XI.1972, MLP. *Santiago Prov.*, N, I (♂, R), El Canelo, 880 m, 8.XI.1963, GFE; N, I (♂, ♀, R), El Canelo, 30.XI/2.XII.1972, MLP. *Talca Prov.*, N, Río Lircay, Altos de Vilches 800 m, 22.XI.1972, MLP & GB; N, Estero Vilches, Laguna de los Patos, Altos de Vilches 800 m, 22.XI.1972, MLP & GB. *Valdivia Prov.*, N, I (♂), ENCO, 25.II.1955, LEP.

Discussion. — Ulmer (1919) described *M. laminata* from male and female imagos and subimagos. Demoulin (1955) later described *M. illapelli* from a female imago. After careful examination of the holotype of *M. illapelli,* and syntypes, and reared adults of *M. laminata* we found that the two species are the same. Demoulin (1955) indicated that the absence of cross veins in the basal half of the costal, subcostal and radial membranes of the fore wings of *M. illapelli* easily distinguished the species from *M. laminata.* We found that both species have cross veins in these membranes. Additionally the assymmetrical fork of vein MA of the fore wings that Demoulin (1955) mentioned as distinctive of *M. illapelli* also exists in *M. laminata.* One of us (MLP) visited the type locality of *M. illapelli* in Río Illapel, Hacienda Illapel, Coquimbo Prov., CHILE, and spent three days of collecting and rearing mayflies. The only species of *Meridialaris* collected at that time was *M. laminata.* On the basis of the above, we designate *M. illapelli* as a junior synonym of *M. laminata.*

The above redescription of male and female imagos, and male and female subimagos is based on the type series, and recently collected and reared specimens. The nymph is described for the first time.

The nymphs of *M. laminata* exhibit a few color variations which include the general body color, relative size of pale yellow markings on the thoracic nota, and color pattern of femora. Nymphs collected from the north (Curico to Coquimbo Prov.), generally have lighter color and larger pale yellow spots on the thoracic nota than those collected from the south (Malleco to Valdivia Prov., CHILE). Similarly, the dorsum of femora of the northern forms are pale yellow with a median and an apical light brown bands, compared to the light brown femora of the southern forms which have a broad basal and small apical pale yellow spots. A few female imagos have discontinuous sublateral dark brown maculae (Fig. 26) while continuous or solid in others (Fig. 25). This variation occurs throughout the geographic range of the species.

Meridialaris laminata can be distinguished from all the other species of the genus by the following combination of characters. In the imagos: (1) vein ICu_1 of the fore wings is strongly divergent distally to vein CuA (Fig. 1); (2) femora have dark brown band; (3) maculae on the abdominal terga are as given in the description and Fig. 24-26; (4) well developed angular bend on inner margin of segment 1 of the male genital forceps is located approximately 1/2 distance from base (Fig. 6); (5) square-shaped penes have blade-like apical projections (Fig. 6-7); and (6) caudal filaments have reddish brown annulation at joints. In the nymph: (1) labrum has a broad, U-shaped anteromedian emargination (Fig. 46), and angular lateral margins; (2) antennal flagella uniformly pale yellow; (3) pro- and mesonota have pale yellow spots; (4) tarsi have short blunt spines (Fig. 58); and (5) abdominal gills are moderately broad and the main tracheal trunk has several branches on both sides (Fig. 63).

Meridialaris laminata belongs to the same phyletic line as *M. diguillina,* and *M. inflata* but can be distinguished from these genera by any of the following characters. In the imagos: (1) maculae on the abdominal terga are as given in the description and Fig. 24-26; (2) square-shaped penes have blade-like apical projections (Fig. 7-8); (3) well developed angular bend on inner margin of segment 1 of genital forceps is located approximately 1/2 distance from base (Fig. 6); and (4)

caudal filaments have reddish brown annulations at joints. In the nymph: (1) labial palpi are bicolorous with segments 1 and 2 yellow, and segment 3 light brown; (2) maculae on abdominal terga are as given in the description and Fig. 23, 24-26; and (3) abdominal gills are moderately broad (Fig. 63).

Biology. — The nymphs of *M. laminata* occur in streams and rivers. On several occasions, one of us (MLP) collected the nymphs near mid-streams where current was swift. The leptophlebiid nymphs collected in this habitat along with *M. laminata* included *M. chiloeense* and *Massatellopsis irrarrazavali.*

The nymphs are usually found in the interstices or crevices of stones, or between stones and small rocks. Occasionally, the nymphs were collected in cracks of submerged logs or twigs and among roots of plants growing along the banks of streams and rivers.

The nymphs and adults were collected in November through March. Emergence of adults was observed from 1600 to 1900 hrs. Reared adults however, emerged anytime during the day. One of us (MLP) observed mass emergences and adult swarms. The first observation took place in Río Illapel, Coquimbo Prov., at 1630 hrs. A small group of about 10-20 adults were flying upstream and downstream about 5-10 feet above the water. The swarm lasted for about 15 minutes. The second observation of mass emergence was in Río Niblinto, Linares Prov., at 1800 hrs. Approximately 50-100 adults were swarming 20-30 feet above the water. The flight pattern was a simple upstream-downstream repertoire. The swarm lasted for more than one hour, and the adults collected indicated a more or less 4:1 male-female ratio. A light trap was set at night on the same vicinity and few adults came to light.

The nymphs of *M. laminata* have been collected at elevations ranging from 230 to 2,000 m above sea level.

A few nymphs collected in Río Renegade, and Río Niblinto, Nuble Prov., and a trib. of Río Bío Bío, Bío Bío Prov., are parasitized by a chironomid, *Symbiocladius wygodzinski* Roback (?). The larva or pupa of the parasite was attached underneath the wing pads of the host. Parasitized nymphs were generally paler than the unparasitized ones, and the wing pads were twisted or wrinkled.

Dissected nymphs revealed the dominant gut contents as diatoms (56.13%), mineral particles (26.52%) and detritus (17.35%). The identified diatoms include the genera *Cymbella, Gomphonema, Navicula* and other naviculoid diatoms.

Meridialaris tintinnabula new species

Fig. 18-19, 38-40, 44, 47

Male imago (in alcohol). — Length: body 8.0 mm, fore wings 9.0 mm. Head brown. Scape and pedicel of antennae reddish brown, flagellum yellow. Upper portion of eyes orange yellow, lower portion black. Thorax: nota reddish brown, pronotum dark yellow. Pleura yellow, katepisterna reddish brown. Sterna reddish brown, median of furcasternum and metasternum orange yellow. Wings: membrane of fore wings hyaline, pterostigma cloudy white; longitudinal and cross veins brown; costal and subcostal cross veins developed; vein ICu_1 parallel to slightly divergent distally from vein CuA as in Fig. 2; 18-20 costal cross veins. Membrane of hind wings hyaline; longitudinal and cross veins brown; 9-11 costal cross veins. Legs:

yellow, profemora and protibiae dark brown; tarsal claws reddish brown; femora with a broad, dark brown mid-transverse band, apex brown. Abdomen: terga translucent yellow, opaque yellow on terga 8-10; black maculae pronounced on terga 1-3 and 7-9 (Fig. 38-40); terga 4-5 with a broad pale yellow median spot. Sterna translucent yellow, opaque yellow on terga 7-10; sternum 1 washed with brown; thin brown markings on sterna 2-8; Genitalia: segment 1 of forceps dark yellow, segments 2 and 3 slightly paler; angular bend on inner margin of segment 1 of forceps weakly developed, gradually tapers towards middle (Fig. 18), segments 2 and 3 subequal length. Styliger plate orange brown with a broad, shallow and U-shaped posteromedian emargination. Bell-shaped penes dark yellow with finger-like apical projections (Fig. 18-19). Caudal filaments yellowish brown.

