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Descriptions of some buprestid larvae from Chile (Coleoptera: Buprestidae)

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Abstract. The last instar larvae of *Bilyaxia cupriceps* (Fairmaire & Germain, 1858), *Ctenoderus chloris* Germain, 1855, *Trigonogenium angulosum ruginosum* (Fairmaire, 1867) and *Philandia valdiviana* (Philippi & Philippi, 1860) are described and illustrated in detail and compared with other related taxa. Discussion on taxonomic value and implication of larval characters of all studied taxa is given and tribal placement of all studied genera is discussed.

Taxonomy, larval morphology, Coleoptera, Buprestidae, *Bilyaxia*, *Ctenoderus*, *Philandia*, *Trigonogenium*, Chile

Introduction

This paper is a part of a long-term project dealing with the larval taxonomy and morphology of the family Buprestidae and it follows previous papers by Bílý & Volkovitsh (2002, 2003, 2005), Volkovitsh & Bílý (1997), Volkovitsh et al. (2003) and others.

The genus *Ctenoderus* Germain, 1856 has been attributed (Bílý, 2004) to the old Gondwanian subtribe Curina Hołyński, 1988 which as supposed was distributed in South America (*Anthaxioides* Cobos, 1978, *Cylindrophora* Solier, 1849, *Ctenoderus, Romanophora* Bílý, 2004) and Australia (*Selagis* Dejean, 1836 = *Curis* Gory & Laporte, 1838); no larvae of this subtribe have been described.

The genus *Bilyaxia* Hołyński, 1989, which like *Ctenoderus* has been separated from *Cylindrophora* (see Hołyński, 1989), was attributed to the subtribe, Anthaxiina Gory & Laporte de Castelnau 1839, of the worldwide distribution (except for Australia) and formed, together with the genera *Agrilaxia* Kerremans, 1903, *Brasilaxia* Théry, 1935, *Paracuris* Obenberger, 1923 and *Tetragonoschema* Thomson, 1857, a characteristic Neotropical group of the subtribe Anthaxiina. Larval characters of *Bilyaxia concinna* (Mannerheim, 1837), the only known genus of this group were shortly discussed in our previous paper (Bílý & Volkovitsh, 2005).

The genus *Philandia* Germain & Kerremans, 1906 was first attributed to Agrilini (Germain & Kerremans, 1906; Obenberger, 1935); later Cobos (1974) transferred it to Buprestini; Bellamy& Moore (1990) attributed this genus to the tribe Mendizabaliini Cobos, 1968 together with the genus *Mendizabalia* Cobos, 1957; based on antennal structures Volkovitsh (2001) separated it in the *Philandia* generic group; the precise taxonomic position of this genus remains uncertain. Cobos (1956) separated the genus *Trigonogenium* Harold, 1869 into the isolated tribe Trigonogeniini Cobos, 1956. Both rather enigmatic genera are endemics of Chile and they seem to be remnants of old, Gondwanian lineages of Buprestini. Nothing has been known on the bionomy of these little known tribes and their larvae have been also unknown.

The morphological terminology used in the present paper follows that used in the papers of Volkovitsh (1979), Volkovitsh & Bílý (1997, 2001, 2005), Bílý (1999) and Bílý & Volkovitsh (2003). To describe the arrangement of the labral sensilla, we use symbols as follows: t – trichoid sensilla or setae, c – campaniform, () – with fused bases, "+" – with closed bases, "-" – with distant bases; medial group – sensillae attached to medial branches of palatine sclerite; anterolateral group – sensillae arising from or situated near the anterior ends of lateral branches of palatine sclerite. All specimens studied are deposited in the National Museum, Prague and in the Zoological Institute of Russian Academy of Sciences, St. Petersburg. Larval images are also available on: http://www.zin.ru/Animalia/Coleoptera/rus/buplarau.htm.

The following codents are used in the text:

ANIC Australian National Insect Collection, Canberra, Australia;
NMPC National Museum, Prague, Czech Republic;
ZIN Zoological Institute of the Russian Academy of Sciences, Sankt Petersburg, Russia.

Larval descriptions

Bilyaxia cupriceps (Fairmaire & Germain, 1858)

(Figs. 1-11, 47)

Specimens studied. Three last instar larvae: Chile, reg. VIII, 22.-23.i.2005, Laguna del Laja, 37°22.217′S 71°20.759′E, S. Bílý leg. All larvae found under bark of trunk of *Austrocedrus chilensis* (Cupressaceae).

Measurements. Length: 12.0 mm, 12.5 mm, 13.1 mm; width of prothorax: 2.8 mm, 2.9 mm, 2.9 mm.

Body of buprestoid type (morpho-ecological subtype 1), cream-white, somewhat flattened (Fig. 1).

Head. Epicranium completely retracted into prothorax, tentorium poorly sclerotised, typical for Anthaxiini.

Mouth parts. Epistome (Fig. 3) transverse, relatively broad, 5.3 times as wide as long; anterior margin distinctly emargined between oval mandibular condyles, posterior margin bisinuous; lateral margins nearly straight, latero-posterior corners poorly projecting outwards; antennal incisions deep, reaching midlength of epistome; epistomal sensillae arranged as follows: 2 groups of 3 sensillae close to each other at anterior half of epistomal length, each group consisting of 2 short setae with nearly fused bases and large campaniform sensilla posteriorly and laterally of setae. Clypeus (Fig. 3) membraneous, 2.8 times as wide as long. Labrum (Fig. 3) slightly trapezoid, 1.4 times as wide as long without lateral lobes, antero-lateral corners widely rounded; maximum width of labrum at anterior fifth; anterior margin widely arcuated, lateral margins straight and slightly converging posteriorly; palatinae sclerites well-defined, slightly diverging anteriorly, medial branches poorly, lateral branches strongly sclerotised; medial sensillae of labrum arranged as follows: 1c-2t-3c, apical seta 2t short, far not reaching anterior margin of labrum, sensillae 1c and 3c situated on both sides of sclerite, distance between 1c and 3c much shorter than between them and apical seta; antero-lateral sensillae of labrum arranged as follows: external: (1t, 2c)-3t-4t, seta 1t being the longest, extending anterior margin of labrum, internal: 1t+2t; dorsal surface of labrum with small areas of microsetae at anterior corners, anterior margin glabrous; ventral side of labrum (epipharynx – Fig. 8) with 2 narrow, longitudinal stripes of sparse, short microspinulae converging posteriorly.

Antennae (Fig. 6) normal, basal segment 1.3 times as long as terminal segment; articular membrane glabrous; basal antennomere slightly longer than wide with well-defined inner sclerite and 2 campaniform sensillae (dorsal and ventral), anterior margin with fringe of sparse microspinulae; terminal antennomere 1.1 times as long as wide, slightly widened apically; anterior margin with fringe of dense microspinulae, inner sclerite well-defined; apical cavity with long trichosensilla which is 1.5 times as long as antennomere, short sensory appendage and 2 palmate sensillae which are nearly as long as appendage; basiconic sensilla short, situated at base of sensory appendage.

Mandibles (Fig. 5) triangular, nearly as long as wide, strongly sclerotised without outer seta and setal brush; apical part black, basal part brown; cutting edge with two rather robust, obtuse apical teeth, external tooth small and obtuse; both dorsal and ventral internal teeth small, obtuse with common bases.

Hypostome moderately sclerotised along anterior margin with a few short setae; ocelli indistinct.

Maxillae (Figs. 4, 7). Cardo (Fig. 4) much longer than wide with microspinuled lateral areas and with 2 short setae and one campaniform sensilla sitting on very poorly defined and sclerotized isolated sclerite, nearly indistinct. Stipes (Figs. 4, 7) much longer than wide, inner sclerite well-defined with long, curved internal process; apical seta shorter than palpus maxillaris, lateral seta short, situated externally near palpus maxillaris; 2 campaniform sensillae situated posteriorly and medially of lateral seta; anterior margin of stipes with fringe of sparse, long microsetae externally and fringe of sparse, short microsetae and field of microspinules internally. Maxillary palpus (Fig. 7) rather short, basal segment 1.2 times as long as terminal segment; basal segment rounded, 1.1 times as long as wide with sparse, short microspinulae along anterior margin, apical seta only slightly longer than terminal palpomere; terminal palpomere subcylindrical, 1.3 times as long as wide, curved sensilla long; apex of palpomere with 8 peg-like sensillae, one of them being longer than others; mala (Fig. 7) as wide as long with well-defined inner sclerite, 1 campaniform sensilla and 4 long setae apically and 4 long setae internally; entire internal surface of mala microspinuled, internal lobe absent.

Labium (Fig. 4) 1.5 times as wide as long, anterior margin arcuately projecting anteriorly, lateral corners widely rounded; lateral margins straight and slightly converging posteriorly, dorsal side (hypopharynx) with lateral fields of microspinulae; ventral side of labium with 2 separated fields of microspinulae medially between anterior margin and bases of apical setae of corner sclerite; anterior margin glabrous only with small areas of short microspinulae near antero-lateral corners; corner sclerites of labium transverse, T-shaped, well-sclerotised; apical setae situated at the middle or proximally on transverse branch of sclerite, relatively short, not reaching anterior, microspinuled area; campaniform sensillae divided into 2 groups: 3

anterior sensillae on short, separate sclerite above and 2 posterior sensillae bellow level of bases of apical setae; postmentum with two setae laterally.

Thorax (Figs. 1-2) strongly expanded, much wider than abdominal segments, rudiments of legs very small, poorly defined, nearly inconspicuous.

Prothorax (Figs. 1-2) 1.4 times as wide as long and 1.5 times as wide as mesothorax, anterior membrane with dense, long microspinulae and sparse setae; both dorsal and ventral plates well-defined, poorly sclerotised, yellow; pronotal plate (Fig. 1) with small, inverted triangular field of transverse, strongly sclerotised asperities (Fig. 11) around common part of grooves; branches of groove with 1 row of asperities laterally; pronotal plate with wide, roundly cordiform, glabrous area surrounding the groove except for the apices of lateral branches, remaining peripheral parts of plate as well as the space between lateral branches completely covered with poorly sclerotized, very dense microteeth and sparse short setae; pronotal groove poorly sclerotised, yellow, inverted Y-shaped; common part poorly defined, branches of pronotal groove straight, widely diverging posteriorly, not reaching posterior margin of plate; angle between branches about 65-70^{o}; prosternal plate (Fig. 2) with triangular, anteriorly widened area of transverse asperities surrounded by glabrous area with short setae which are much denser than these on pronotum, microteeth are only on peripheral parts of plate; prosternal groove unsclerotised, poorly defined, distinct only in posterior third of prosternal plate.

