

STUDIES IN NEOTROPICAL LEPTOCERIDAE  
(TRICHOPTERA), IV:  
A REVISION OF *BRACHYSETODES* SCHMID

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ABSTRACT

The taxonomy and systematics of the Neotropical long-horned caddisfly genus *Brachysetodes* Schmid are reviewed. Illustrations, synonymies, diagnoses, and distribution maps are provided for each species. Keys to the genera of Neotropical Leptocerinae and to males and females of the 10 *Brachysetodes* species are included. The larval and pupal stages of *Brachysetodes forcipatus* Schmid are described and illustrated for the first time; the larva possesses a unique set of heavy setae on the dorsal sclerite of abdominal segment IX and the dorsal plate of the anal prolegs; both features are diagnostic for the genus. A phylogeny of the species of *Brachysetodes* is proposed; two species, *Brachysetodes bifidus* Schmid and *B. major* Schmid, are included in the genus as species *incertae sedis*.

INTRODUCTION

Schmid (1955) erected *Brachysetodes* and included in it three species: *B. bifidus*, *B. quadrifidus*, and *B. trifidus*, the type species. In 1958 he described three additional species, *B. extensus*, *B. major*, and *B. spinosus*, and in 1964 he described *B. forcipatus* and *B. tripartitus*. Flint described *B. insularis* in 1968, *B. nublensis* in 1969, and *B. bifurcatus* in 1983. Flint (1972) also transferred the wide-spread South American species *Setodes duodecimpunctatus* Navás to *Brachysetodes*.

It is now apparent that several of the species originally assigned or transferred to *Brachysetodes* are clearly not related to the type species and that *Brachysetodes sensu lato* is polyphyletic. I removed one of these species, *B. duodecimpunctatus* (Navás), and placed it in the monobasic genus *Achoropsyche* (Holzenthal 1984). I also erected the tribe Achoropsychini to accommodate the new genus and its single species. *Achoropsyche duodecimpunctata* (Navás) shares a sister-group relationship with the Triaenodini-through-Mystacidini branch of Morse's (1981) phylogeny (Figure 30). In addition, I removed *B. insularis* and included it and 9

undescribed species fitting the same morphotype in a new genus *Amphoropsyche* (Holzenthal 1985). *Amphoropsyche* is restricted in distribution to the northern Andes of South America and the Lesser Antilles. It shares a sister-group relationship with Morse's Nectopsychini-through-Mystacidini branch (Figure 30).

Monophyly for 8 of the 10 species of *Brachysetodes s. str.* is inferred by 7 synapomorphies (see below). Two species, *Brachysetodes bifidus* and *B. major*, do not share any of these apomorphies with the other 8 species of *Brachysetodes s. str.* and the phallic apparatus of each is autapomorphically reduced. They also differ markedly from their congeners in other generic attributes and in venational features; their immature stages are unknown. I cannot find a synapomorphy which suggests monophyly for *Brachysetodes* when these two species are included in the genus and I suspect that each is not congeneric with the other members of *Brachysetodes*. Neither have I found synapomorphies indicating that the two species are sister species. In the interest of preserving stability of classification, though, I prefer to retain them in *Brachysetodes* as species *incertae sedis*. Retaining *B. bifidus* and *B. major* in *Brachysetodes* potentially renders the genus polyphyletic, but I consider this danger less objectionable than creating two additional monotypic genera with uncertain or tenuous tribal relationships. Study of their immature stages and more refined analyses of adult features likely will help resolve the phylogenetic position of these enigmatic species. They are both excluded from the generic diagnosis provided below and instead are discussed separately in the section entitled "Species *Incertae Sedis*".

Morse (1981) classified *Brachysetodes* along with the Oriental genus *Poecilopsyche* Schmid, 1968, as *tribus incertae sedis*, phylogenetically represented in a trichotomy with the Leptocerini-through-Mystacidini branch, and the entire complex in a sister group relationship with Nectopsychini (Morse 1981, fig. 1). The node of his trichotomy was defined by the synapomorphic narrow hind wings and his Leptocerini-through-Mystacidini node was defined by the synapomorphic losses of the adult mid-cranial sulcus and the 2nd article on the male inferior appendages. The inclusion of *B. bifidus* and *B. major* each as *incertae sedis* creates a pen-

tachotomy at node 4 of Morse's Leptocerinae branch (Morse 1981, fig. 1) (= node 5 in Figure 30).

In the remainder of this paper, illustrations, synonymies, diagnoses, and keys to the genera of Neotropical Leptocerinae and to the males and known females of the 10 species of *Brachysetodes* are provided. The type locality of each species is indicated with its synonymy. Distributions of all species are indicated by country and province and individual collection records are plotted on maps. Complete collection data for only those specimens examined in preparing larval and pupal descriptions and illustrations are provided below. The females of all species (except *B. bifurcatus* Flint) and the immature stages of the genus are described and illustrated here for the first time. I have examined associated larval material for *B. extensus*, *B. forcipatus*, *B. quadrifidus*, and *B. trifidus*. Larvae of these 4 species are very similar and I have not attempted to find characters with which to separate them. Finally, a phylogeny of the species of *Brachysetodes* is proposed.

Terminology for wing venation and female genitalia follows the reviews by Schmid (1970, 1980) and for male genitalia, those by Schmid (1980), Nielsen (1957), and Morse (1975). In Figures 3-15, 17-20, 22, and 23 of the adult terminal abdominal segments, A, B, and C are lateral, dorsal, and ventral views, respectively (except 19C is a ventral view of the male left inferior appendage only), and D and E are lateral and ventral views, respectively, of the male phallic apparatus. Terminology for larval and pupal morphology follows the reviews by Wiggins (1977, 1984). Larval setal nomenclature and homology follows that proposed by Williams and Wiggins (1981). All material examined, including holotypes, is from the collection of the National Museum of Natural History, Smithsonian Institution, Washington, D.C., (USNM).