Female imago. — Unknown.

Male subimago (in alcohol). — Similar to male imago except as follows: head dark yellow; median of pronotum, scutellum, and outer 1/2 of sclerite between inner and outer parapsidal furrows orange yellow; pleura orange yellow, faintly washed with black; membrane of both wings translucent white; longitudinal and cross veins light brown; genital forceps yellow; progressively darker basally; styliger plate brown; penes yellow; and caudal filaments yellowish brown.

Female subimago. — Unknown.

Mature nymph (in alcohol). — Body length 7.0-9.0 mm. Dorsum of head yellow, venter pale white; a black spot near clypeal suture; a pale yellow spot anterior to median ocellus and lateral to lateral ocelli. Scape and pedicel of antennae orange brown, flagellum yellow. Mouthparts: labrum with a narrow, deep, V-shaped anteromedian emargination as in Fig. 45, lateral margins smooth and rounded (Fig. 44). Maxillary palpi yellow; outer margin with 28-34 long spines. Labial palpi pale yellow, outer margin of segment 1 with 25-30 long spines. Thorax: nota dark yellow with pale yellow markings. Sterna yellow; Legs: dorsum yellow, venter pale white; femora and tarsi a little darker than tibiae; dorsum of femora with a basal, median, and apical pale yellow spots; tarsi with thick, moderately long spines as in Fig. 59. Abdomen: terga yellow with black maculae as in male imago, somewhat reticulated on terga 6-8; a black brown spot near base of gills. Sterna yellow. Gills: membrane cloudy white, tracheae grayish black; main tracheal trunk with several developed branches on both sides as in Fig. 64; dorsal and ventral lamellae moderately broad. Caudal filaments yellow with 3-4 prominent reddish brown annulations near base.

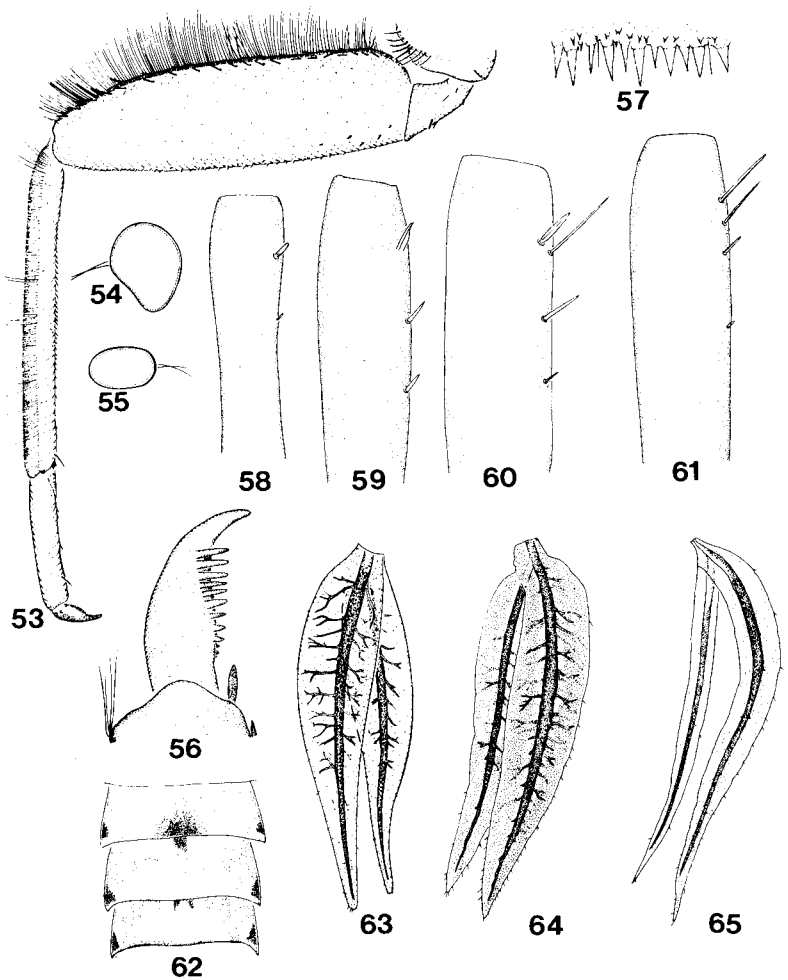
Geographical distribution (Fig. 79). — *Meridialaris tintinnabula* occurs in the high mountains of Tucuman, Argentina.

Holotype ♂ imago. — ARGENTINA, Tucuman Prov., stream at Quebradita, NW Tafi del Valle, 6,600 ft (12,010 m), 29.I.1969, WLP & JGP. Paratypes, 1 ♂ imago, 1 ♂ subimago, and 250 nymphs, same data as holotype. ARGENTINA: *Tucuman Prov.,* 6 nymphs, Rt. 307, 76 Tafi del Valle, 11.X.1973, OSF; 3 nymphs, Rt. 307, 3317Km W Acheral, 11.X.1973, OSF.

The nymph and imago are associated by rearing.

All types are preserved in alcohol. Types are deposited as follows: holotype, 1 ♂ subimaginal and 100 nymphal paratypes, FAMU; 1 ♂ subimaginal and 100 nymphal paratypes, UU; 59 nymphal paratypes, USNM.

Etymology. — tintinnabulum, L., meaning bell.



FIGURES 53-56. — Nymphal leg of *Meridialaris laminata:* 53, fore leg; 54-55, cross section of tibia and tarsus; 56, fore claw. FIG. 57. Posterior spines of nymphal abdominal terga. FIG. 58-61. Nymphal metatarsal spines: 58, *M. diguillina;* 59, *M. spina;* 60-61, *M. chiloeense.* FIG. 62. Color pattern of abdominal terga of *M. spina.* FIG. 63-65. Gill 4 of nymphs: 63, *M. laminata;* 64, *M. chiloeense;* 65, *M. diguillina.*

Discussion. — *Meridialaris tintinnabula* can be distinguished from all the other species of the genus by the following combination of characters. In the imagos: (1) vein ICu_1 of the fore wings is parallel to slightly divergent distally from vein CuA as in Fig. 2; (2) femora have a dark brown band; (3) maculae on the abdominal terga are as given in the description and Fig. 38-40; (4) weakly developed angular bend on the inner margin of segment 1 of the genital forceps is located approximately 1/2 distance from the base (Fig. 18); and (5) bell-shaped penes have finger-like apical projections (Fig. 19). In the nymph: (1) labrum has a narrow, deep, V-shaped anteromedian emargination as in Fig. 45, and lateral margins smooth and rounded (Fig. 44); (2) antennal flagellum pale yellow; (3) pro- and mesonota have pale yellow spots; (4) tarsi have moderately long spines as in Fig. 59; and (5) abdominal gills are moderately broad and have a few to several well developed tracheal branches as in Fig. 63.