Mesothorax (Figs. 1-2) strongly transverse, 2.6 times as wide as long and 1.2 times wider than metathorax, mainly glabrous, dorsally with transverse stripe of microspinulae, ventrally with microspinuled lateral areas; dorsal ambulatory pads poorly defined, ventral pads absent.

Metathorax (Figs. 1-2) 1.9 times as wide as long and nearly as wide as first abdominal segment, glabrous; dorsal and ventral pairs of ampular pads well-developed with distinct inner structure.

Abdomen (Fig. 1) flattened, lateral depressions poorly developed, ambulatory pads well-defined dorsally, absent ventrally; terminal process absent; first abdominal segment 1.9 times as wide as long and nearly of the same width like second segment; abdominal segments 2-8 about 1.2-1.4 times as wide as long, 9th segment 1.6 times as wide as long; terminal (10th) segment conical with unsclerotised anal rim. Surface of all segements with areas and longitudinal stripes of microspinulae, laterally and on the apex of 10th segment with denser short setae.

Spiracles (Figs. 9-10). Mesothoracic spiracles (Fig. 9) of buprestoid, cribriform type, about 2.5 times as wide as long with scarsely branched trabeculae; perithrema reniform, closing apparatus poorly sclerotised; spiracles surrounded by microspinulae; abdominal spiracles (Fig. 10) about 1.8 times as wide as long, very similar to mesothoracic ones but smaller and with less trabeculae; this type of spiracles is very common among anthaxiine taxa (e.g. *Maoraxia* Obenberger, 1937, *Neocuris* Saunders, 1868, *Anthaxia* Eschscholtz, 1829, *Xenorhipis* LeConte, 1866).

Proventriculus (Fig. 47) spherical with following inner armament: main fields with sclerotised, separated from each other scale-like tubercles bearing 3-8 finger-like outgrowths with or without microteeth; armament of lateral margins of the same type but poorly defined; anterior part with long microspinulae without swollen bases, posterior part of the same type;

medial stripes well-developed dorsally, poorly developed ventrally and formed by long microspinulae; glabrous area with longitudinally rugose sculpture.

Ctenoderus chloris Germain, 1855

(Figs. 12-23, 46)

S p e c i m e n s s t u d i e d. One last instar larva: Chile, 15.ii.2005, 15 km E of Los Andes, S. Bílý leg.; larva was cut from a sapwood of a thick branch of *Kageneckia angustifolia* (Rosaceae).

Measurements. Length: 36.0 mm; width: 5.4 mm.

Body cream-white, of the buprestoid type (morpho-ecological subtype 1), slightly flattened, without distinct pubescence (Fig. 12); prothorax moderately expanded, head completely retracted into prothorax.

Head. Medial and frontal branches of tentorium broad, poorly sclerotised except for medial lines; membrane and posterior part of branches with numerous, short setae and campaniform sensilla.

Mouthparts. Epistome (Fig. 14) strongly transverse, 3.8 times as wide as long, relatively broad; anterior margin deeply emargined between mandibular condyles which are globular; posterior margin bisinuous with distinct lateral emarginations, medial part arcuately protruding posteriorly; lateral margins deeply emargined, latero-posterior corners sharply triangular, distinctly projecting outwards; antennal incisions deep, reaching half of epistomal length; arrangement of epistomal sensillae: 2 groups of 3 sensillae arranged linearly in the middle of epistome and arrising from small, shallow depressions very close to each other; each group consists of 2 short setae with nearly fused bases medially and 1 campaniform sensilla laterally. Clypeus (Fig. 14) trapezoid, 3.3 times as wide as long, membraneous and glabrous. Labrum (Fig. 14) slightly trapezoid, nearly as wide as long, maximum width at anterior fifth, antero-lateral corners evenly rounded, lateral lobes absent; anterior margin nearly straight, lateral sides slightly tapering posteriorly; palatinae sclerites well-defined, moderately sclerotised, subparallel, both lateral and medial branches well-developed; medial sensillae of labrum arranged as follows: 1c-2t-3c; apical setae 2t short, far not reaching anterior margin of labrum; 1c situated on membrane at middistance between branches, 3c at medial branch beneath and slightly medially of the base of 2t, distance between all sensillae nearly equal; antero-lateral sensillae of labrum arranged as follows: external sensillae (1t, 2c)+3t-4t; 1t and 2c with completely fused and strongly sclerotised bases, 3t very close to them also with strongly sclerotised base, setae 1t, 3t and 4t long, extending anterior margin; internal sensillae (1t, 2t), their bases fused and strongly sclerotised. Labrum (Fig. 14) dorsally with narrow, transverse stripe of microsetae along anterior margin and antero-lateral corners, ventrally (epipharynx – Fig. 18) with two broad, slightly converging posteriorly longitudinal stripes of dense microsetae at lateral sides.

Antennae (Fig. 17) 2-segmented, not modified, situated in lateral incision between epistome and pleurostome; inner sclerites well-developed, articular membrane glabrous, antennomere 1 about 1.7 times as long as antennomere 2; 1st antennomere subcylindrical, 1.4 times as long as wide with 2 campaniform sensillae at outer and inner margins; anterior margin with fringe of dense microspinulae leaving inner margin glabrous; 2nd antennomere slightly longer than wide, external margin strongly curved near apex; anterior margin with fringe of dense microspinulae; apical cavity shallow, its bottom reaching ¼ of antennomere length; apical cavity contains long trichosensilla which is 1.5 times as long as antennomere, relatively short and robust sensory appendage not extending upper margin of cavity, two closely situated palmate sensillae near outer margin reaching about two thirds of appendage length, and short basiconic sensilla.

Mandibles (Fig. 16) triangular, nearly as long as wide, strongly sclerotised with black apical and brown basal parts; outer seta and inner setal brush absent, inner glandulae invisible; cutting edge composed of rather robust, rounded apical tooth, two obtuse internal teeth with common base both dorsally and ventrally and large, rather sharp external teeth.

Hypostome with several short setae, poorly sclerotised, yellow, anterior margin somewhat more sclerotised, brown; ocelli invisible.

Maxillae (Figs. 15-19). Cardo (Fig. 15) very short, transverse, glabrous with microspinuled fields on sides; isolated sclerites of cardo or even setae and campaniform sensilla absent; stipes (Figs. 15-19) much longer than wide with well-defined, curved inner sclerites; apical seta shorter than palpus maxillaris, lateral seta short, situated bellow palpus, both campaniform sensillae at the same level as lateral seta; anterior margin of stipes with fringe of dense, external and internal microsetae; maxillary palpus (Fig. 19): basal segment of palpus maxillaris 1.2 times longer than terminal segment, slightly transverse, 1.1 as long as wide with 1 campaniform sensilla and a few microspinulae at antero-lateral corner; terminal palpomere subconical, 1.6 times as long as wide; curved sensilla rather long situated at basal third of palpomere; apex of palpomere with 8 peg-like sensillae, one of them being distinctly longer and stouter than others. mala only slightly longer than wide with well-defined inner sclerite, 1 campaniform sensilla and 4 long setae externally and 2 lateral setae and dense microspinulae internally.

Labium (Fig. 15). Prementum strongly transverse, nearly twice as wide as long, anterior margin very slightly emargined, antero-lateral corners widely rounded, lateral sides subparallel; dorsal side (hypopharynx) with wide, parallel lateral areas of long microspinulae, ventral side with narrow, transverse stripe of long microspinulae along entire anterior margin and lateral corners, posterior margin of this stripe triangularly projecting backwards; central part of ventral side with isolated and elevated field of long microspinulae and with 2 short setae just behind this field; these setae are situated on the same level as bases of apical setae of corner sclerites; corner sclerites of labium T-shaped, well-sclerotised, apical setae relatively short, not reaching posterior margin of anterior, microspinuled area, situated distally on transverse branch of sclerite; corner sclerites with 2 anterior, campaniform sensillae situated on small, separate sclerite in front of bases of apical setae and 3 posterior, campaniform sensillae behind bases of apical setae; postmentum glabrous.

Thorax (Figs. 12-13) strongly expanded, much wider than abdominal segments with rudiments of legs which are accompanied by groups of sensillae medially and laterally (Fig. 23). Prothorax slightly transverse, 1.1 times as wide as long and 1.2 times wider than mesothorax; anterior membrane with dense, long and short pubescence, tubercles and longer setae, lateral sides with rather dense, long setae and microspinuled areas; both dorsal and ventral plates yellow, well-sclerotised; armament of dorsal plate consisting of extensive field of transverse, strongly sclerotised, brown asperities in central part (Fig. 12) and of fields of short microteeth between branches of dorsal groove; fields of the same microteeth are situated also laterally of branches and along margins of dorsal plate anteriorly and laterally;

pronotal V-shaped groove yellow-brown, poorly sclerotised without common, anterior part; branches of groove straight, not reaching posterior margin of plate, angle between them about 40^{o} (Fig. 12); prosternal plate with extensive field of asperities in central part and small fields of microteeth along anterior margin; prosternal, medial groove poorly sclerotised, yellow with posterior third somewhat more sclerotised (Fig. 13). Mesothorax (Figs. 12-13) strongly transverse, 3.2 times as wide as long and 1.2 times as wide as metathorax, nearly completely covered by microspinulae; ambulatory pads poorly developed. Metathorax (Figs. 12-13) strongly transverse, 2.5 times as wide as long and of the same width as 1st abdominal segment, mainly glabrous with lateral fields of poorly defined microspinulae and W-shaped area of larger microspinulae medially between dorsal ampular pads and with longitudinal stripe of these microspinulae between ventral pads; dorsal and ventral ampular pads well-developed with inner structure.

Abdomen (Fig. 1) flattened with sparse, short setae and poorly developed microspinulae laterally; lateral depressions well-developed, parallel with lateral sides; ambulatory pads well-developed only on first segment; 1st abdominal segment 1.4 times as wide as long and nearly of the same width as second segment; segments 2-8 nearly as wide as long, flattened, with longitudinal stripes of microspinulae dorsally and ventrally; 9th segment subcylindrical, as wide as long, covered by microspinulae; terminal (10th) segment subcylindrical, as wide as long, glabrous, covered only by not very dense setae; anal rim unsclerotised.