### BRACHYSETODES Schmid

*Brachysetodes* Schmid 1955: 134. Type species by original designation

*Brachysetodes trifidus* Schmid

*Brachysetodes* Schmid 1958: 203.

*Adult*: Tibial spur formula 1,2,2. Midcranial sulcus present. Mesopleural katepisternum truncate dorsally. Forewing (Figure 16A) with forks I and V present;

fork I distinctly petiolate; M 2-branched, the branch sessile or with a short petiole; thyridial cell about 2/3 length of discal cell; forewing golden-brown with band of white hairs along anterior and posterior edges or uniformly golden-brown (*B. nublensis*, *B. trifidus*). Hindwing (Figure 16B) narrow; forks I and V present; fork V shallow. Wing venation and coloration similar in both sexes. Length of forewing 5-6 mm.

*Male:* Segment IX annular, broadest laterally, narrowest dorsally, sometimes with paired, ventral, setal warts. Segment X composed of one (*B. spinosus*), 2 (*B. bifurcatus*, *B. extensus*, *B. nublensis*) or 3 (*B. forcipatus*, *B. quadrifidus*, *B. trifidus*, *B. tripartitus*) processes, each bearing prominent, stout setae. Preanal appendages long, narrow; their bases inserted close together on segment X. Inferior appendage consisting of a main body or first article (= "coxopodite" of Nielsen, 1957) bearing at least 2, but more often 3 or 4, thin, well separated branches; 2nd article of inferior appendage lost or completely fused to, and indistinguishable from, 1st article (although an apparent remnant of the point of articulation between the 1st and 2nd articles remains in *B. spinosus*, Figure 12C); inferior appendages connected basally along the mesal surfaces of paired, more or less vertical, dorsally rounded plates, together these plates form a ventral, trough-like support or guide for the phallobase. Phallic apparatus consisting of the following structures (anterior to posterior): phallic apodeme, phallic shield (or "rim-like sclerite" of Nielsen, 1957, fig. 55.1), phallobase (= posterior part of phalotheca of Schmid, 1970), endotheca, parameres, phallicata (or "aedeagus" of Nielsen, 1957, and others), endophallic membranes, and phallostremal sclerite. Their internal and external relations are as discussed and illustrated by Nielsen (1957) and Morse (1975). Phallic apodeme and phallobase small, the phallic shield arising at their juncture and with narrow, lateral, sclerotized strips (Morse 1975, fig. 31, 1981; = "relatively broad chitinous strips" or "broad external bands" of Schmid 1968, labeled "c" in his lateral views of male genitalia) attached to apicolateral edges of segment IX; endotheca usually with paired, dorsal, erectile lobes; paired, heavily sclerotized parameres present; phallicata thin, lightly sclerotized; endophallic membranes erectile, often with paired dorsal lobes; phallostremal sclerite U-shaped in dorsal view.

*Female:* Sternum IX developed into a flat, sclerotized plate, bearing lateral, flange-like projections (best developed in *B. forcipatus*, absent in *B. spinosus*). Valves large, flat, spatulate; generally situated in a horizontal plane, except in *B. spinosus* where they are held more or less vertically. Appendages of segment X each a small, setose projection or reduced to a setose patch (except in *B. spinosus* where they appear as large, triangular, setose flaps). Vaginal chamber and vaginal apparatus with posterior neck and central keyhole-shaped sclerites.

*Egg:* Unknown.

*Larva:* Head (Figures 1A, 1B, 2A): long and narrow; ventral apotome triangular (Figure 2A), subequal in length to ventral ecdysial line; posterior ventral ecdysial apotome sometimes present; subocular ecdysial line present (Figure 1A); head setal pattern as in Figure 2A, typical for family; mandibles short and wide, with short, rounded teeth (Figure 1D). Thorax (Figures 1A, 1B): pronotum with anterolateral corners delimited by ecdysial line; mesonotum covered by a pair of large, thin sclerites; metanotum without sclerites; thoracic setal pattern as in Figure 1B. Head

and thoracic sclerites uniformly reddish-brown, without contrasting spots or muscle scars. Legs long and slender; moderately setose (Figure 1A). Abdomen (Figures 1A, 1E): segment 1 with "check-mark" shaped lateral hump sclerite; gills absent; lateral fringe present on segments III-VII; lateral tubercles present on segment VIII; dorsal sclerite of segment IX and dorsal plate of anal proleg with prominent setae of the size and position indicated in Figures 1A, 1E; anal claw with 3-4 teeth; thin spines and fine setae present along either side of anal opening (Figure 1E). Length of larva 5-6 mm.

*Larval Case:* Constructed of rock fragments; slightly curved and tapered; posterior opening with slightly smaller diameter than anterior opening and not restricted with silk (Figure 1C). Length up to 7 mm.

*Pupa:* Head (Figure 2C): 2 pairs of long frontal setae, one pair of setae on vertex, 2 setae below each eye, and 6 pairs of setae on labrum; mandibles thin and stylet-like, with fine serrations on inner margins. Abdomen (Figures 2B, 2D): hook plates as in Figure 2B; anal processes long, slender, lyre-shaped in dorsal view and each bearing a brush of short setae along inner apical margins (Figure 2D).

*Distribution and biology:* *Brachysetodes s. str.* is restricted to the Chilean subregion of Argentina and Chile (Figures 25-28). Immatures and adults are associated with small-moderate sized, cool, clear, gravel bottomed streams (O.S. Flint, Jr., pers. comm.).