Meridialaris tintinnabula appears most closely related to *M. spina* but can be distinguished from it by any of the following characters. In the nymph: (1) dorsum of femora has basal, median, and apical pale yellow spots; (2) outer margin of cardo has 23-34 long spines; and (3) maculae on the abdominal terga are as given in the description and Fig. 38-40.

Biology. — The biology of *M. tintinnabula* is unknown. The nymphs were found underneath small rocks and stones from a small, cold swift flowing high mountain stream in Tucuman, Argentina. The nymphs were collected in June and the adults in January.

Dissected nymphs revealed the gut contents as mineral particles (53.2%), detritus (41.27%), diatoms (3.82%), and filaments algae (1.64%). Identified diatoms include the genus *Cocconeis*.

Meridialaris spina new species

Fig. 59, 62

Male and female imagos. — Unknown.

Male and female subimagos. — Unknown.

Mature nymph (in alcohol). — Body length 8.0-10.0 mm. Dorsum of head light brown to dark brown, black between ocelli, venter pale white; eyes ringed with pale yellow; a pale yellow spot anterior to median ocellus and lateral to lateral ocelli. Scape and pedicel of antennae reddish brown, flagellum yellow, apical 2/3 with narrow reddish brown annulation at joints. Mouthparts: labrum with a narrow, deep, V-shaped anteromedian emargination as in Fig. 45, lateral margins smoothly curved and rounded as in Fig. 44. Maxillary palpi brown; outer margin of cardo with 19-22 long spines. Segment 1 and 2 of labial palpi yellow, segment 3 light brown; outer margin of segment 1 with 19-21 long, thick spines. Thorax: nota bright yellowish brown to dark brown with pale yellow markings. Sterna pale white. Legs: dorsum shiny brown, venter pale; dorsum of femora with basal and apical yellow spots; tarsi with moderately long spines (Fig. 59). Abdomen: terga yellowish brown to dark brown with black maculae as in Fig. 62; terga 4-5 and 8-9 with a pale yellow median spot, largest on tergum 9; a black spot near base of gills. Sterna yellowish brown with small brown markings near lateral margins. Gills cloudy white, tracheae

grayish black; main tracheal trunk with several well developed branches (Fig. 64); dorsal and ventral lamellae moderately broad as in Fig. 64. Caudal filaments with prominent reddish brown annulation near base, followed by a narrow orange annulation at joints.

Geographical distribution (Fig. 79). — *Meridialaris spina* occurs in the Andean slopes of Chile and Argentina.

Holotype ♂ mature nymph. — Chile: Llanquihue Prov., El Canelo, Hornohuinco, Correntoso, 22/23.XII.1976, MLP & LEP. Paratypes, 30 nymphs, same data as holotype. CHILE: *Arauco Prov.*, 2 nymphs, Caramavida, 31.I.1967, LEP. *Bío Bío Prov.*, 1 nymph trib. of Río Bío Bío, Santa Barbara, 6/8.XII.1972, MLP & LEP. *Curico Prov.*, 13 nymphs, El Coigo. *Llanquihue Prov.*, 15 nymphs Río Tenio, 3Km W Lago Chapo, 23.XII.1972, MLP. *Malleco Prov.*, 1 nymph, Nahuelbuta Nat. Park, nr Los Gringos Camp, 29.I/5.II.1979, D&MD & BA. *Osorno Prov.*, 1 nymph, 250 m Río Chanlelfu, Puyehue, 21.XI.1963, GFE; 5 nymphs, Río Pescadero nr Antillanca, Puyehue, 12.XII.1972, MLP; 6 nymphs, a small stream near Lago Las Marizas, Puyehue Nat. Park, Puyehue 800 m, 13.XII.1972, MLP & LEP; 1 nymph, small stream near boundary between Chile and Argentina, Puyehue, 1,500 m, 13.XII.1972, MLP; 10 nymphs, P.N. Puy. Río Chanlelfu, 1Km S Agua Calientes, 8/9.II.1978. *Santiago Prov.*, 10 nymphs, Río Lircay, Altos de Vilches, 800 m, 22.XI.1972, MLP & GB. ARGENTINA: *Neuquen Prov.*, 1 nymph, Ao. Rosales, nr S.M. d.l. Andes, 22.I.1972, OSF; 2 nymphs, Río Aseret, nr Lago Currhue, 23.I.1974, OSF; 6 nymphs, 2Km N Tres Puentes, 23.I.1974, OSF; 5 nymphs, 7Km NW Lago Lolog 23.I.1974, OSF; 10 nymphs, a brooklet at Lago Melliquina, 25.I.1974, OSF; 14 nymphs, brooklet at Lago Huechulafquen, 26.I.1974, OSF; 2 nymphs, Ao. La Estacado, 13Km S La Angostura, 4.II.1974, OSF. *Río Negro Prov.*, 2 nymphs, 8Km N Río Villegas, 7.II.1974, OSF; 20 nymphs, Río Litran, 5Km N Lago Alumine, 1.III.1978, CMF & OSF.

All types are preserved in alcohol. Types are deposited as follows: holotype and 30 nymphal paratypes, FAMU; 30 nymphal paratypes, UU; 50 nymphal paratypes, USNM.

Etymology. — spina, L., meaning spine.

Discussion. — The nymphs of *M. spina* typically have reduced tergal maculae that are confined near the posterolateral corners (Fig. 62). A few nymphs however, have slender and elongated sublateral maculae that extend almost the entire length of the terga. Others have the abdominal terga faintly washed with brown which obfuscates the pattern of maculae. All these color variations occur throughout the species geographic range.

Meridialaris spina can be distinguished from all the other species of the genus by the following combination of characters. In the nymph: (1) labrum has a narrow, deep, V-shaped anteromedian emargination as in Fig. 46, and lateral margins are smooth and rounded as in Fig. 44; (2) antennal flagellum pale yellow; (3) pro- and mesonota lack spots; (4) tarsi have moderately long spines (Fig. 59); and (5) abdominal gills are moderately broad and the main tracheal trunk has several developed branches as in Fig. 64.

Meridialaris spina is known only from the nymph and appears most closely related to *M. tintinnabula*. In addition to being a geographic disjunct, *M. spina* can

be distinguished from *M. tintinnabula* by any of the following characters: (1) femora lack median pale yellow spot; (2) maxillary palpi are brown; (3) outer margin of cardo has 19-22 long spines; and (4) maculae on the abdominal terga are as given in the description and Fig. 62.

Biology. — The nymphs were found under small rocks or stones in swift flowing streams. The nymphs were collected from November to February. Some of the nymphs collected in November have black wing pads. The species has a wide altitudinal range, from 250 m to 1,500 m above sea level.

Dissected nymphs revealed the gut contents as detritus (49.82%), mineral particles (31.87%), diatoms (15.75%) and filamentous algae (2.56%). Identified diatoms include the genera *Eunotia* and *Cymbella*.

Phylogenetic Relationships of the Species of Meridialaris

The different species of *Meridialaris* can be grouped into phyletic units by analyzing the external morphology of both the adults and nymphs. Polarity of character states is based on the concept that plesiomorphic character states are generally widespread in the genus and often in the family.

Figure 76 shows the probable phylogenetic relationships of the species of *Meridialaris*. The sequence of branching is based on shared possession of apomorphic character states. Table 1 shows the character states analyzed herein.