Spiracles (Figs. 20-21). Mesothoracic spiracles (Fig. 20) of typical buprestoid, cribriform type, 5.4 times as wide as long, reniform situated on sides of anterior, separated part of mesothorax; perithrema cancellate with numerous, strongly branched trabeculae, closing apparatus poorly sclerotised; spiracles surrounded by microspinulae; abdominal spiracles (Fig. 21) narrow, 3.2-3.5 times as wide as long, very similar to mesothoracic spiracles but smaller.

Proventriculus (Fig. 46) large and spherical; inner armament consisting of the following structures: main fields with large, dense and well-sclerotised, scale-like tubercles bearing rows of long microteeth, lateral margins with longer and sparse tubercles bearing single or a few microteeth, anterior and posterior parts with dense, long and fine microspinulae with reduced bases, central stripes absent, glabrous areas with longitudinally rugose sculpture.

Trigonogenium angulosum ruginosum (Fairmaire, 1867)

(Figs. 24-34)

S p e c i m e n s s t u d i e d: 6 specimens of the last instar, 12 specimens of middle-aged larvae; Chile, reg. VII, 17.-21.i.2005, Las Trancas, 1000 m, 36°54.731′S 71°28.739′E, S. Bílý leg.; all larvae taken from living stems and branches of *Fabiana sativa* (Solanaceae).

Measurements. Length of body of last instar larva 39.0-46.0 mm, width of prothorax 3.1 mm.

Body cream or yellowish-white with short pubescence which is visible only on lateral sides; larva of buprestoid type (morpho-ecological subtype 2), strongly elongate, worm-like with moderately expanded thoracic and longitudinal narrow abdominal segments (Fig. 24); abdominal segments 2-8 divided by secondary folds into two parts – anterior, flattened part bearing narrow, lateral depressions with abdominal spiracles at anterior part and posterior, subcylindrical part which is somewhat laterally strangulated at middlength.

Head. Epicranium completely retracted into prothorax, structure and arrangement of tentorial branches typical for Buprestini – Anthaxiini.

Mouth parts. Epistome (Fig. 27) strongly transverse, 4.0-4.2 times as wide as long, narrow; anterior margin distinctly emargined between slightly transverse mandibular condyles, posterior margin distinctly bisinuous; latero-posterior corners sharply angular, obtused apically, strongly projecting outwards; lateral margins obliquely emargined, antennal incisions shallow; epistomal sensillae arranged into 2 groups of 3 sensillae trapezoidally and posteriorly of epistomal midlength – each group consisting of 2 relatively long basal setae and one campaniform sensilla which is situated medially and somewhat anteriorly of them; distance between setae slightly shorter than that between anterior seta and campaniform sensilla. Clypeus (Fig. 27) trapezoid, narrow, 3.5 times as wide as long, membraneous and glabrous. Labrum (Fig. 27) transverse, 1.4 times as wide as long, without lateral lobes, maximum width at anterior third; antero-lateral corners evenly rounded, anterior margin widely emargined, lateral sides broadly rounded; palatinae sclerites well-defined, moderately sclerotised, diverging anteriorly, medial and lateral branches subparallel; medial sensillae of labrum arranged as follows: 1c-2t-3c; apical sensillae long, overlapping anterior margin of labrum, distance between apical seta and campaniform sensillae nearly equal to distance of bases of campaniform sensillae; antero-lateral sensillae of labrum arranged as follows: external: (1t, 2c) -3t-4t, internal: 1t+2t; labrum glabrous dorsally, ventrally (epipharynx) with 2 fields of microspinulae at antero-lateral corners (Fig. 30).

Antennae (Fig. 29) 2-segmented situated in lateral incisions between epistome and pleurostome, articular membrane glabrous; 1st antennomere slightly longer than 2nd one, subcylindrical, slightly longer than wide with 2 campaniform sensillae at the middle of both dorsal and ventral surfaces; inner sclerite well-defined and sclerotised; anterior margin with fringe of sparse, short microspinulae; terminal antennomere subcylindrical, as wide as long with well-developed inner sclerite, covered with sparse, short microspinulae along entire anterior margin; apical cavity shallow, its bottom reaching about first third of antennomere length; apical cavity contains 1 long trichosensilla (1.5 times as long as antennomere 2) situated externally at anterior third of antennomere (in one larvae there are two trichosensillae on one antenna), long, narrow sensory appendage (4 times as long as wide) extending anterior margin of cavity, 2 short, closely situated palmate sensillae arising near the base of sensory appendage and one short, basiconic sensilla situated externally of the base of sensory appendage.

Mandibles (Fig. 26) triangular, nearly as long as wide, strongly sclerotised, brown; base of mandibles lighter, yellow-brown; cutting edge with 1 apical tooth and 2 lateral ridges, without setal brush, inner glandules invisible because of strong sclerotisation; outer edge with two setae; apical tooth obtuse-angled, external tooth absent; internal teeth forming ridge both dorsally and ventrally.

Hypostome distinctly sclerotised and brown along anterior margin, rest of hypostome yellow; ocelli present but poorly defined, basal margin of hypostome bearing a few short setae and campaniform sensillae.

Maxillae (Figs. 28-31) relatively short. Cardo (Fig. 28) wider than long, glabrous, isolated sclerites of cardo small, roundly triangular and well-sclerotised bearing 2 short setae and 1 campaniform sensilla (in one larvae one seta located far from sclerite arising from membrane). Stipes (Figs. 28-31) longer than wide, inner sclerite well-developed with long, straight internal process and 1 campaniform sensilla near external margin (bellow lateral seta); apical seta of stipes longer than palpus maxillaris, situated at internal, anterior corner, lateral seta short, situated near external margin bellow palpus maxillaris; external armament consisting of a few microspinulae at external corner, internal armament consisting of dense, microspinuled areas along anterior and internal margins; internal margin densely microspinuled. Palpus maxillaris (Fig. 31) very short, transverse, 1st palpomere slightly longer than 2nd one; 1st palpomere 1.5 as wide as long, transversely triangular, external side long; apical seta nearly twice as long as 2nd palpomere situated at external corner, campaniform sensilla at the base, closer to external side; external corner with group of short microspinulae, inner margin with a few microspinulae at base of 2nd palpomere; 2nd palpomere very short, transverse, subconical, 1.1 as wide as long bearing very short, thick and strongly curved sensilla at middlength of internal margin; apex of 2nd palpomere with about 6 peg-liked sensillae, one of them distinctly longer and robuster than others; mala (Fig. 31) very short, transverse, 2.5 times as wide as long, arising from antero-lateral margin of stipes and not overlapping palpus maxillaris; internal sclerite of mala well-defined and transverse, internal lobe absent; external armament of mala consisting of 1 campaniform sensilla at base and 3 long, apical setae, internal armament consisting of 5 strongly sclerotised, flat setae and microspinuled field along inner margin.

Labium (Fig. 28). Prementum slightly transverse, 1.4 times as wide as long, strongly rounded laterally; anterior margin widely arcuate laterally, slightly and arcuately emargined, nearly straight at middle; ventral side completely glabrous; dorsal side (hypopharynx) with narrow, poorly visible fields of microspinulae along pharynx. Corner sclerites of labium rather narrow, oblique, well-sclerotised; apical setae relatively long, not extending anterior margin of prementum; each sclerite with 5 campaniform sensillae: 3 above and 2 bellow bases of apical setae. Postmentum with 2 short setae.

Thorax (Figs. 24-25) moderately expanded, flattened, slightly wider than abdominal segments; rudiments of legs poorly developed forming small, ventral, white spots at posterior part of thoracic segments. Prothorax slightly transverse, about 1.5 times as wide as long and about 1.2 times as wide as mesothorax; anterior membrane bearing dense, short and longer microspinulae and sparse long setae; dorsal and ventral plates poorly defined, unsclerotised, not colored, separated from the rest of prothorax by circular, secondary fold; sides of prothorax rounded bearing dense longer and short microspinulae and sparse, long setae. Pronotal plate (Fig. 24) completely glabrous, only with small microspinuled areas at anterior and posterior corners, and with very sparse, isolated and short setae, cuticular texture finely, longitudinally rugose; pronotum only with one, medial, moderately sclerotised and brownish groove which anteriorly reaches transverse, semilunar sclerotisation. Prosternal plate (Fig. 25) completely glabrous with isolated, short setae, surface with fine, longitudinally rugose texture which is somewhat denser than that on pronotum; prosternal groove moderately sclerotised, nearly of the same shape like pronotal groove but apical sclerotization much longer and narrower. Mesothorax (Figs. 24-25) slightly narrower than prothorax, about 2.5 times as wide as long and 1.1 times as wide as metathorax, glabrous; lateral sides and intersegmantal membrane with dense microspinulae and sparse, long setae; ambulatory pads only poorly developed both dorsally and ventrally. Metathorax (Figs. 24-25) glabrous with narrow, longitudinal stripes of microspinulae, about 2.4 times as wide as long, very slightly narrower than mesothorax; lateral sides bearing dense microspinulae and sparse, long setae; both dorsal and ventral ambulatory pads poorly defined.

Abdomen (Fig. 24) strongly elongated, without sclerotised terminal process, segments 2-8 bearing transverse, secondary folds separating anterior, flattened part with lateral, longitudinal depressions from posterior, subcylindrical part which is somewhat strangulated at midlength; lateral, longitudinal depressions are very narrow, well-defined and developed only on two anterior "pseudosegments"; both dorsal and ventral ambulatory pads poorly developed on 1st segment; 1st abdominal segment 1.6 times as wide as long and as wide as 2nd segment, narrowing posteriorly, dorsal and ventral plates glabrous, surrounded by microspinulae; segments 2-7 strongly elongate, 2-3 times as long as wide with secondary folds separating flattened anterior part from posterior, subcylindrical part; dorsal and ventral plates with longitudinal stripes of very fine microspinulae; 8th abdominal segment only 1.1 times as long as wide with poorly separated and short posterior part; 9th segment 1.2 times as long as wide, subcylindrical, with the same kind of armament like segments 2-7; terminal (10th) segment short and parallel-sided, 1.3 times as wide as long, its armament of the same type like that on previous segments; apex of terminal segment with vertical, unsclerotised anal rim, covered with microspinulae and sparse setae.