*Material examined:* ARGENTINA: Chubut: 8 km S Hoyo de Epuyen, 10.ii.1974, O.S. Flint, Jr., *B. quadrifidus*, larvae, male pupae (USNM). Neuquén: 5 km NW Lago Lolog, 22.i.1974, O.S. Flint, Jr., 1 larva (USNM). Río Negro: Arroyo Negro, San Carlos de Bariloche, 26.xii.1972, M.L. Pescador, many prepupae, immature pupae (USNM). 5 km S Río Villegas, 7.ii.1974, O.S. Flint, Jr., *B. quadrifidus*, larvae, male pupae (USNM). CHILE: Aconcagua: Río Blanco, 10.iii.1968, Flint and Peña, *B. trifidus*, male pupae (USNM). Cautín: Río Pedregoso, 4.i.1966, Flint and Cekalovic, *B. forcipatus*, male pupa (USNM). near Pucon, 4.i.1966, Flint and Cekalovic, *B. forcipatus*, larvae, male, female pupae (USNM). Malleco: Río Manzanares, 2.i.1966, Flint and Cekalovic, *B. forcipatus*, many larvae, male pupa (USNM). Osorno: Parque Nacional Puyehue, Playa Puyehue, 10.ii.1978, C.M. and O.S. Flint, Jr., *B. extensus*, male, female pupae (USNM). Santiago: El Alfalfal, 12-13.x.1969, Flint and Barria, many larvae (USNM).

#### KEY TO GENERA OF NEOTROPICAL LEPTOCERINAE (ADULTS)

- 1 Hindwing fork III present in both sexes (i.e. M 3-branched) (Morse 1981, fig. 1); female forewing fork III present . . . . . TRIPLECTIDINAE  
Hindwing fork III absent in both sexes (i.e. M 2-branched); female forewing fork III absent (except in *Amphoropsyche*, where it is present) . . . . .  
. . . . . Leptocerinae . . . . . 2
- 2(1) Forewing M with stem atrophied (thyridial cell absent); hindwing fork V absent (Schmid 1980, fig. 678) . . . . . *Triaenodes* Mac Lachlan  
Forewing M with stem present (thyridial cell present); hindwing fork V present . . . . . 3

- 3(2) Forewing  $M_{1+2}$  and M rectilinear ( $M_{3+4}$  appearing as a branch of  $CU_1$ ) (Schmid 1980, fig. 697) ..... *Oecetis* Mac Lachlan  
 Forewing  $M_{1+2}$  and M not rectilinear ( $M_{3+4}$  branching from M) ..... 4
- 4(3) Hindwing Rs and M atrophied (Schmid 1980, fig. 704) .....  
 ..... *Nectopsyche* Müller  
 Hindwing Rs and M present ..... 5
- 5(4) Forewing thyridial cell 1.5 to 2X longer than discal cell ..... 6  
 Forewing thyridial and discal cells subequal in length or thyridial cell obviously shorter than discal cell ..... 7
- 6(5) Forewing fork I distinctly petiolate ..... *Brachysetodes* Schmid (*pars*)  
 Forewing fork I sessile or subsessile; female forewing fork III present (Holzenthal 1985, figs. 1A, 2A) ..... *Amphoropsyche* Holzenthal
- 7(5) Hindwing fork I absent ..... *Brachysetodes* Schmid (*pars*)  
 Hindwing fork I present ..... 8
- 8(7) Forewing M distinctly petiolate; forewing with 12 small brown spots (Holzenthal 1984, fig. 3A) ..... *Achoropsyche duodecimpunctata* (Navás)  
 Forewing M sessile, or with very short petiole; forewing without small brown spots ..... *Brachysetodes* Schmid (*pars*)

KEY TO ADULTS OF BRACHYSETODES<sup>1</sup>

- 1 Males ..... 2  
 Females ..... 11
- 2(1) First article of inferior appendage more or less digitate, without branches (Figures 19A, 22A); inferior appendage with small, ventral, subapical, 2nd article (Figures 19A, 19C, 22A, 22C); phallic apparatus without parameres ..... 3  
 First article of inferior appendage with at least 2 (Figures 4A, 6A, 12A), but more often 3 (Figures 3A, 8A, 14A) or 4 (Figure 10A) thin, well separated branches; inferior appendage without 2nd article; phallic apparatus with paired parameres (Figure 3D) ..... 4
- 3(2) Subanal plate present and with pair of long, posteriorly directed, rod-like processes, each with a small mesal spine and apical setae (Figure 19A) ..  
 ..... *B. major* Schmid  
 Subanal plate apparently absent ..... *B. bifidus* Schmid
- 4(2) Segment X composed of a single, long process bearing a pair of long, stout, terminal setae (Figures 12A, 12B) ..... *B. spinosus* Schmid  
 Segment X composed of 2 or 3 flat, blade-like processes; lateral pair each bearing at least a single, short, stout, terminal or subterminal seta . . . . 5
- 5(4) Segment X composed of 2 flat, blade-like processes (Figures 3B, 4B, 8B); sternum IX with pair of setal warts (Figures 3C, 4C, 8C) ..... 6  
 Segment X composed of 3 processes: a pair of flat, blade-like lateral processes and a mesal process (Figures 6B, 10B, 14B, 17B); sternum IX with or without setal warts ..... 8

<sup>1</sup>The female of *B. bifurcatus* Flint is unknown.