Furcation 1 represents the probable major phyletic split within the genus. The nymphs of Lineage 1A (*M. chiloeense, M. spina* and *M. tintinnabula*) with the exception of *M. biobionica* in which the nymph is unknown, share the apomorphic deep, V-shaped anteromedian emargination of the labrum (Fig. 45) and varied development of the tarsal spines ranging from moderately long (Fig. 59) to long needle-like spines (Fig. 60-61). The adults however, have retained the plesiomorphic cylindrical (Fig. 15, 20) to bell-shaped penes (Fig. 18). Individuals in Lineage 1B (*M. diguillina, M. inflata* and *M. laminata*) retain the plesiomorphic

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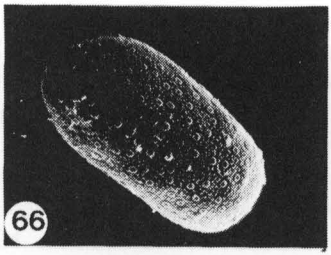
Figures 66-69 — Scanning electron micrographs of eggs: 66-67, egg (510X) and micropyle (2400X), *Meridialaris laminata;* 68-69, egg, (510X) and micropyle (2600X), *Massartellopsis irrarrazavali.* Fig. 70-75. Photomicrograph and scanning electron micrographs of nymphal structures of *M. laminata* (71-75) and *M. chiloeense* (70): 70, hair near dorsoapical margin of labrum (400X); 71, dorsal setae of nymphal femora (570X); 72, enlarged pits of antenna (7000X); 73-74, antennal segments (430X, 220X); 75, caudal filaments (175X).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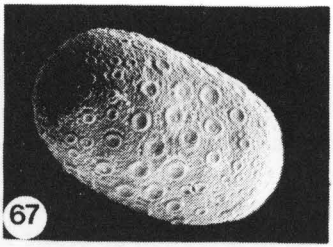
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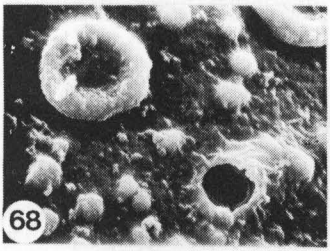
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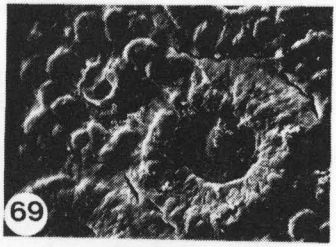
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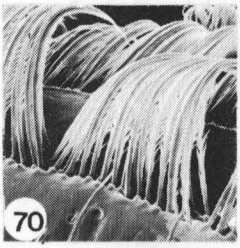
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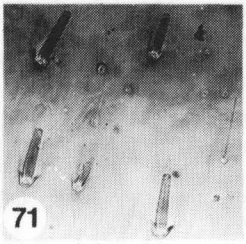
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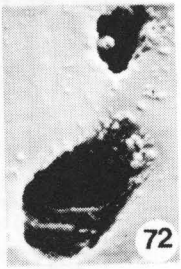
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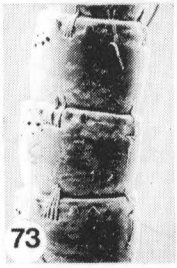
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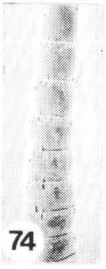
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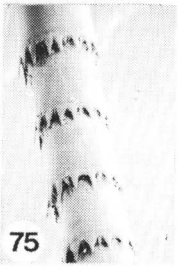
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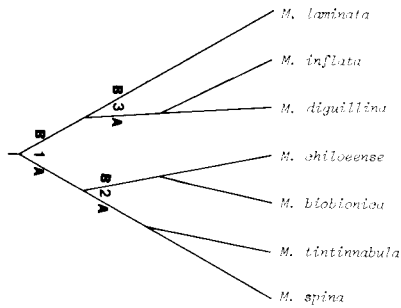


FIGURE 76. — Phylogenetic diagram of *Meridialaris*.

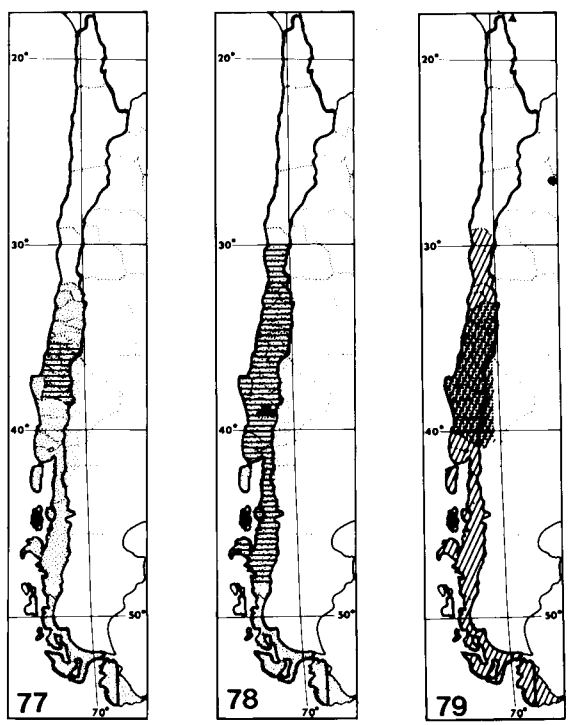


FIGURE 77-79. — Geographic distribution of *Meridialaris* and *Massartellopsis*. 77, *Meridialaris biobionica* (hatched) and *M. chiloeense* (stippled); 78, *M. diguillina* (stippled), *M. laminata* (hatched) and *M. inflata* (solid); 79, *M. spina* (stippled), *M. tintinnabula* (solid, circle) and *Massartellopsis irrarrazavali* (hatched and triangle).

broad U-shaped emargination of the labrum (Fig. 46), and short, blunt tarsal spines (Fig. 58). The adults have the apomorphic square-shaped penes (Fig. 6) or swollen penes (Fig. 9, 12).

Lineage 2A (*M. tintinnabula* and *M. spina*) is defined in the nymphs by the smooth and rounded lateral margins of the labrum (Fig. 44), and moderately long thick tarsal spines (Fig. 59). The adults of *M. spina* are unknown. The weakly developed angular bend on the genital forceps (Fig. 18), and thick spinous setae near the base of the apical projections of the penes (Fig. 19) are unique to *M. tintinnabula* as both character states do not occur in any of the southern South American Leptophlebiidae. The moderately

TABLE 1. — Character States of Figure 1. a, apomorphic; p, plesiomorphic.