Spiracles (Figs. 32-33). Mesothoracic spiracles (Fig. 32) of buprestoid, cribriform type, reniform, transverse, 3.4 times as wide as long situated medially on sides of mesothorax surrounded by poorly developed microspinulae; perithrema cancellate, bearing multiple, chinked slots arranged parallely to each other; trabeculae absent, atrium unsclerotised, closing apparatus well-defined but poorly sclerotised. Abdominal spiracles of the same type, reniform, 2.3 times as wide as long, situated dorsally at anterior third of depressions; perithrema of the same type like on mesothoracic spiracle only with less slots; other structures of abdominal spiracles analogue to those on mesothoracic spiracles.

Proventriculus (Fig. 34) rounded, inner armament poorly sclerotised and developed, rather sparse; main field expanding on central parts of both dorsal and ventral surfaces with small, sparse, poorly sclerotised, single, rarely double or triple microteeth sitting on common base (Fig. A); margins with mainly single, sparse microteeth (Fig. B), anterior part of proventriculus without microsculpture, posterior part with relatively long microciliae; glabrous area with longitudinaly and finely rugose texture. Armament of proventriculus is rather similar to that in *Anilara* and Melanophilini.

Philandia valdiviana (Philippi & Philippi, 1860)

(Figs. 35-45)

S p e c i m e n s s t u d i e d. One last instar and one middle-aged ecdysial larvae: Chile, reg. IX, 25.-31.i.2005, Parc Nacional Nahuelbuta, 1200 m, 37°48.530′S 73°00.954′E, S. Bílý leg.; both larvae taken from living branch of *Escallonia virgata* (Escalloniaceae); material deposited in NMPC and ZIN.

Measurements. Length: 18.5 and 12.1 mm; width of prothorax: 2.9 and 1.6 mm.

Body of agriloid type (Fig. 35), cream-white, flattened, glabrous with isolated, short setae which are well-visible on lateral sides.

Head. Epicranium of agriloid type, lateral sides strongly sclerotised, tentorium with brown, strongly sclerotised frontal and medial branches.

Mouth parts. Epistome (Fig. 37) strongly transverse, 4.4 times as wide as long, anterior margin widely emarginate between mandibular condyles which are globular; posterior margin with shallow medial and lateral emarginations, latero-posterior corners nearly rectangular, obtused apically and slightly projecting outwards; lateral margins nearly straight, antennal depressions deep; epistomal sensillae form two groups of 3 sensillae arranged nearly linearly just above epistomal midlength; each group consisting of 2 very short setae, nearly fused at bases and one campaniform sensilla anteriorly and somewhat sideward of them. Clypeus (Fig. 37) trapezoid, relatively wide, 2.5 times as wide as long, membraneous and glabrous; labrum (Fig. 37) subquadrate, 1.2 times as wide as long without lateral lobes, antero-lateral corners obtuse-angled; anterior margin finely bisinuous, nearly straight, lateral margins nearly straight, only weakly converging posteriorly; palatinae sclerites well-developed and sclerotised, slightly diverging anteriorly, medial and lateral branches nearly subparallel; medial sensillae of labrum arranged as follows: 1c-2t-3c; apical setae relatively short and thick, not extending anterior margin of labrum, distance between all sensillae nearly equal; antero-lateral sensillae of labrum arranged as follows: external sensillae (1t, 2c)-3t-4t; 1t very short, nearly completely sunken in small cavity, 3rd longest, 4t also extremelly short, nearly like 1t; internal sensillae 1c-2t+3t, 2t and 3t thick and curved; dorsal surface of labrum with field of very dense, long microsetae along medial part of anterior margin continuing on ventral surface; ventral surface of labrum (epipharynx – Fig. 40) with posteriorly tapering field of very dense and long microsetae extending base of labrum.

Antennae (Fig. 41) two-segmented, situated in lateral depression of epistome, basal segment 1.4 times as long as terminal segment, articular membrane glabrous; 1st antennomere as long as wide, slightly narrowed apically, inner sclerites well-defined and sclerotised with 2 campaniform sensillae, anterior margin glabrous; 2nd antennomere slightly enlarged apically, nearly as long as wide with well-developed inner sclerites; apical cavity poorly developed, shallow, apex of antennomere containing usual set of sensillae; trichosensilla short, slightly longer than 2nd antennomere, sensory appendage relatively long and narrow extending far beyond apical depression; two rather distant palmate sensillae behind sensory appendage and basiconic sensilla which is long, reaching about midlenght of sensory appendage and arising externally of it.

Mandibles (Fig. 39) triangular, nearly as long as wide, apical part well-sclerotised, black, basal half brown; inner glandules invisible on slide, mandibles without external setae and with setal brush consisting of a few setae situated on small depression of inner margin; cutting edge with 2 obtuse apical teeth, dorsal one slightly shorter than ventral one; internal teeth absent.

Hypostome with ocelli posteriorly and laterally of mandibular sockets, with curved seta posteriorly and medially of it.

Maxillae (Fig. 38). Cardo transverse, glabrous with small transversely oval isolated sclerite bearing 2 medium-sized setae and without campaniform sensilla. Stipes glabrous, elongate, much longer than wide, inner sclerite well-developed and sclerotised; apical seta thick and much shorter than palpus maxillaris, situated at internal, anterior corner of stipes; lateral seta very short, situated near external margin; stipes with 1-2 dorsal, medial campaniform sensillae and 1 ventral campaniform sensilla at base. Maxillary palpus: basal segment glabrous, 2.2 times as long as 2nd, slightly wider than long with short apical seta and 1 campaniform sensilla at middle, closer to external margin; terminal segment slightly elongate, 1.2 times as long as wide, barrel-shaped with very short curved sensilla situated on internal margin at midlength of segment; terminal segment with 1 campaniform sensilla at anterior third of external margin and 9-10 apical, conical sensillae of different size, one of them being distinctly bigger than others. Mala strongly elongate, about 1.8 times as long as wide, parallel-sided with rounded apex; inner sclerite well-developed, internal lobe absent; mala with 2 thick, moderately long setae apically and 5 thick and short setae along inner margin.

Labium (Fig. 38). Prementum slightly elongate, 1.2 times as long as wide, rounded laterally; anterior margin rounded and weakly emargined medially, lateral sides widely arcuate, slightly tapering posteriorly; dorsal surface of labium (hypopharynx) with dense, long microsetae along anterior and lateral margins, ventral side with field of dense, long microsetae at anterior third; corner sclerites of labrum elongate, poorly sclerotised with 5 campaniform sensillae; apical setae short, far not reaching anterior margin. Postmentum glabrous.

Thorax (Figs. 35-36) weakly expanded, metathorax nearly as wide as prothorax and nearly of the same width as abdominal segments; rudiments of legs absent. Prothorax slightly transverse, 1.6 times as wide as long, 1.5 times wider than mesothorax and nearly as wide as metathorax; anterior membrane nearly glabrous with grainy texture and isolated, very short setae; lateral sides arcuately rounded, both dorsal and ventral plates well-defined and sclerotised, yellow and rounded; pronotal plate nearly completely covered with very fine, transverse, poorly sclerotised asperities (Fig. 35) which originate from small, tubercles on membrane surrounding the plate (asperities are wider and more transverse on posterior half of plates); pronotal groove biramous, well-sclerotised, brown, without common anterior part (resembling that in *Coraebus* larva); branches of groove slightly diverging backward, weakly curved; prosternal plate with the same type of armament like pronotal plate, prosternal groove uniramous, well-sclerotised, narrowing posteriorly. Mesothorax slightly narrower than prothorax and metathorax, 2.3 times as wide as long, without lateral pilosity, mainly glabrous with extensive areas of poorly defined, very short microspinulae dorsally and ventrally and small field of sclerotised, short and yellow microteeth near spiracles; ambulatory pads absent. Metathorax nearly as wide as prothorax, 2.9 times as wide as long without lateral pilosity and with the same armament like mesothorax.

Abdomen (Fig. 35) flattened with trapezoid or bell-shaped segments and non-segmented, sclerotised terminal process; abdominal segments straight or slightly strangulated at anterior third, posterior corners rounded and projecting outwards; ambulatory pads absent. 1st abdominal segment transverse, twice as wide as long with nearly straight sides slightly diverging backwards, mainly glabrous with fields of poorly defined, very short microspinulae dorsally and ventrally; segments 2-7 progressively elongate, trapezoid (2-3) or bell-shaped (4-7) with distinctly produced, rounded posterior corners; 8th segment distinctly narrower than segment 7 and 1.2 times as wide as long, subparallel; segment 9 rounded, nearly as wide as segment 8 with indistinct lateral pilosity and fields of microteeth; 10th abdominal segment triangular, sclerotised, yellow-brown with 2 non-segmented, well-sclerotised and brown terminal processes surrounding anal rim (Fig. 42).

Spiracles (Figs. 43-44). Thoracic spiracles (Fig. 43) reniform, situated on sides of mesothorax, intermediate between buprestoid and agriloid type, with parallel slots and numerous, non-branched trabeculae; perithrema cancellate, atrium and closing apparatus non-sclerotised; small group of sclerotised, yellow microteeth close to each spiracle; abdominal spiracles (Fig. 44) reniform, situated at anterior, lateral corners dorsally, similar to mesothoracic ones but smaller.

Proventriculus absent.

Discussion

Systematic list of studied taxa.

A complete list of the anthaxiine taxa previously studied was given in Bílý & Volkovitsh (2005). Below the detailed information presented only for genera described or discussed in this paper. The taxonomic position of the examined taxa follows that in Bellamy (2003) and Bílý (2004) which was followed also by Bílý & Volkovitsh (2005).

TRIGONOGENIINI Cobos, 1956
Trigonogenium Harold, 1869
T. angulosum ruginosum (Fairmaire, 1867): see under description → page 0.

MAORAXIINI Hołyński, 1984
Maoraxia Obenberger, 1937
Description of larva published by Bílý & Volkovitsh (2005).

MELOBASINI Bílý, 2000
Melobasis Laporte de Castelnau & Gory, 1837
Descriptions of larvae published by Volkovitsh & Hawkeswood (1995) and Bílý & Volkovitsh (2002).

ANTHAXIINI Gory & Laporte de Castelnau, 1839
Anilarina Bílý, 2000
Anilara Saunders, 1868
Description of larva published by Volkovitsh & Hawkeswood (1993).
Anthaxoschema Obenberger, 1923[1]
Description of larva published by Bílý & Volkovitsh (2005).

Necocurina Hołyński, 1988
Neocuris Saunders, 1868
Description of larva published by Volkovitsh & Hawkeswood (1987).

Curina Hołyński, 1988
Selagis Dejean, 1836
S. intercribrata (Fairmaire, 1877): Western Australia, Beverly, vi.2006, M. Powel leg., *Casuarina obesa* (Casuarinaceae), 1 specimen (mature).