- 6(5) Inferior appendage with 2 major lobes and a small, median, triangular point (Figure 4A) . . . . . *B. extensus* Schmid  
 Inferior appendage with 3 major lobes . . . . . 7
- 7(6) Median lobe of inferior appendage bifid (Figure 3A); parameres very long and slender (Figure 3D) . . . . . *B. bifurcatus* Flint  
 Median lobe of inferior appendage simple (Figure 8A); parameres very short; paired lobes of endothelial membrane bearing many small spines (Figure 8D) . . . . . *B. nublensis* Flint
- 8(5) Segment X with prominent, spatulate, mesal process (Figures 10B, 14B) . . . . . 9  
 Segment X with mesal process upturned and bulbous (Figures 17A, 17B) or short and membranous (Figures 6A, 6B) . . . . . 10
- 9(8) Inferior appendage with 3 lobes (Figure 14A); mesal lobe of segment X with 2 pairs of short, stout, straight setae and 3 pairs of long, stout, hooked setae (Figures 14A, 14B) . . . . . *B. trifidus* Schmid  
 Inferior appendage with 4 lobes (Figure 10A); mesal lobe of segment X with 3 pairs of thin setae (Figure 10B) . . . . . *B. quadrifidus* Schmid
- 10(8) Inferior appendage L-shaped in lateral view (Figure 6A); mesal projection of segment X short, membranous, bifid (Figure 6B); parameres unbranched, long, curved (Figure 6D) . . . . . *B. forcipatus* Schmid  
 Inferior appendage approximately C-shaped (Figure 17A); mesal projection of segment X upturned and bulbous (Figures 17A, 17B); parameres trifid (Figures 17D, 17E) . . . . . *B. triparitus* Schmid
- 11(1) Hindwing fork I absent (Figure 24B) . . . . . *B. major* Schmid  
 Hindwing fork I present (Figures 16B, 21B) . . . . . 12
- 12(11) Forewing thyridial cell long and narrow, about 1.5X longer than discal cell . . . . . *B. bifidus* Schmid  
 Forewing thyridial cell short, 2/3 length of discal cell . . . . . 13
- 13(12) Appendage of segment X large and triangular (Figure 13A); sternum IX semimembranous (Figure 13C) . . . . . *B. spinosus* Schmid  
 Appendage of segment X reduced to a small, setose, projection or setose patch; sternum IX a flat, sclerotized plate bearing lateral, flange-like projections . . . . . 14
- 14(13) Flange-like projections of sternum IX apparently with cushion-like, membranous areas (Figures 5C, 9C); vaginal chamber large, in lateral view shaped as in Figures 5A, 9A . . . . . 15  
 Flange-like projections of sternum IX completely sclerotized; vaginal chamber small, not as above . . . . . 16
- 15(14) Pleuron IX with invaginated pocket (Figure 9A, 9C); flanges of sternum IX with apicomeral corners cushion-like (Figure 9C) . . . . . *B. nublensis* Flint  
 Pleuron IX without pocket but with a small, hooked, sclerotized projection just below base of valve (Figure 5A); flanges of sternum IX with apicolateral corners cushion-like (Figure 5C) . . . . . *B. extensus* Schmid
- 16(14) Flange-like lateral projections of sternum IX small (Figures 11C, 15C); pleuron IX with a sharp, thin, sclerotized ridge (Figures 11A, 15A) . . . . . 17  
 Flange-like lateral projections of sternum IX very large (Figures 7C, 18C); pleural ridge absent . . . . . 18

- 17(16) Forewing uniformly golden-brown ..... *B. trifidus* Schmid  
 Forewing with band of white hairs along anterior and posterior edges .....  
 ..... *B. quadrifidus* Schmid
- 18(16) Flange-like lateral projections of sternum IX together forming a very  
 prominent, fish tail-shaped structure (Figure 7C); valves stout and trian-  
 gular, each with a thin, mesal, shelf-like process (Figures 7A, 7C) .....  
 ..... *B. forcipatus* Schmid
- Flange-like lateral projections of sternum IX together forming a more or  
 less quadrate plate (Figure 18C); valves flat and spatulate, without mesal  
 process (Figures 18A, 18C)..... *B. tripartitus* Schmid

### **Brachysetodes bifurcatus** Flint

Figures 3, 25

*Brachysetodes bifurcatus* Flint 1983: 69, fig. 249, male (CHILE: Cautín: Fundo el Coigüe, 27 km NE Villarrica, 500 m, 28.ii-3.iii.1979, D. Davis, D. Ackerbergs, USNM Type 100541).

*Male:* Segment X with paired, blade-like, lateral processes, each with a pair of short, stout, closely appressed, terminal setae, and with a patch of 3 subterminal setae. Inferior appendages each with hooked dorsal lobe, bifid mesal lobe, and sharply tapered ventral lobe. Phallobase with prominent, ventrally-directed posterior face; parameres very long and slender, each tipped with a small seta.

*Female:* Unknown.

*Distribution:* CHILE: Cautín.

### **Brachysetodes extensus** Schmid

Figures 4, 5, 25

*Brachysetodes extensa* Schmid 1958: 204, fig. 45, male (CHILE: Arauco: Pichinahuél, 23-31.i.1954, L.E. Peña, USNM Type 71824).

*Brachysetodes extensa*, Flint 1974: 90, distribution.

*Male:* Segment X with paired, blade-like processes, each with a pair of short, stout, terminal setae and 3 pairs of mesal setae. Each inferior appendage with two main lobes; a prominent dorsal lobe bearing a small triangular basal spine and a massive ventral lobe bearing a short, blunt process and a thin, tapered process, its tip slightly bifid to truncate and directed mesally. Parameres with tips bifid.

*Female:* Flange-like lateral processes of sternum IX with cushion-like apicolateral corners; a small, hooked, sclerotized projection present on posterior edge of pleuron IX just below base of valve.

*Distribution:* ARGENTINA: Neuquén. CHILE: Arauco, Cautín, Chilóe, Malleco, Orsorno, Valdivia.

**Brachysetodes forcipatus Schmid**

Figures 1, 2, 6, 7, 26

*Brachysetodes forcipata* Schmid 1964: 334, fig. 10, male (CHILE: Bío-Bío: Santa Barbara, 6.ii.1958, L.E. Peña, USNM Type 71828).

*Brachysetodes forcipata*, Flint 1974: 90, distribution.

*Male:* Segment X with a short, membranous, bifid, mesal process and paired lateral processes bearing 4 pairs of short, stout setae. Inferior appendages L-shaped, each with a large, dorsal lobe bearing terminal, hooked spines and a long, curved, tapered, ventral lobe bearing a slender, short, basomesal projection. Parameres long and curved, tips setose; small, paired, finger-like, membranous endophallic structures present.

*Female:* Valves triangular, stout, each with a thin, mesal, shelf-like process. Flange-like lateral processes of sternum IX forming a very prominent, fish tail-shaped structure.

*Distribution:* ARGENTINA: Neuquén, Río Negro. CHILE: Bío-Bío, Cautín, Chiloé, Curicó, Linares, Llanquihue, Malleco, Ñuble, O'Higgins, Osorno, Valdivia.