Furcation 1	A	B
Penes	(p) cylindrical (Fig. 16), or bell-shaped (Fig. 18)	(a) square-shaped (Fig. 18) or swollen (Fig. 9)
Labrum	(a) anteromedian emargination deep V-shaped (Fig. 45)	(p) anteromedian emargination broad U-shaped (Fig. 46).
Nymphal tarsi	(a) tarsi with moderately thick spines (Fig. 59) combination of needle-like spines	(p) tarsi with short blunt spines (Fig. 58)
Furcation 2		
Labrum	(p) smooth and rounded lateral margins (Fig. 44)	(a) angular lateral margins (Fig. 43)
Nymphal tarsi	(p) tarsi with thick spines only (Fig. 59)	(a) tarsi with long needle-like spines (Fig. 60-61)
Adult femora	(a) lack median brown band	(p) with dark brown median band
Genital forceps	(a) inner margin of genital forceps with weaklydeveloped angular bend (Fig. 18)	(p) inner margin of segment 1 of genital forceps with well developed angular bend (Fig. 12)
Furcation 3		
Penes	(p) glabrous between apical projections (Fig. 10, 13)	(a) with short hair-like setae between apical projections (Fig. 7)
Genital forceps	(a) angular bend near base (Fig. 12)	(p) angular bend located approximately 3/5 distance from base (Fig. 6)
Gill lamellae	(a) slender (Fig. 65)	(p) moderately broad (Fig. 63, 64)

long thick tarsal spines of the nymphs in this lineage appear to represent the phenoclinal intermediate between the short blunt spines (Fig. 58) in Lineage 1B, and the long needle-like spines in Lineage 2B (Fig. 60-61). In *Meridialaris,* the rounded lateral margins of the labrum are limited to *M. spina* and *M. tintinnabula,* but this character state is common among the more primitive genera, (eg., *Nousia* and *Penaphlebia*). Individuals of Lineage 2B (*M. chiloeense* and *M. biobionica*) share a well developed angular bend on the inner margin of the genital forceps (Fig. 20). As mentioned earlier, the nymph of *M. biobionica* is unknown. The nymph of *M. chiloeense* has the apomorphic long needle-like tarsal spines (Fig. 60-61) which are quite unique in the species. This character state is common among the nymphs of the genus *Massartellopsis,* a derived sister group of *Meridialaris.* The adults of *M. chiloeense* and *M. biobionica* retain the plesiomorphic well-developed angular bend on the inner margin of segment 1 of the genital forceps (Fig. 20).

Lineage 3A (*M. diguillina* and *M. inflata*) is characterized by the plesiomorphic lack of setae between the apical processes of the penes (Fig. 10, 13, Table 1) and the apomorphic angular bend of the genital forceps (Fig. 12). Lineage 3B (*M. laminata*) has the angular bend of the genital forceps located approximately 3/5 distance from the base (Fig. 6) and the apomorphic pilose condition between the processes of the penes (Fig. 7). Similarity of the genital forceps of Lineage 3A and Lineage 2B suggests that this character state probably arose independently, as it sporadically occurs in some species of the other leptophlebiid genera. The nymph of *M. diguillina* (Lineage 3A) has the apomorphic slender gills (Fig. 65) compared to the plesiomorphic moderately broad gills (Fig. 63) in Lineage 3B. Except for the species *Meridialaris tintinnabula* which is geographically isolated in the high mountain streams of Tucuman Prov., Argentina, *Meridialaris* is confined in the cool-mountain streams of southern South America. The geographic disjunction of *M. tintinnabula* is biogeographically interesting because no species of the genus has been collected in the intermediate low lying areas between the high mountain streams of Tucuman Prov. and the cool region of southern South America. Whether the genus had had a widespread or contiguous distribution prior to the evolution of the Andes remains a speculative argument.

Massartellopsis Demoulin

Massartellopsis Demoulin, 1955:9; Peters and Edmunds, 1974:1409; Pescador 1980:43.

Type species. — *M. irrarrazavali* Demoulin.

Species included. — *M. irrarrazavali* Demoulin.

Distribution. — Magallanes Province (ca. 54 S) north to Andean region of La Paz, BOLIVIA.

Imago. — Length: ♂ body 7.5-8.9 mm, fore wings 8.0-11.0 mm; ♀ body 8.0-9.0 mm; fore wings 8.5-12.0 mm. Eyes of male meet on meson of head, lower portion of eyes 3/4 length of upper portion; eyes of female separated on meson of head by a length 3.5 to 4x width of an eye. Wings (Fig. 80-81): vein Rs of fore wings forked 1/5 to slightly more than 1/4 distance from base to margin; vein MA forked more than 1/4 distance from base to margin, fork symmetrical; distal portion of vein MA of fore wings moderately sagged (Fig. 80); vein MP_2 moderately recurved, attached at base to vein MP_1 with a cross vein more than 1/5 distance from base to margin; vein ICu_1 attached at base by a cross vein to CuA (Fig. 80). Costal margin of hind wings with concavity located approximately 1/2 distance from base; apex obtuse (Fig. 81); vein Sc 9/10 maximum length of hind wing (Fig. 81). Legs: length ratios of segments in ♂ fore legs, 0.77:1.00 (3.5 mm): 0.05:0.28:0.22:0.22:0.16. Claws of a pair alike, both apically hooked each with an opposing hook (Fig. 83). Male genitalia (Fig. 84-85): segments 2 and 3 of forceps subequal in length, segment 2 1/5-1/4 length of segment 1; base of segment 1 broad, inner margin with well developed angular bend (Fig. 84). Maximum length of styliger plate approximately 1/3 maximum width. Penes lobes divided, each lobe with a slender tongue-like apical processes and minute hairs (Fig. 85). Ninth sternum of female apically entire and rounded (Fig. 82). Terminal filament longer than cerci.

Egg. — Elongate oval, polar cap absent; chorion granulate with combination of circular ridges (Fig. 68), smaller ridges on polar end; one small oval sperm guide (Fig. 69).

Mature nymph. — Head prognathous (Fig. 103). Antenna approximately 2x as long as head; flagellar segments with fine apical hairs and in whorls, and denticles progressively smaller distally; antenna with prominent pits (Fig. 72-73). Mouthparts (Fig. 90-96): length of labrum approximately 1/4x maximum width, lateral margins angularly curved (Fig. 90), dorsal hair feathery as in Fig. 70; anteromedian emargination deep V-shaped (Fig. 91). Clypeus narrower than labrum, lateral margins divergent (Fig. 90). Outer margin of mandibles angular (Fig. 92), apical half with series of short hairs and median hair tuft (Fig. 92), outer incisor with spines. Galea-lacinia of maxillae apically broad with 15-22 subapical pectinate setae (Fig. 93); segments 1 and 2 of maxillary palpi subequal length, segment 3 2/3 length of segment 2, inner margin of segment 2 with long spines. Lingua of hypopharynx with well developed lateral processes (Fig. 94), paired longitudinal rows of hairs on dorsal surface, anterior margin deeply cleft; superlingua with hair along anterior margin, lateral margins obtuse. Segments 1 and 2 of labial palpi subequal length, segment 3 approximately 2/5 length of segment 2; glossae straight, flat (Fig. 95), submentum with thick ventrolateral spines (Fig. 95). Lateral margins of pronotum glabrous (Fig.

103). Legs (Fig. 97): maximum width of tibiae approximately twice that of tarsi; tibiae of fore legs in cross section ovoid (Fig. 98), tarsi rounded (Fig. 99); femora with fine long hair and cylindrical setae, setal insertion depressed; denticles on claws long, gradually larger apically (Fig. 100). Gills (Fig. 101): gills on segment 1-7 alike, dorsal and ventral lamellae moderately broad, progressively smaller posteriorly, main tracheal trunk along median with several branches (Fig. 101). Posterolateral projections on segment 2-9; terga with fine hairs, and short transparent needle-like setae; lateral margins pilose, posterior margin with short, basally broad spines (Fig. 102). Terminal filament longer than cerci; segments of caudal filaments with fine hair in groups of variable number, apical spines closely set together (Fig. 75).