Cylindrophora group sensu Volkovitsh, 2001
Ctenoderus Germain, 1856
C. chloris Germain, 1855: see under description → page 0.
Bilyaxia Hołyński, 1989
B. concinna (Mannerheim, 1837); material studied see in Bílý & Volkovitsh (2005).
B. cupriceps (Fairmaire & Germain, 1858): see under description → page 0.

Anthaxiina Gory & Laporte de Castelnau, 1839
Anthaxia Eschscholtz, 1829
For references of descriptions of larvae see Bílý (1997).
Chalcogenia Saunders, 1871
Description of larva published by Volkovitsh & Bílý (1997).

XENORHIPIDINI Cobos, 1986
Hesperorhipis Fall, 1930
Material studied see in Bílý & Volkovitsh (2005).
Xenorhipis LeConte, 1866
Material studied see in Bílý & Volkovitsh (2005).

Philandia generic group Volkovitsh, 2001
= Mendizabaliini Cobos, 1968 sensu Bellamy & Moore, 1990 (partim)
Philandia Germain & Kerremans, 1906
P. valdiviana (Philippi & Philippi, 1860): see under description → page 0.

Nascio generic group Volkovitsh, 2001
= Nascionina Hołyński, 1988 (partim)
Nascio Laporte de Castelnau & Gory, 1837
N. vetusta Boisduval, 1835: Australia, Black Mts., Canberra, A.C.T., 12.x.1981, R. McInnes, J. Lawrence leg., *Eucalyptus mannifera* (Myrtales, Myrtaceae), 14 specimens (mature and middle-aged, pupa, adult), ANIC, Canberra.
Nascioides Kerremans, 1903
N. enysii (Sharp, 1877): New Zealand, Waniumoto, ix.1980, J. R. Grehan coll., 5 specimens (different instars), ZIN (from R. L. Westcott). Description of larva published by Dumbleton (1932).

PTEROBOTHRINI Volkovitsh, 2001
Pterobothris Fairmaire & Germain, 1858
P. corrosus Fairmaire & Germain, 1858: Chile, Antillanca, Osorno, 21.vi.1982, Luis Cerda leg., *Nothofagus pumilio* (Fagales: Fagaceae), 1 specimen (?mature), NMPC. Description of larva published by Moore & Cerda (1986).

<u>On the larval characters and taxonomic position of *Bilyaxia* and *Ctenoderus*.</u>
Table 1, 2

A comparative character analysis of all known anthaxiine larvae was made and the taxonomic implications of the included larval characters were discussed by Bílý & Volkovitsh (2005). Here, we discuss the taxonomical position of mainly two Neotropical genera *Bilyaxia* and *Ctenoderus*.

Ctenoderus [as subgenus of *Curis* Gory & Laporte de Castelnau, 1838 (now *Selagis* Dejean, 1836)] and *Bilyaxia* (as subgenus of *Anthaxia*) were separated by Hołyński (1989) from *Cylindrophora* and placed in two different subtribes of Anthaxiini – Curina (as Curidina) and Anthaxiina correspondingly. The main diagnostic characters to distinguish these subtribes according Hołyński (1988, 1989, 1993) are the reticulate sculpture of head, the pronotum and the prosternal process, and the labrum much wider than long, without a median sulcus (Anthaxiina) versus punctuate sculpture and labrum about as long as wide, longitudinally (usually deeply) sulcate (Curina). But both characters are rather variable even within the same genus: we found both states of labrum among *Neocuris* (e.g. *N. thoracica* Fairmaire, 1877 – *N. fortnumi* Hope,1847), *Anthaxia* [e.g. *A.* (*Merocratus*) *tamdaoensi*s Bílý, 1998 – *A.* (*A.*) *rutilipennis* Abeille, 1891; within this genus all the transition states from bilobed, longitudinal to undivided transverse labrum can be observed] and other anthaxiine genera (also in *Castiarina* Gory & Laporte de Castelnau, 1838 from Stigmoderini); *Chalcogenia* Thomson, 1879 (Anthaxiini) has punctuate sculpture, that in *Anthaxia* is quite variable.

Bílý (2000) placed the Old World and Neotropical anthaxiine genera (including *Ctenoderus* as a distinct genus) in Anthaxiina (Anthaxiini) while the Australian taxa were grouped in Anilarini (with subtribes Anilarina, Neocurina, and Curina Hołyński, 1988), Melobasini, and Maoraxiini Hołyński, 1988; *Cylindrophora* and *Paracuris* Obenberger, 1923 (treated before as subgenera of *Anthaxia*) were resurrected as distinct genera but *Bilyaxia* was not mentioned in this publication.

Volkovitsh (2001) underlined the similarity in adult antennal structures between Australian and Neotropical anthaxiine taxa contrasting them to Old World and Nearctic taxa, and combined all of them in six informal groups and a few formal taxa within Anthaxiinioid lineage (Maoraxiini was regarded to be a separate group).

Bellamy (2003) followed Hołyński (1988, 1989, 1993) in treating *Ctenoderus* and *Bilyaxia* as subgenera of *Selagis* (Curini) and *Anthaxia* (together with the subgenera *Cylindrophora* and *Paracuris*) (Anthaxiini, included also Neotropical genera *Agrilaxia*, *Brasilaxia*, and *Tetragonoschema* Thomson, 1857) correspondingly. He also synonymised Anilarini under Curini.

Bílý (2004) upgraded *Bilyaxia* to generic rank and separated one more genus, *Romanophora* (type species *Anthaxia verecunda* Erichson, 1834) from *Cylindrophora* (type species *Chrysomela maulica* Molina, 1782). This corrected concept regarded Curina and Anthaxiina as subtribes of Anthaxiini with Curina comprising Australian *Selagis* together with Neotropic *Anthaxioides* Cobos, 1978, *Cylindrophora*, *Ctenoderus*, and *Romanophora*, and Anthaxiina including Neotropical (and partly Nearctic) *Agrilaxia* Kerremans, 1903, *Bilyaxia*, *Brasilaxia*, *Tetragonoschema*, and Old World and Nearctic genera.

Bílý & Volkovitsh (2005) regarded Curini and Anthaxiini as separate tribes. In analysis of larval characters of known anthaxiine genera they also treated *Bilyaxia* and *Agrilaxia* as a members of Anthaxiini but they noted (p. 24) that in some larval characters *Bilyaxia* was much closer to Curini (meaning Australian anthaxiine genera), that was supported by adult

Table 1. Comparison of the main taxonomic characters between the larvae of *Bilyaxia* and *Ctenoderus*

Character	Bilyaxia	Ctenoderus
Epicranium: anterior part	With sparse short setae and campaniform sensillae between medial and frontal apodemes	With numerous short setae and campaniform sensillae between medial and frontal apodemes
Epistome: latero-posterior corners	Rectangular, weakly to moderately projecting outwards (Fig. 3)	Sharply triangular, distinctly projecting outwards (Fig. 14)
Epistome: disposition of epistomal sensillae	At anterior half (Fig. 3)	At the middle (Fig.14)
Labrum: shape	Transverse, with anterior margin widely rounded (Figs. 3, 8)	Subquadrate, with anterior margin nearly straight (Figs. 14, 18)
Labrum: external armament	With small microsetal areas at anterior corners; anterior margin glabrous at the middle (Figs. 3, 8)	With stripe of microsetae along anterior margin (Figs. 14, 18)
Maxillary cardo: isolated sclerite	Poorly developed or lacking; in last case setae and sensilla arise from membrane (Fig. 4)	Completely lacking, no trace of setae or sensilla (Fig. 15)
Labium: prementum, shape	Nearly as long as wide; anterior margin widely rounded (Fig. 4)	Transverse, definetly wider than long; anterior margin nearly straight (Fig. 15)
Labium: prementum, armament	With two small lateral areas of microspinulae at anterior corners and central microspinulate area (Fig. 4)	With stripe of microspinulae along anterior margin, central elevated microspinulated area, and 2 short setae at base of this area (Fig. 15)
Postmentum: armament	With 2 setae (Fig. 4)	Glabrous (setae drifted to prementum) (Fig. 15)
Pronotal groove: shape	“Y”-shaped (Fig. 1)	“V”-shaped (Fig. 12)
Pronotal plate: armament	as in Fig. 1	as in Fig. 12
Prosternal plate: armament	as in Fig. 2	as in Fig. 13
Body: armament (excluding setae)	Nearly glabrous, with small areas of poorly defined microspinulae	With extensive microspinulate areas and stripes
Spiracles: inner trabeculae	With a few scarcely branched trabeculae (Figs. 9-10)	With numerous strongly branched trabeculae (Figs. 20-21)
Proventriculus: armament	as in Fig. 47	as in Fig. 46

antennal structures. Larval characters of *Agrilaxia* based on the incomplete description of Costa et al. (1988) are quite similar to *Bilyaxia* though its adult antennal structures are closer to Old World Anthaxiini.

Diagnostic characters of the larva of *Bilyaxia* (*B. concinna*) were indicated in Bílý & Volkovitsh (2005, table 1); as it appears now, it shares some of the most important states with *Ctenoderus*. These are: the prothoracic plates covered with well-defined microteeth combined with large transverse asperities forming distinct areas along grooves (shared with *Ctenoderus*); the anterior margin of the labrum externally with microsetal areas only at antero-lateral corners, anterior margin glabrous at the middle (shared with *Agrilaxia*); metathorax with two pairs of well defined ampular pads on each side connected with inner duct (shared with *Maoraxia*, *Ctenoderus, Agrilaxia*, and *Anthaxia-Chalcogenia*). Comparison of main diagnostic characters between the larvae of *Bilyaxia* and *Ctenoderus* is shown in Table 1. Larval characters of *Ctenoderus* indicate an obvious affinity to *Bilyaxia* rather than *Selagis* (Table 2) and contradict any close relationship to the latter. The *Ctenoderus* larva is characterized by having the epicranium with numerous short setae and campaniform sensillae at the anteriordorsal part between the medial and frontal branches; the maxillary cardo very short, without an isolated sclerite and its sensillae (possibly an artifact in the single larva studied); the prementum with an isolated elevated area at the middle (like many Buprestini) and with two short setae just behind the latter, positioned at the same level as the bases of apical setae of corner sclerites (possibly shifted from their usual position on postmentum); the apical portion of the corner scerites of labium bearing the apical setae transverse, perpendicular to sclerite itself. It shared some important characters with Australian anthaxiine genera (unmodified antennae, microspinulate labrum and labium); additionally in the asperate prothoracic plates armament it demonstrates a similarity to *Melobasis*. Conversely, *Ctenoderus* (as well as *Bilyaxia* and *Agrilaxia*) shares with the Old World Anthaxiini and the Australian Maoraxiini an important character of the presence of paired metathoracic ampular pads having a complicated inner structure. With this synapomorphy, it may be supposed that the Neotropical anthaxiine genera constitute a distinct phyletic lineage (*Cylindrophora* generic group sensu Volkovitsh, 2001) closely related but independent from both the Australian and Old World lineages though their closer affinities to the Australian taxa based at least on adult antennal morphology cast no doubts.