**Brachysetodes nublensis Flint**

Figures 8, 9, 26

*Brachysetodes nublense* Flint 1969: 511, fig. 33, male (CHILE: Ñuble: Recinto, 4-5.iii.1968, Flint and Peña, USNM Type 70431).

*Brachysetodes nublense*, Flint 1974: 90, distribution.

*Male:* Segment X with mid-dorsal patch of long, stout, setae; lateral processes of X each with a pair of short, stout, closely appressed, terminal setae. Inferior appendages each with 3 lobes: dorsal lobe with apex hooked and bearing prominent setae; mesal lobe tapered, curved mesally, and bearing a short, thin, blunt basomesal process; ventral lobe with inner margin bearing spine-like serrations. Parameres very short; paired endothelial membranes bearing many short, stout setae.

*Female:* Apicomesal corners of flange-like lateral projections of sternum IX cushion-like. Pleural region of IX with invaginated pocket.

*Distribution:* CHILE: Ñuble.

**Brachysetodes quadrifidus Schmid**

Figures 10, 11, 27

*Brachysetodes quadrifida* Schmid 1955: 136, fig. 18, male (CHILE: Chiloé: Isla de Chiloé, Aucar, 6.i.1952, L.E. Peña, USNM Type 71823).

*Brachysetodes quadrifida*, Flint 1974: 90, distribution.

*Male:* Mesal process of segment X flat, spatulate, lateral processes blade-like, each with 3 subterminal, stout setae. Inferior appendages each with 4 processes; mesoventral process with 4 small, bifid, terminal subprocesses. Parameres long, stout; tips bifid.

*Female:* Pleuron IX with sharp, thin, sclerotized ridge.

*Distribution:* ARGENTINA: Chubut, Neuquén, Río Negro. CHILE: Bio-Bío, Chiloé, Llanquihue, Malleco, Ñuble, Osorno, Talca, Valdivia.

### **Brachysetodes spinosus Schmid**

Figures 12, 13, 27

*Brachysetodes spinosa* Schmid 1958: 203, figs. 40-42, male (CHILE: Arauco: Picahuel, 14-18.ii.1957, L.E. Peña, USNM Type 21824).

*Brachysetodes spinosa*, Flint 1974: 90, distribution.

*Male:* Segment X bearing a single, long, process with a pair of very long, stout setae at its tip. Each inferior appendage composed of a long, slender, basodorsal, rod-like process bearing a stout, terminal seta and a large ventral body with a trace of a terminal, articulated segment (2nd article). Parameres very long, their dorsal surfaces serrate; phallicata long and tubular.

*Female:* Appendages of segment X broad, triangular, setose. Sternum IX semi-membranous; flange-like lateral processes absent.

*Distribution:* CHILE: Arauco, Ñuble.

### **Brachysetodes trifidus Schmid**

Figures 14, 15, 16, 28

*Brachysetodes trifida* Schmid 1955: 135, fig. 17, male (CHILE: Santiago: El Manzano, 9.ii.1950, L.E. Peña, USNM Type 71822).

*Brachysetodes trifida*, Schmid 1958: 203, fig. 46, wings.

*Brachysetodes trifida*, Flint 1974: 90, distribution.

*Male:* Mesal lobe of segment X with 2 pairs of short, stout, straight, subterminal seta and 3 pairs of long, stout, hooked, mesal setae. Inferior appendages each with 3 lobes. Parameres long, curved, each tipped with short setae.

*Female:* Pleuron IX with sharp, thin, sclerotized ridge.

*Distribution:* CHILE: Aconcagua, Colchagua, Curicó, Linares, Neuquén, Ñuble, O'Higgins, Santiago, Talca, Valdivia.

### **Brachysetodes tripartitus Schmid**

Figures 17, 18, 28

*Brachysetodes tripartita* Schmid 1964: 333, fig. 9, male (CHILE: O'Higgins: Graneros, 4.iii.1962, L.E. Peña, USNM Type 71827).

*Brachysetodes tripartita*, Flint 1974: 90, distribution.

*Male:* Mesal lobe of segment X upturned, apical portion bulbous and bearing 2 stout setae. Inferior appendage C-shaped and bearing 3 large, stout spines dorsally. Parameres 3-branched; ventral pair of branches sharply downcurved.

*Female:* Flange-like lateral processes of sternum IX forming a large, quadrate plate.

*Distribution:* CHILE: O'Higgins, Santiago.

### Species *Incertae Sedis*

#### **Brachysetodes bifidus** Schmid

Figures 19, 20, 21, 29

*Brachysetodes bifida* Schmid 1955: 135, fig. 16, male (CHILE: Santiago: El Manzano, 26.x.1951, L.E. Peña, USNM Type 71821).

*Brachysetodes bifida*, Flint 1974: 90, distribution.

*Adult:* Spurs 1,2,2. Midcranial sulcus present. Mesopleural katapisternum truncate dorsally. Forewing with forks I and V present; M branching before *r-m* crossvein, thyridial cell long and slender, discal cell 2/3 length of thyridial cell; forewing uniformly dark brown with a small patch of yellowish-white hairs at arculus. Hindwing with forks I and V present; first branch of Rs occurring well before *r-m* crossvein. Wing venation and coloration similar in both sexes. Length of forewing 6 mm.

*Male:* Preanal appendages broad and short. Segment X large, with a dorsomesal projection and paired lateral projections. First article of each inferior appendage with apex and inner apical surface bearing many small spines; 2nd article small, positioned apicoventrally. Phallic apparatus with phallicata and parameres apparently absent.

*Female:* Appendages of segment X small, flap-like. Valves large, spatulate; sternum IX with a pair of semimembranous, rugose areas.

*Larva:* Unknown.

*Distribution:* CHILE: Curicó, Malleco, Ñuble, O'Higgins, Santiago.

#### **Brachysetodes major**, Schmid

Figures 22, 23, 24, 29

*Brachysetodes major* Schmid 1958: 204, fig. 43-44, male (CHILE: Linares: Hacienda San Manuel, 14.i.1953, L.E. Peña, USNM Type 71826).