Discussion. — Demoulin (1955) established *Massartellopsis* for *M. irrarrazavali* from Chile. Peters and Edmunds (1972) subsequently redescribed the genus from nymphs and reared adults.

Tillyard (1935) described the species *Atalophlebia ida* from female imagos collected in Tasmania. Scholes (1961) subsequently changed the name to *Massartellopsis ida* giving no reason at all of his action. His only comment was that the nymphs are undescribed, but is of the crawling type and resemble those of the genus *Atalophlebia*. Tillyard's original drawing of the fore wing of *A. ida* shows great similarities to the fore wing of *Massartellopsis*, but the ninth abdominal sternum is deeply cleft compared to entire in *Massartellopsis* (Fig. 82). We have examined a few nymphs from the same locality where *A. ida* was reportedly collected and found to represent an undescribed genus. Until reared material of *A. ida* are available, the species remains in *Atalophlebia*.

Massartellopsis can be distinguished from the other genera of Leptophlebiidae by the following combination of characters. In the imagos: (1) vein Sc of hind wings is 9/10 of the maximum length of hind wing (Fig. 80); (2) claws of a pair are alike, both are apically hooked and each with an opposing hook (Fig. 83); (3) penes lobes are divided and tubular, and each lobe has a slender tongue-like apical processes and minute hairs (Fig. 85); (4) female ninth sternum is apically entire (Fig. 82). The eggs have granulate chorion and scattered circular ridges with the smaller ridges on polar ends. In the nymph: (1) lateral margins of the labrum are angularly curved (Fig. 90); (2) outer margin of the mandibles is angular and has series of short hairs on apical half, and median hair tuft (Fig. 92); (3) segment 3 of labial palpi is approximately 2/5 length of segment 2, and glossae are straight and flat (Fig. 95); (4) submentum has thick ventrolateral spines (Fig. 95); (5) posterolateral projection occurs on abdominal segments 2-9; and (6) abdominal gills 1-7 are alike, and lamellae are gradually tapered apically (Fig. 101).

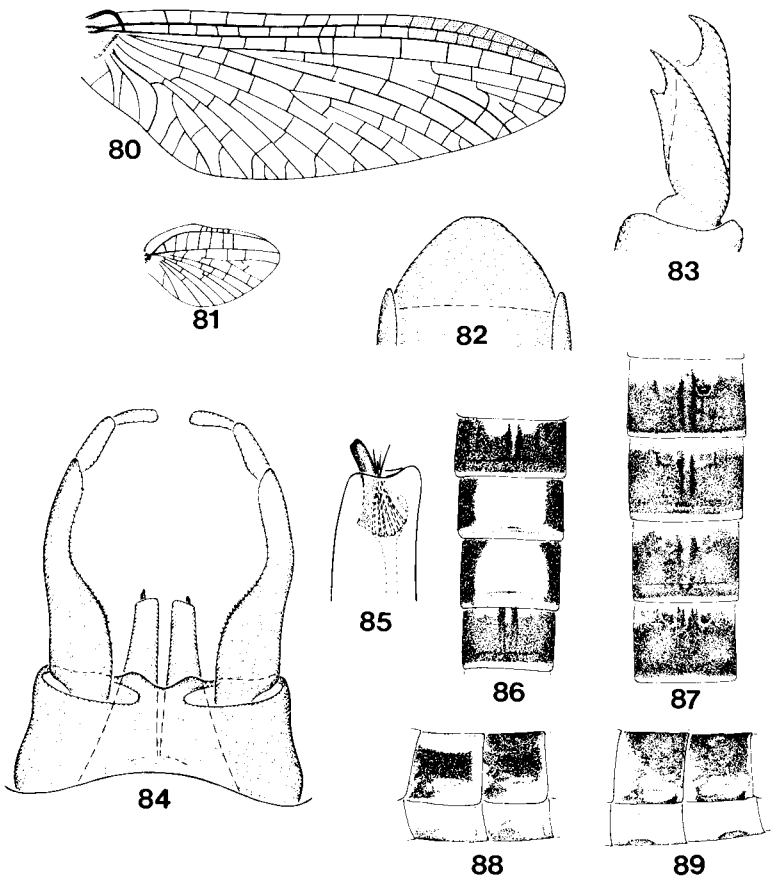
Massartellopsis and *Meridialaris* are sister groups (Pescador and Peters, 1980). *Massartellopsis* can be distinguished from *Meridialaris* by any of the following characters. In the imagos: (1) penis lobes are divided and tubular (Fig. 84, 85); (2) claws of a pair are alike, both apically hooked, each with an opposing hook (Fig. 83); and (3) female ninth sternum is apically entire and rounded (Fig. 82). The chorion of eggs has both large and small circular ridges, the smaller ridges are concentrated on the polar ends (Fig. 68). In the nymphs: (1) submentum has thick ventrolateral spines (Fig. 95); and main tracheal trunk of the abdominal gills has several well developed branches (Fig. 101).

Massartellopsis irrarrazavali Demoulin

Fig. 68-69, 80-102

Massartellopsis irrarrazavali Demoulin, 1955, 31:9; Edmunds, 1972, 65:1409.

Male imago (in alcohol). — Length: body 7.0-9.0 mm, fore wings 7.0-9.0 mm. Head yellow. Scape and pedicel of antennae yellow, flagellum paler. Upper portion of eyes orange yellow, lower portion black. Thorax: nota reddish brown, median of



FIGURES 80-89. — *Massartellopsis irrarrazavali:* 80-81, ♂ fore and hind wings; 82, ♀ 9th abdominal sternum; 83, ♂ fore claw; 84, ♂ genitalia (ventral); 85, apex of penis lobe (enlarged); 86-89, abdominal color pattern of ♂ terga (86, 88, terga 3-7; 87, 89, pleura 5-6).

mesofurcasternum and metasternum pale yellow. Wings: membrane of fore wings hyaline; longitudinal and cross veins light brown, veins C, Sc, and R_1 darker; costal cross veins 19-22. Membrane of hind wings hyaline; longitudinal and cross veins light brown; costal cross veins 6-9. Legs: brownish yellow, tibiae and tarsi paler; claws reddish brown; margins of femora washed with black. Abdomen: terga translucent yellow with black maculae, pronounced on terga 1-3 and 6-8 (Fig. 86-89); maculae on terga 4-5 and 9-10 reduced to broad sublateral stripes. Sterna translucent yellow to light brown; sternum 1 faintly washed with dark brown. Genitalia: segment 1 of forceps reddish yellow, segments 2 and 3 paler. Styliger plate reddish yellow. Penes dark yellow. Caudal filaments pale yellow.