Differences between *B. concinna* and *B. cupriceps* appear in the shape of epistome (in *B. concinna*, the posterior margin has hardly visible lateral emarginations and latero-posterior corners are rectangular, more strongly obtuse and less projecting outwards); the shape of the central microspinulate area on the labium (more extensive in *B. concinna*); the shape of mandibles (with more straight and acute apical teeth); the arrangement of asperities along the pronotal groove (in *B. concinna* the asperities border the lateral branches along both sides, while in *B. cupriceps*, only externally); and the shape of the asperate prosternal area (in *B. concinna* this area converges from the base to the apex). Unfortunately, we have only a single old slide of *B. concinna* larva with many details only poorly visible.

New data on the larval morphology of the Chilean anthaxiine taxa have shown that:

1) in larval characters, *Ctenoderus* and *Bilyaxia* are quite similar and may be treated as closely related taxa; 2) there are important differences between the larvae of these genera and that of *Selagis* (Table 2) that contradict to their placement in Curini (Curina) as suggested by Hołyński (1989); 3) the separation of Curina(ini) and Anthaxiina based on adult characters indicated by Hołyński (1988, 1989, 1993) is unwarranted; 4) larval characters support the separation of *Ctenoderus* and *Bilyaxia* as distinct genera; 5) *Ctenoderus* and *Bilyaxia* share some important larval character states with Australian anthaxiine genera in one respect and with Old World genera from another, thus they can be regarded as belonging to a particular phyletic lineage of Gondwanan origin (*Cylindrophora* generic group) which presumably also includes *Agrilaxia* and other Neotropical genera. Additionally we conclude that the separation of Curini and Anthaxiini as distinct tribes is unwarranted.

<u>On taxonomic position of *Trigonogenium* Harold, 1869.</u>
Table 2

Cobos (1956) placed *Trigonogenium* in the monotypic tribe Trigonogeniini which he suggested was related to Buprestini and Kisanthobiini and also shared some characters with Anthaxiini and Melanophilini. Hołyński (1988, 1993) downgraded Trigonogeniini to a subtribe of Anthaxiini sensu Hołyński, 1988 which comprised a number of unrelated taxa (Bílý, 2000; Volkovitsh, 2001). Bílý (2000) treated Trigonogeniini as an independent tribe with affinities to Anthaxiini. Volkovitsh (2001) placed Trigonogeniini to Anthaxiinioid branch of Anthaxioid lineage based on antennal sensory structures which are rather primitive and differ from these in other anthaxiine taxa; he also noted that taxonomic position of *Trigonogenium* remains obscure. Bellamy (2003) followed this concept. Bílý & Volkovitsh (2005) again repeated the contention that the relationships of Trigonogeniini, whose larvae at that time remained unknown, were still unclear. In this way, all authors mentioned above were agreed regarding the relationships of *Trigonogenium* to Anthaxiini sensu lato and its rather isolated position.

The present study of larval characters of *Trigonogenium* completely supports this viewpoint. The larva of *Trigonogenium* possesses a unique set of characters (Table 2) that differs from all known chrysochroine and buprestine larvae by having a uniramous pronotal groove (this state is typical for Polycestinae and occurs in some larvae of Agrilinae). Another important character is the strongly elongated, „worm-like“ body with the 2nd-8th abdominal segments divided by transverse folds into the flattened anterior and subcylindrical posterior parts; a similar structure of abdominal segments is found in the larvae of *Nascio* and *Maoraxia* although in these larvae the expanded and lateral impressions with the spiracles are located posteriorly. One more important diagnostic character state is the externally glabrous labrum and labium which are very similar in shape, structure of palatinae sclerites and armament to these in many Polycestinae (Volkovitsh & Hawkeswood, 1999) in one respect, and *Anthaxia*, *Cratomerus*, and *Chalcogenia* (see Bílý & Volkovitsh, 2005) from another perspective, differing from them in only well-developed, long 1trichoid sensilla in external antero-lateral group (in the other genera discussed herein it is substituted by campaniform sensillae, 1c). Spiracles with perithrema cancellate, bearing multiple narrow slots arranged in parallel to each other, resembling *Prospheres* Saunders, 1868 (see Volkovitsh & Hawkeswood, 1999), *Xyroscelis* Saunders, 1868, *Paratassa* Marseul, 1882 (see Bílý & Volkovitsh, 1996), *Maoraxia*, *Neocuris*, *Bilyaxia*, *Anthaxia*, *Cratomerus* (see Bílý & Volkovitsh, 2005) and others; such spiracles belong to a transition state between a multiloculate spiracle (*Ptosima* Dejean, 1833, *Anthaxoschema* Obenberger, 1923) and a normal cribriform spiracle of buprestoid type with cancellate perithreme and numerous branched trabeculae. The armament of the proventriculus of the *Trigonogenium* larva belongs to *Melanophila* type, found in *Anilara* (see Volkovitsh & Hawkeswood, 1993), *Melanophila* Eschscholtz, 1829, and *Phaenops* Dejean, 1833. Finally, in the shape of epistome *Trigonogenium* slightly resembles *Neocuris* (see Volkovitsh & Hawkeswood, 1987). The only unique larval character found in *Trigonogenium* is the very short, transverse maxillary palps and mala but it is difficult to evaluate the significance of this character for taxonomy.

In conclusion, the larval characters of *Trigonogenium*, which are mainly plesiomorphic, confirm the affinities of this genus to the anthaxiine complex and its position within a separate tribe. Recently Bellamy (2007) described a second monotypic genus of Trogonogeniini, *Hovorigenium* Bellamy, 2007 from Ecuador, but its larvae is unknown.

Table 2. Comparison of the main taxonomic characters among the larvae of known anthaxiine genera

* No data for *Agrilaxia*.

Character	TRIGONOGENIINI	MAORAXIINI	MELOBASINI	CURINI			ANTHAXIINI		XENORHIPIDINI
				Anilarina	Neocurina [1]	Curina	*Cylindrophora* group	Anthaxiina	
	Trigonogenium	*Maoraxia*	*Melobasis*	*Anilara, Anthaxoschema*[1]	*Neocuris*	*Selagis*	*Ctenoderus, Bilyaxia, Agrilaxia*	*Anthaxia, Chalcogenia*	*Xenorhipis, Hesperorhipis*
Body: shape	Worm-like with seudosegmentation (Fig. 24)	Worm-like with seudosegmenta-tion	Normal	Normal	Normal	Normal	Normal (Figs. 1, 12)	Normal	Normal
Body: armament	With areas and stripes of microspinulae	With areas and stripes of microspinulae	Nearly glabrous	Nearly glabrous, with areas of poorly defined microspinulae or microampulae	Nearly glabrous, with groups of microampulae and poorly defined microspinulae	Glabrous	With areas and stripes of microspinulae	Glabrous	Glabrous
Prothoracic plates: armament	Mainly glabrous (Figs. 24, 25)	Mainly glabrous	Glabrous or with asperities along the grooves	Glabrous	Glabrous with small areas of microteeth anteriorly	Glabrous	Areas of microteeth and asperities along the grooves* (Figs. 1-2, 12-13)	Glabrous	Glabrous
Pronotal groove	Uniramous (Fig. 24)	"V"-shaped	"V"-shaped	"V"-shaped	"Y"-shaped	"V"-shaped	"Y" or "V"-shaped (Figs. 1, 12)	"Y" or "V"-shaped	"V"-shaped
Prosternal groove	Uniramous (Fig. 25)	3-armed	3-armed	Uniramous	Uniramous	3-armed	Uniramous (Figs. 2, 13)	Uniramous	Uniramous
Metathorax: ampular pads	Absent (Figs. 24, 25)	Present	Absent	Absent	Absent	Absent	Present (Figs. 1, 2, 12, 13)	Present	Absent
Abdominal segments 2-8: shape	Much longer than wide with 2 secondary folds (Fig. 24)	Much longer than wide with 2 secondary folds	Wider than long to slightly longer than wide; without secondary folds	Wider than long to slightly longer than wide; with or without 1 secondary fold	Wider than long to slightly longer than wide; without secondary folds	Wider than long to slightly longer than wide; without secondary folds	Wider than long to slightly longer than wide; without secondary folds (Figs. 1, 12)	Wider than long to slightly longer than wide; without secondary folds	Wider than long to slightly longer than wide; without secondary folds
Antennae: position and shape	In lateral incision between epistome and pleurostome; normal (Figs. 27, 29)	In lateral incision between epistome and pleurostome; normal	In lateral incision between epistome and pleurostome; normal	In lateral incision between epistome and pleurostome; normal	In lateral incision between epistome and pleurostome; normal	In lateral incision between epistome and pleurostome; normal	In lateral incision between epistome and pleurostome; normal (Figs. 3, 6, 27, 29)	In lateral depression of epistome; modified	In lateral depression of epistome; modified
Labrum and labium externally: armament	Glabrous (Figs. 27, 28)	With icrospinulate areas or stripes	With microspinulate areas or stripes	With microspinulate areas or stripes	With microspinulate areas or stripes	With anterior areas of microspinulae	With microspinulate areas or stripes (Figs. 3, 4, 14, 15)	Glabrous	With microspinulate areas or stripes
Labrum: antero-lateral sensillae, arrangement	(1t, 2c)-3t-4t 1t+2t (Figs. 27, 30)	(1t, 2c)-3t-4t (1t, 2t)	(1t, 2c, 3t)-4t (1t)	(1t, 2c)-3t-4t (1t) / 1t+2t	(1t, 2c)-3t-4t (1t, 2t)	(1t, 2c)-3t-4t (1t, 2t)	(1t, 2c)-/+3t-4t (1t, 2t) (Figs. 3, 8, 14, 18)	(1c, 2c)+3t-4t 1t-2t	(1t, 2c)-3t-4t 1t-2t
Mandibles: external setae	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