*Brachysetodes major*, Flint 1974: 90, distribution.

*Adult:* Spurs 1,2,2. Midcranial sulcus absent. Mesopleural katapisternum truncate dorsally. Forewing with forks I and V present; fork I distinctly petiolate; M 2-branched with a very short petiole; thyridial cell about 2/3 length of discal cell; forewing light golden brown. Hindwing with fork I absent; fork V present. Wing venation and coloration similar in both sexes. Length of forewing 7-8 mm.

*Male:* Preanal appendages short and broad. Segment X saddle-shaped; apex with a shallow cleft and bearing a pair of short, stout, subterminal setae. Subanal plate present and bearing a unique pair of long, posteriorly directed, rod-like pro-

cesses, each with a small, mesal spine and apical setae. First article of inferior appendages large and thumb-shaped, with a linear, basomesal patch of short, stout setae; 2nd article small, positioned apicoventrally. Phallic apparatus with phallicata and parameres apparently absent.

*Female:* Appendages of segment X small. Valves large and spatulate. A quadrangle, wedge-shaped structure present ventrally between valves and projecting posteriorly.

*Larva:* Unknown.

*Distribution:* ARGENTINA: Neuquén. CHILE: Bio-Bio, Cautín, Curicó, Linares, Malleco, Ñuble, Osorno, Valdivia.

### EVOLUTION OF BRACHYSETODES

#### Figure 31

Monophyly for the species of *Brachysetodes*, excluding *B. bifidus*, and *B. major*, is inferred by the following 7 synapomorphies:

- 1.) larval head narrow; apparently shared only with some Setodini.
- 2.) larval lateral hump sclerite "check-mark" shaped; shared with no other genus.
- 3.) dorsal sclerite of larval abdominal segment IX bearing heavy, apical setae; the form and distribution of these setae are shared with no other genus.
- 4.) dorsal plate of larval anal proleg bearing heavy, apical setae; the form and distribution of these setae are shared with no other genus.
- 5.) thyridial cell short, 2/3 length of discal cell; apparently shared with some Athripsodini; the plesiomorphic condition is a short discal cell and a long, narrow thyridial cell.
- 6.) inferior appendages of male at least bilobed and in most species 3-4-branched; the trend towards multilobed inferior appendages is shared with many genera, but the branched nature of these appendages in *Brachysetodes* is inferred to be independently evolved.
- 7.) mesal and lateral processes of male segment IX with at least one, but more often several, pairs of short, stout setae; shared with no other genus.

*Brachysetodes spinosus* appears to be the least derived member of the genus because it does not share any obvious homologues of the male and female genitalia with any of the other species. The remaining 7 species form a monophyletic cluster based on the following synapomorphies:

- 8.) female sternum IX with lateral, flange-like, sclerotized projections; shared with no other genus.
- 9.) appendages of female segment X reduced to a small projection or a setose patch; these appendages are lost or reduced in several other genera but reduction loss in *Brachysetodes* is interpreted here to be homologous.

*Brachysetodes bifurcatus*, *B. extensus*, and *B. nublensis* share the following 4 apomorphies, for which the plesiomorphic condition occurs in *B. forcipatus*, *B. quadrifidus*, *B. trifidus*, and *B. tripartitus*:

- 10.) flange-like, lateral projections of female sternum IX with apical, membranous cushions.
- 11.) lateral processes of male segment X with unique, flat, tapered appearance.
- 12.) male phallobase, in lateral view, with ventrally-directed, posterior face which has a large surface of contact with the fused bases of the inferior appendages.
- 13.) mid-dorsal patch of setae present on male segment X (very long and stout in *nublensis*).

Monophyly for *B. bifurcatus* and *B. nublensis* is inferred by the following 2 synapomorphies:

- 14.) ventrally-directed, posterior face of phallobase more highly developed (as compared to the condition of *B. extensus*).
- 15.) lateral processes of male segment X each with 2 closely appressed, short, stout, terminal setae.

Two synapomorphies indicate monophyly for *B. forcipatus*, *B. quadrifidus*, *B. trifidus*, and *B. tripartitus*:

- 16.) male segment X with spinose mesal process.
- 17.) male segment X with highly developed, uniquely shaped, blade-like, lateral projections.

All of the species immediately above, except *B. tripartitus*, share the following apomorphic character:

- 18.) lateral processes of segment X with 2-4 pairs of short, stout setae.

Monophyly for *B. trifidus* and *B. quadrifidus* is indicated by two synapomorphies:

- 19.) mesal lobe of male segment X flat and spatulate.  
20.) female pleuron IX with sharp, thin, longitudinal, sclerotized ridge.

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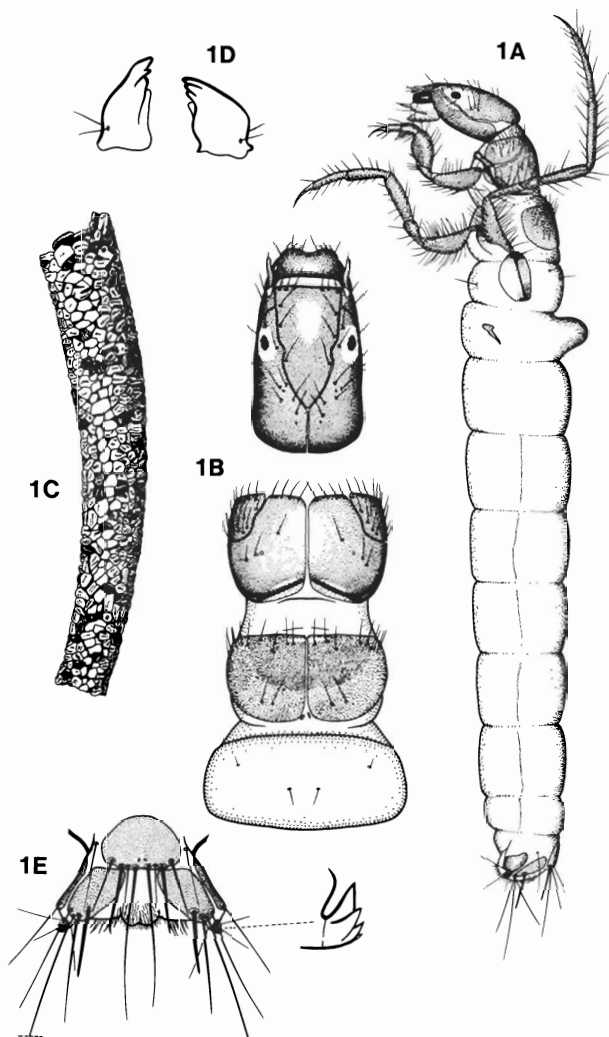