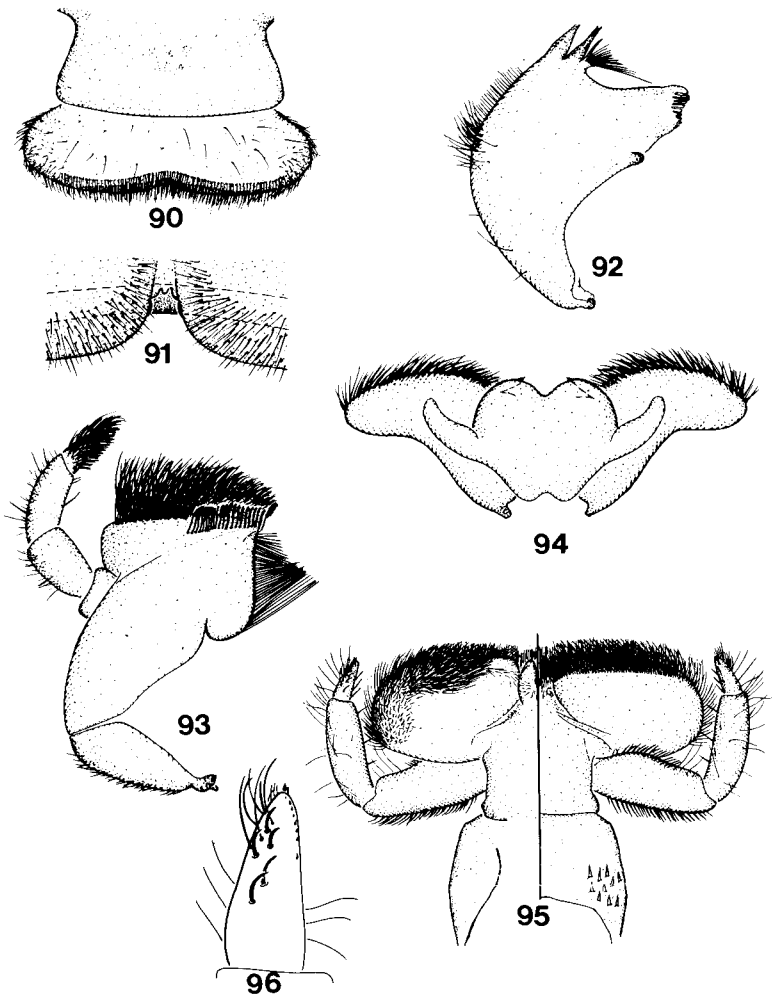
Female imago (in alcohol). — Length: body 7.0-9.0 mm, fore wings 7.0-9.0 mm. Similar to male imago except as follows: head yellow, blackish brown between ocelli; antennae yellow, apex of pedicel and base of flagellum darker; eyes black; 20-23 costal cross veins in fore wings, 6-9 in hind wings.

Male subimago (in alcohol) — Similar to male imago except as follows: head cloudy yellow, black between ocelli; antennae light brown; pronotum pale yellow, basal hump of scutellum and inner 1/2 of sclerite between inner and outer parapsidal furrows brown; outer parapsidal furrows and apical corners of scutellum black; pleura yellow, epimera and episterna reddish brown; membrane of wings translucent smoky brown; longitudinal and cross veins brown; cross veins in basal 1/2 of costal, subcostal and radial membranes clouded with dark brown; and caudal filaments brown.

Female subimago (in alcohol). — Similar to male subimago except as follows: head yellow with small reddish brown markings at vertex; antennae yellowish brown, apex of pedicel and base of flagellum orange brown; cross veins in bullae thickly clouded with dark brown; and tarsi smoky brown.

Mature nymph (in alcohol) (Fig. 103). — Body length 7.0-9.0 mm. Dorsum of head orange yellow, faintly washed with dark brown, venter pale; a small pale yellow spot anterior to median ocellus and lateral to lateral ocelli. Scape and pedicel of antennae reddish brown, flagellum yellow progressively darker distally; apical 2/3 of flagellum with narrow reddish brown annulation at joints. Mouthparts: maxillary palpi bicolorous with segments 1 and 2 yellow, and segment 3 brown; outer margin of cardo with 30-40 spines. Labial palpi bicolorous with segments 1 and 2 yellow, and segment 3 brown; outer margin of segment 1 of labial palpi with 30-40 spines, inner margin 15-20 spines. Thorax: nota amber-yellow, washed with blackish brown; margins of pronotum pale yellow. Pleura and sterna pale yellow, episterna and epimera orange brown, washed with black. Legs: dorsum yellow except subcoxae and coxae brown; venter pale yellow, femora faintly washed with black. Abdomen: terga washed with blackish brown maculae as in imagos. Sterna dark yellow to brownish yellow, anterior margin washed with brown. Gills: membrane cloudy white, tracheae greyish black. Caudal filaments yellow with 3-4 prominent reddish brown annulations near base.

Geographical distribution (Fig. 79). — *Massartellopsis irrarrazavali* has a wide geographic range occurring in the mountain ranges of Bolivia southward to the Andean region of Chile and Argentina (Fig. 79).

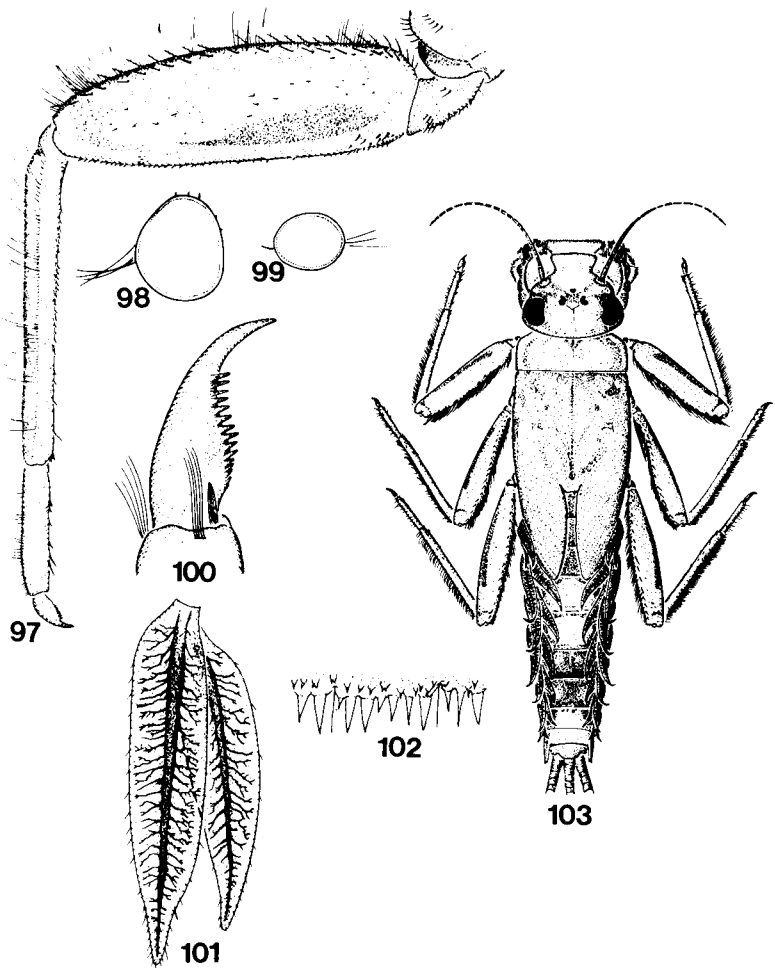


FIGURES 90-96 — Mouthparts of mature nymph of *M. irrarrazavali:* 90, clypeus and labrum; 91, anteromedian emargination of labrum (enlarged); 92, left mandible; 93, right maxilla, ventral; 94, hypopharynx; 95, labium, dorsal (left), ventral (right); 96, enlarged third segment of labial palp.