[1] According to larval characters *Anthaxoschema* is much closer to *Neocuris* than *Anilara* (Bílý & Volkovitsh 2005)

On taxonomic position of *Philandia* Germain & Kerremans, 1906.
Table 3

Cobos (1974) transferred *Philandia* from Agrilinae to Buprestinae and indicated that the wing venation and some other characters of this genus were certainly buprestine; among putative affinities he indicated the Australian *Nascio* Germain & Kerremans, 1906 and the Neotropical *Pterobothris* Fairmaire & Germain, 1858. Bellamy & Moore (1990) attributed *Philandia* to the tribe Mendizabaliini Cobos, 1968 together with another Chilean genus *Mendizabalia* Cobos, 1957. Based on adult antennal morphology Volkovitsh (2001) separated this genus to the informal *Philandia* generic group and indicated that antennal sensory structures of *Mendizabalia* and *Philandia* were quite different. Bellamy (2003) followed this separation and confirmed tribal level of *Philandia* generic group. Hołyński (1988, 1993) placed *Nascio* and *Pterobothris* together with *Nascioides* Kerremans, 1903 separated in the subtribe Nascionina Hołyński, 1988 of Anthaxiini and noted that the later genus could possibly belong to another group (Hołyński, 1988); *Philandia* remained unknown to that author. Volkovitsh (2001) indicated that according to adult antennal structures *Pterobothris* differs greatly from *Nascio* and *Nascioides* (*Nascio* generic group) and established the monotypic tribe Pterobothrini using additionally larval characters (agriloid larval body); this viewpoint was reflected in Bellamy (2003).

The larva of *Philandia* (Fig. 35), at first glance, is typically agriloid (e.g. the habitus, particularly the configuration of the abdominal segments and the presence of paired terminal sclerotized processes, mandibles with a setal brush on the inner surface, spiracles somehow resembling those in Agrilinae, the lack of a sclerotized proventriculus) but some differences in the antennal, terminal process and spiracle structures indicate that this habitual similarity could be convergent (Table 3). In all agriline taxa we have studied, the apex of antennomere 2 is convex, without any trace of apical invagination or cavity, sensory organs and microspinulae situated superficially (in *Philandia* and those compared genera, the apex although shallowly invaginated and the sensory organs sit in this invagination, the walls of cavity are glabrous); terminal processes in Agrilinae, if present, are distinctly segmented and contain internal glandules (in *Philandia* those are unsegmented, in *Nascio* they are represented by a poorly sclerotized fold with lateral membranous swellings, in *Pterobothris* the processes bear a distinct internal ledge and seem bisegmented, no internal glandules found); spiracles in Agrilinae are circular, perithreme not cancellate, inner trabeculae are of another type (spiracles in *Philandia*, *Nascio*, and *Pterobothris* are reniform or falciform, much resembling spiracles of Stigmoderini (see Volkovitsh & al., 2003). The adult characters also contradict an transfer of *Philandia* to Agrilinae (see above); it (as well as compared genera) completely lacks such as important character as abdominal sternal groove (Jendek, 2001) which is regarded to be an important synapomorphy of Agrilinae. In contrast to larval characters, the adult antennal structures of all three genera are quite different and give no evidence to support the close relations of these taxa (Volkovitsh, 2001). Comparison of larval characters of *Philandia, Nascio, Nascioides* and *Pterobothris* (Table 3) show that *Nascioides* differs greatly from other genera being much more similar to the larvae of Dicercini (*Dicerca* Eschscholtz, 1829, *Capnodis* Eschscholtz, 1829, *Lampetis* Dejean, 1833, etc.), Epistomentini (*Diadoxus* Saunders, 1868), or Coomaniellini Bílý, 1974 (*Coomaniella* Bourgoin, 1924) and confirms the opinion of Hołyński (1988). Larval characters support the relatively close affinities of

Table 3. Comparison of the main taxonomic characters among the larvae of *Philandia*, *Nascioides, Nascio, Pterobothris,* and Agrilini (*Agrilus, Coraebus, Meliboeus*).

Character	*Nascioides*	*Nascio*	*Philandia*	*Pterobothris*	Agrilini
Antennae: apical cavity	Deep with walls covered with dense microspinulae	Shallow with walls glabrous	Shallow with walls glabrous	Shallow with walls glabrous	Absent
Mandibles: setal brush	Absent	Present	Present (Fig. 39)	Present	Present
Prothoracic plates: armament	With microteeth changing to asperities only along the groove	Entirely covered by round or tooth-like asperities which are bigger and strongly sclerotized along the grooves	Entirely covered by transverse asperities (Figs. 35, 36)	Entirely covered by round or tooth-like asperities	Different, with microteeth, asperities or both
Pronotal groove	"Y"-shaped	"V"-shaped	Double (Fig. 35), slightly diverging posteriorly	Double, strongly diverging posteriorly	Uniramous, biramous, double
Abdomen: secondary folds	Absent, segments more or less transverse	2 folds, segments strongly elongate	Absent, segments more or less transverse (Fig. 35)	Absent, segments more or less transverse	Absent, segments more or less transverse
Anal segment: terminal processes	Absent	Absent, anal segment with poorly sclerotized fold and two lateral membranous swellings	Present, poorly developed, unsegmented (Figs. 35, 42)	Present, with internal ledge, 2-segmented in appearance	Present, segmented, or absent
Spiracles	Typically buprestoid, reniform	Intermediate between buprestoid and agriloid	Intermediate between buprestoid and agriloid (Figs. 43-44)	Intermediate between buprestoid and agriloid	Typically agriloid, circular
Proventriculus	Present	Absent	Absent	Absent	Absent

Philandia to *Pterobothris* and obvious, although more distant, affinities to *Nascio* and agree with the earlier opinion of Cobos (1974) and, partly, that of Hołyński (1988, 1993) concerning the relations between the two latter genera. Regarding the taxonomic position and rank of *Philandia* generic group and its affinity to *Mendizabalia* (whose larva is still unknown), as well as the taxonomic rank of *Nascio* generic group (Nascionina) and Pterobothrini, these questions invite further investigations. In our opinion the possible affinities of these taxa to Stigmoderini should not be set aside.