FIGURE 1. *Brachysetodes forcipatus* Schmid, larva and case: A, larva, lateral; B, head and thorax, dorsal; C, case, lateral; D, mandibles, ventral; E, abdominal segment IX and anal prolegs, dorsal, anal claw enlarged.

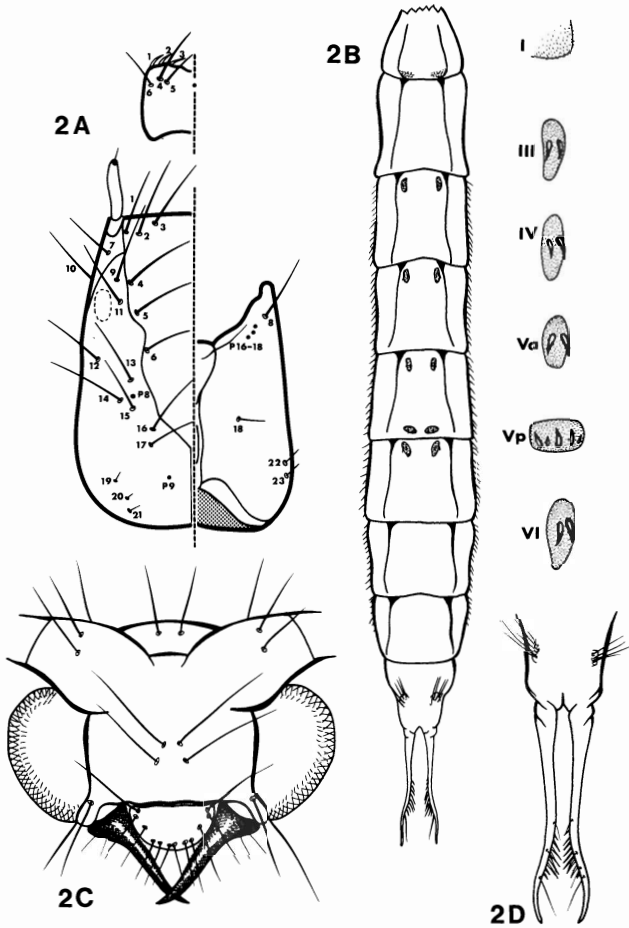


FIGURE 2. *Brachysetodes forcipatus* Schmid, larva and pupa: A, larva, head and labrum setal pattern, left half dorsal, right half ventral; B, pupa, abdomen, dorsal, hook plates enlarged; C, pupa, head, frontal; D, pupa, anal processes, dorsal.

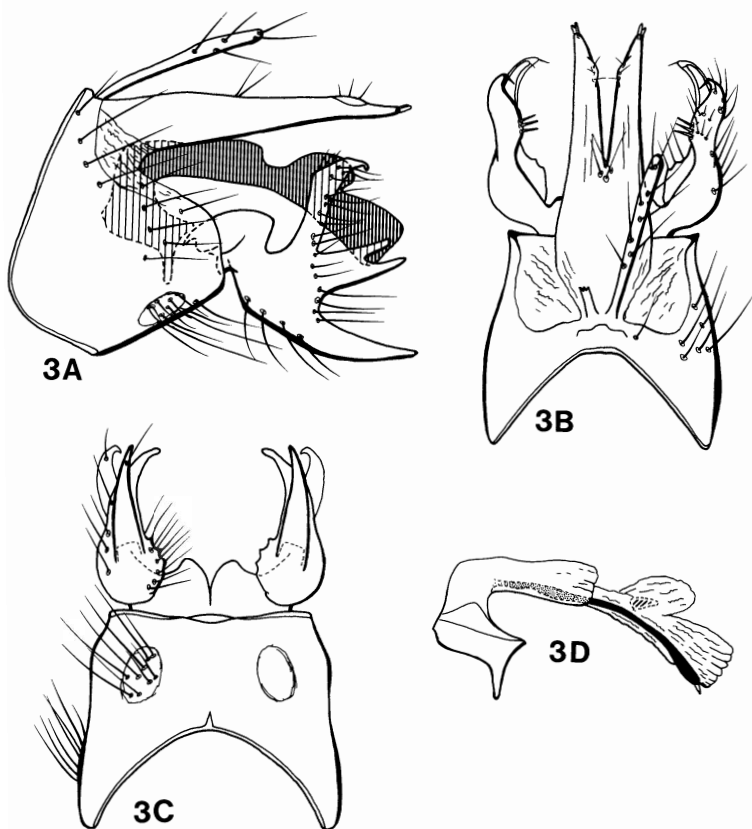


FIGURE 3. *Brachysetodes bifurcatus* Flint, male genitalia.