Type specimens and deposition. — Holotype, 1 ♂ subimago, 1200-1500 m, Los Maitenes (70′17″W-33′32″S), Santiago Prov., Chile, 16/18.X.1954, LEP; paratype, 1 subimago, same data as holotype; allotype, 1 ♀ subimago, 2500 m, Hacienda Illapel, Río Cenicero, Coquimbo Prov., XI.1956, LEP. ISNB.

Additional specimens examined. — CHILE: *Aconcagua Prov.*, N, S, I (♂), Piscicultura, Río Blanco, 20/30.XI.1958, LEP; N, I (♂, ♀), Río Blanco, 1,600 m, 10.XI.1963, GFE; N, Río Blanco, 2,200 m, 10.XI.1963, GFE; N, I (♂, ♀, R), Río Blanco, El Juncal, 21 Km SW Portillo, 1,890 m, 20.XI.1972, MLP & GB. *Aisen Prov.*, N, Puerto Ibanez, 17/22.I.1961, LEP; N, Puerto Cisnes II.1961, LEP. *Cautin Prov.*, I (♂), Lago Villarica, 19.IV.1959, B; N, Fundo El Coique ca 29 Km NE Villarica, 3.III.1979, D&MD & BA. *Chilóe Prov.*, N, a small stream in Dalcahue 16.XI.1972, MLP & LEP. *Colchagua Prov.*, N, El Temblor, Los Maitenes, 2,250 m, 20.X.1954, LEP; N, S (♀), Río Tinguirirrica, 1300 m, Cordillera Colchagua, S. Fernando, 28.XI.1957, LEP; N, Las Cabras, 19.X.1954, LEP. *Coquimbo Prov.*, N, Estero Cenicero, Hda. Illapel, 2,500 m, 10/11.XI.1954, LEP; N, I (♂), Palo Colorado, Pichidangui, 6/10.VIII.1960, LEP; N, S, I (♂, ♀), Los Molles, Ovalle, 2,200 m, 11.XI.1961, LEP; N, Río Caren, Sta. Virginia, Hda. Illapel, Illapel, 18.XI.1972, MLP & GB. *Curico Prov.*, I, S (♂, ♀), Río Teno, 26.X.1968, LEP. *Llanquihue Prov.*, N, Río Tepu, Ensanada, 17.II.1957, LEP; S (♀), Seno Gtway, Río El Gamso, 31.XII.1962, TC. *Magallanes Prov.*, I, S (♂, ♀), San Jose, 24.I.1960, TC; N, I (♂, ♀), a stream near Cerro Guido, 18.III.1958, JI; N, S (♂, ♀), Chorillo Tres Puentes, 13.II.1963, TC; N, Chorillo de la Piedra, 22.V.1962, TC; N, I (♂), Mornington, Pto. Alert 26/27.IX.1969 OSF; N, Isla de los Estados, Bahia Capitan, Canepa, 1/3.V.1971, OSF & GFH. *Malleco Prov.*, N, Estero Cabrera, 21.I.1959, LEP; N, Estero Huemul, trib. Lago Galletúe, ca. Marimenuco, 11.XII.1963, GFE. *Maule Prov.*, N, Laguna del Maule, IV.1957, LEP. *Nuble Prov.*, N, Estero E Termas Chillan, 1800 m, 18.I.1955, LEP. *Osorno Prov.*, S (♀), ca Termas de Puyehue, arroyo (small stream), 22.XI.1963, GFE; N, P.N. Puyehue, Paso Puyehue, 1360 m, 13.11.1978, CMF & OSF. *Santiago Prov.*, N, Los Maitenes, 1500 m Piedras en estero Cordillera, 20.X.1954, LEP; N, I (♂, ♀), Río Volcan, 25.I.1958, JI; N, S (♂, ♀), Río Volcan, Hochgebirge, nr Santiago, 2,600 m, 25.III.1958, JI; N, La Disputa, Cordillera Santiago, VIII.1958, LEP; N, Farellones, 2,700 m, LEP; N, I, S (♂, ♀), Santiago de Maipo, 1,000 m, 2.XI.1963, GFE; N, Río Arrayan, 2.XII.1963, GFE; N, I, S (♂, ♀, R), Melocoton, San Jose de Maipo, 2.XII.1972, MLP & GB; N, El Canelo, 30.XI/2.XII.1972, MLP & GB. ARGENTINA: *Neuquen Prov.*, N, I, S (♂, ♀), a small stream W San Carlos de Bariloche, 25.IX.1957, JI; N, Lago Tomen, Lanin, 9.II.1962, IR; N, Ao. Chapelco, Chico, E.S. M.d.l. Andes, 25.II.1978, CMF & OSF; N, Ao. del Gato, 8 Km S Rahue, 2.III.1978, CMF & OSF; N, Ao. Pilpil, nr S. M. d. l. Andes, 22.II.1978, CMF & OSF; N, Los Totoros, 23 Km NW Va. La Angostura, 20.II.1978, CMF & OSF. BOLIVIA: La Paz Distrito: N, Rio entrelos 2 lagunos de Viscachoni, 3820 m, 7.VIII.1983; N, a source of R. Zongo, 9280 m, 9500 m, 9750 m, 7.VIII.1963; N, Laguna Milluni, 9650 m, 7.VIII.1983.

Discussion. — Demoulin (1955) described *M. irrarrazavali* from a male subimago and 2 female subimagoes from Los Maitenes, Santiago Prov., CHILE. The male and female imagos, and nymphs are described for the first time. The nymph and adults are associated by rearing.



FIGURES 97-103. — Nymph of *Massartellopsis irrarrazavali:* 97, fore leg, 98-99, cross section of tibia and tarsus; 100, fore claw, 101, gill 4; 102, posterior spines of abdominal terga; 103, mature nymph.

Massartellopsis irrarrazavali exhibit a few color variations. The nymph and adults typically have a large pale yellow median spot on abdominal terga 4-5 (Fig. 86). A few specimens however, have this median spot faintly washed with chocolate brown which obfuscates the pattern of the dark brown maculae on the abdominal terga (Fig. 87). Likewise, the scape and pedicel of the antennae of some nymphs and adults are faintly washed with reddish brown. All these color variations occur sporadically throughout the geographic range of the species, except they are more common among specimens collected from Magallanes Province. Moreover, nymphs and adults from Magallanes are generally darker than those from the other localities.

Biology. — The nymphs of *M. irrarrazavali* occur in streams, rivers and lakes. The nymphs were abundantly collected under stones or small rocks in moderately swift flowing streams and rivers. Few nymphs were collected among stones or gravels along lake shorelines.

Some nymphs from Los Maitenes, Santiago Prov., Chile were parasitized by a chironomid, *Symbiocladius wygodzinski* Roback (?) The parasitic larva was attached on the metathorax underneath the hind wing pads. Parasitized nymphs were much paler than the unparasitized ones, and the hind wing pads were deformed.

Collection records indicate that the nymphs of *M. irrarrazavali* appear to occur almost throughout the year, having been collected from August thru March. The adults have been collected from August thru February.

Dissected nymphs revealed the gut contents as detritus (44.03%), mineral particles (45.86%), diatoms (8.11%) and filamentous algae (1.22%). Identified diatoms include *Synedra* and *Gomphonema.*

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