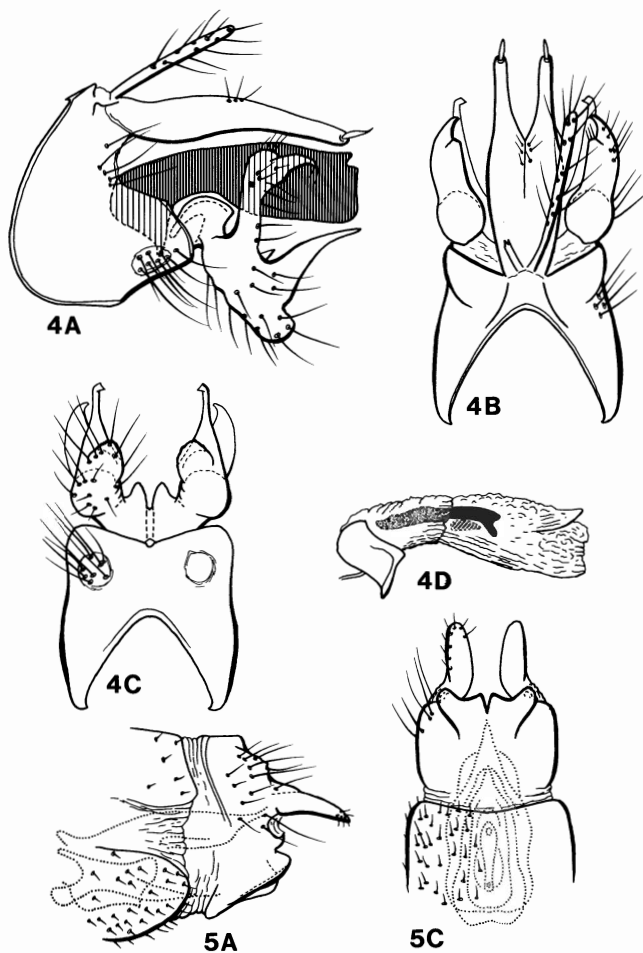


FIGURE 4. *Brachysetodes extensus* Schmid, male genitalia.

FIGURE 5. *Brachysetodes extensus* Schmid, female genitalia.

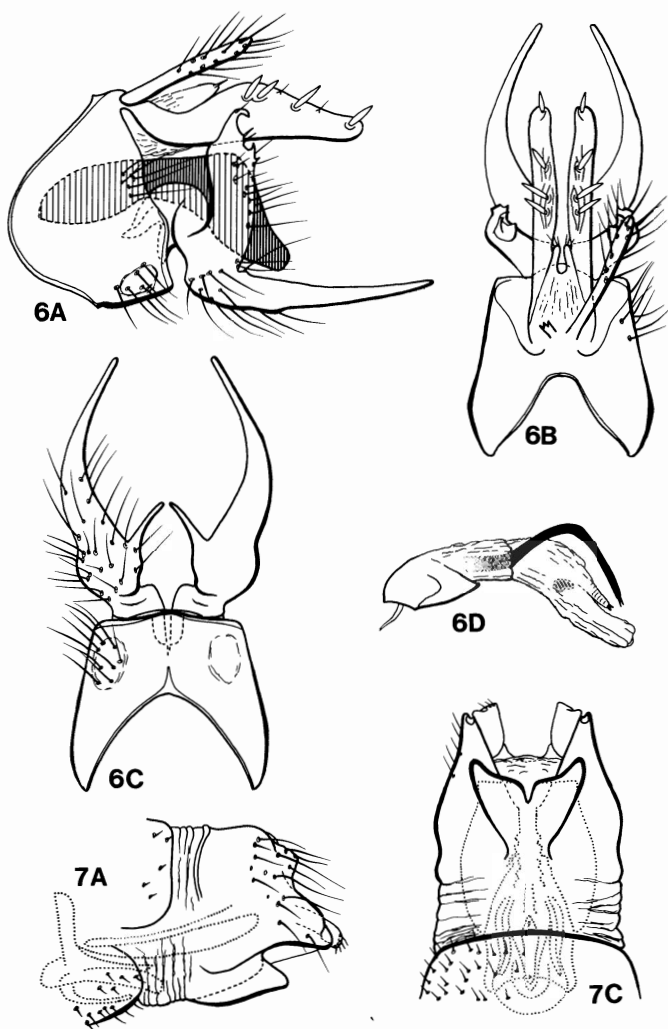
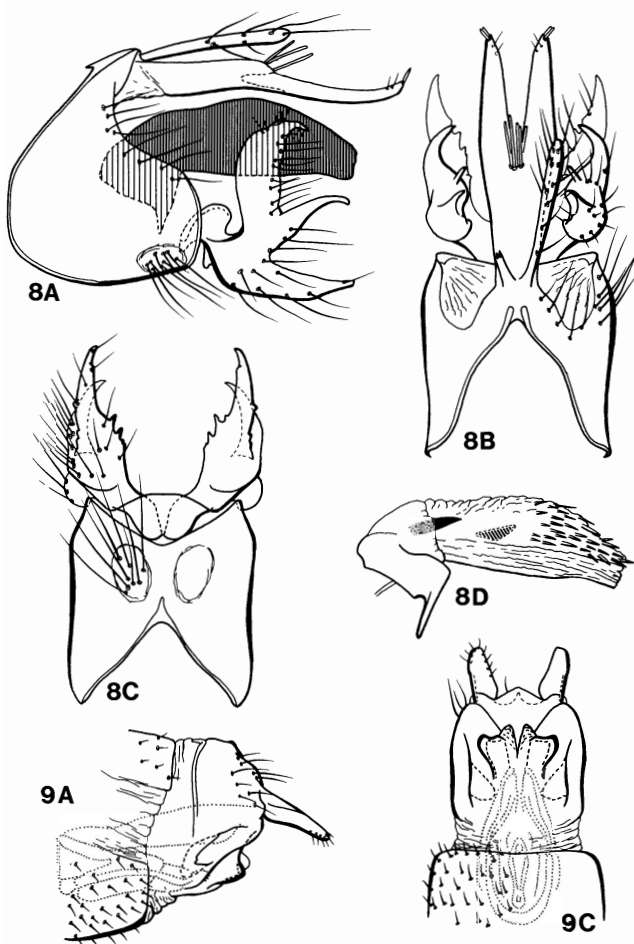


FIGURE 6. *Brachysetodes forcipatus* Schmid, male genitalia.

FIGURE 7. *Brachysetodes forcipatus* Schmid, female genitalia.

FIGURE 8. *Brachysetodes nublensis* Flint, male genitalia.FIGURE 9. *Brachysetodes nublensis* Flint, female genitalia.