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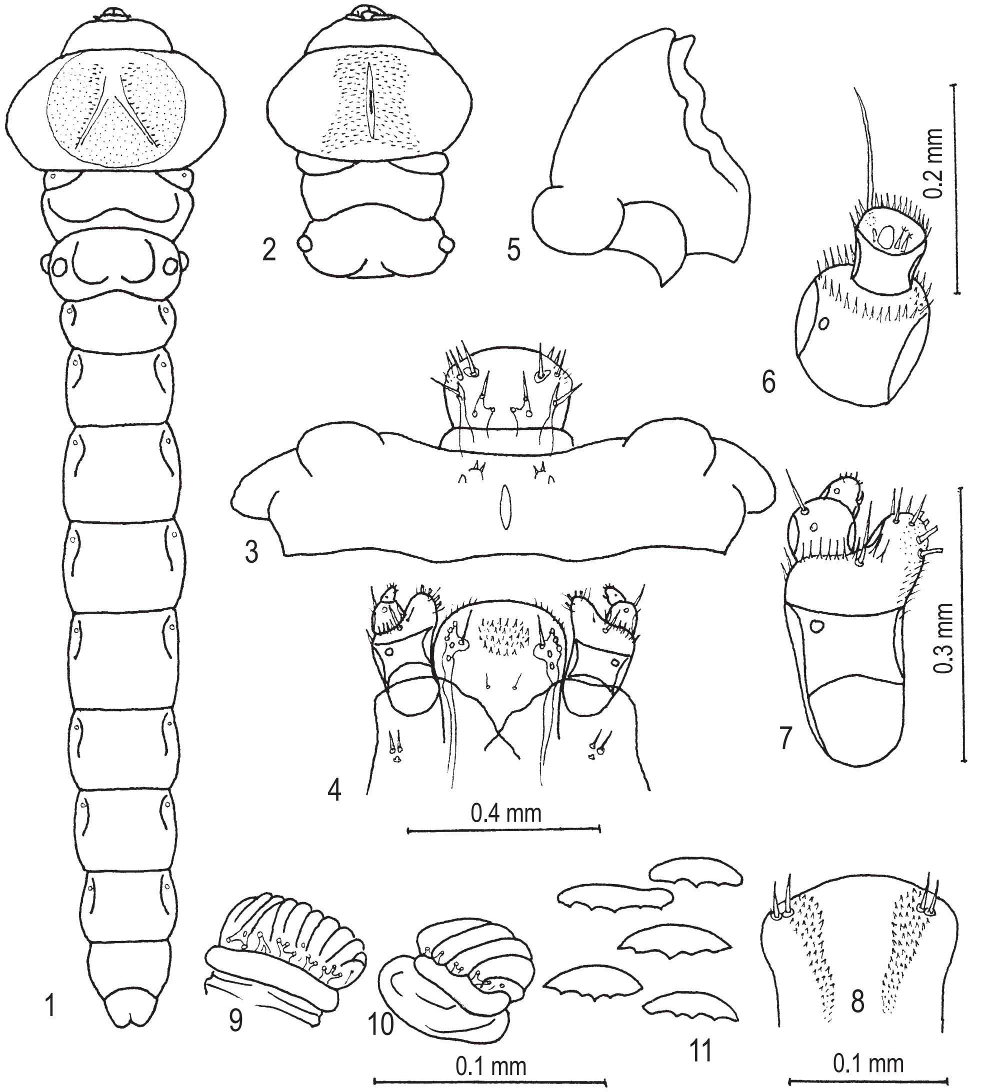
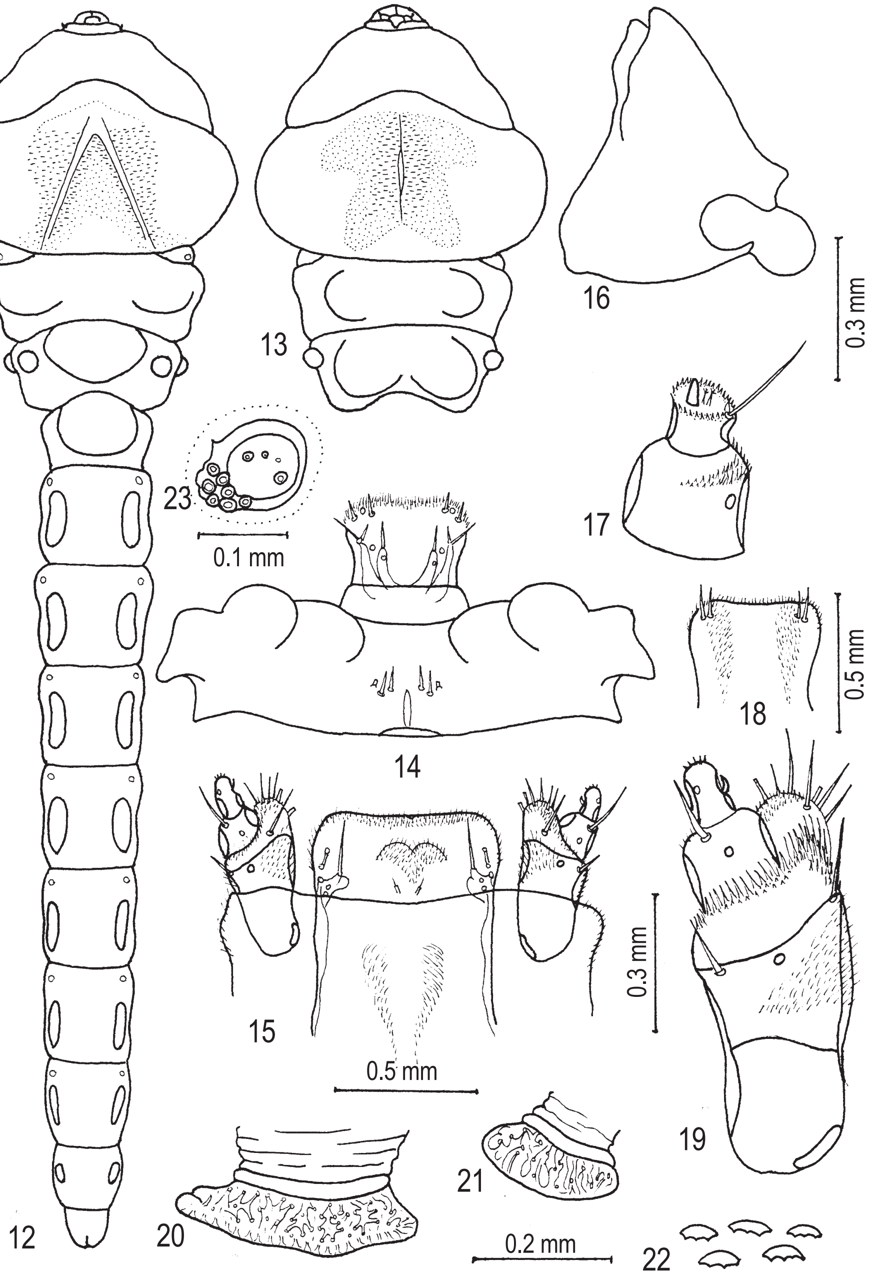
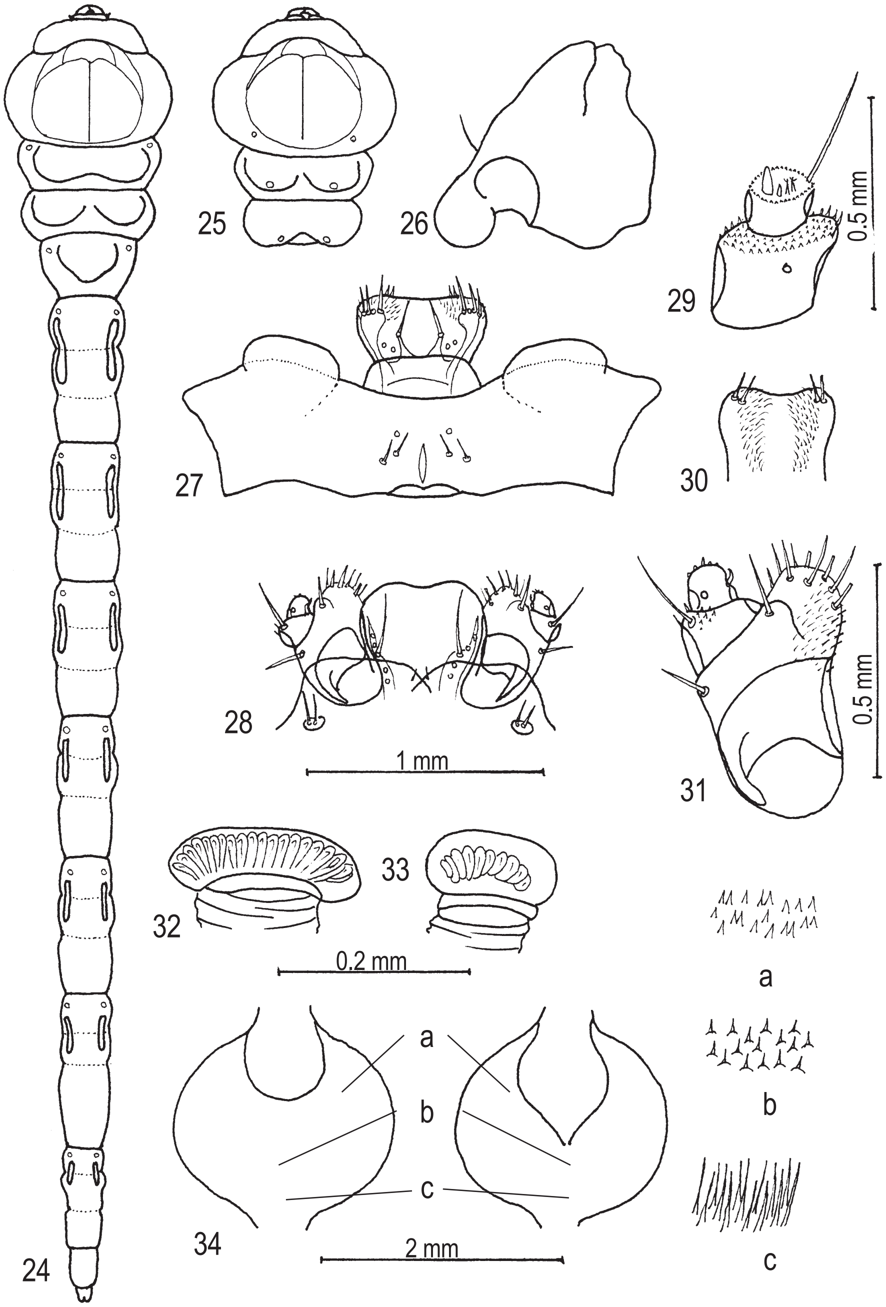


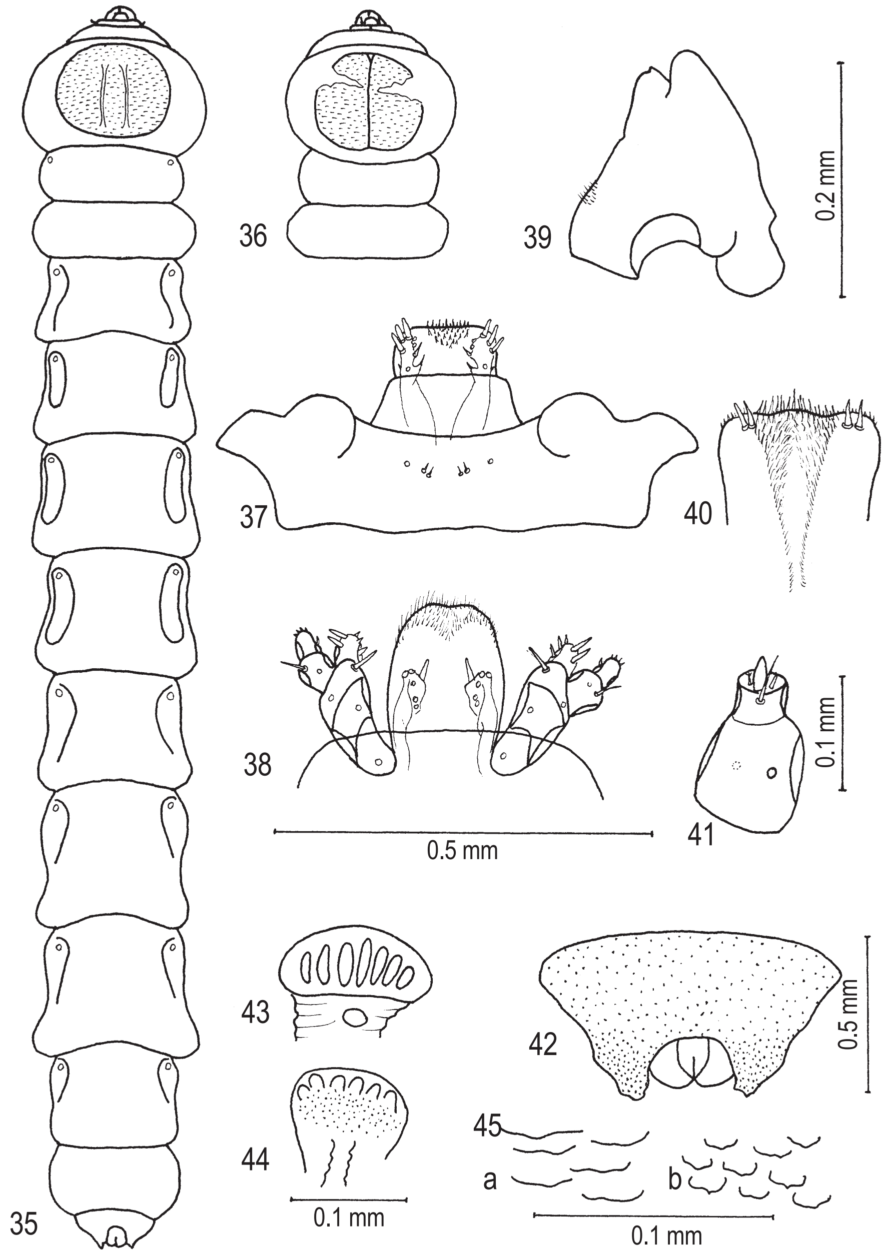
Figs. 1-11. Larva of *Bilyaxia cupriceps* (Fairmaire & Germain). 1 – last instar larva, dorsal view, 14.5 mm; 2 – thorax, ventral view; 3 – epistome, clypeus and labrum; 4 – labiomaxillary complex; 5 – left mandible; 6 – left antenna; 7 – left maxilla; 8 – epipharynx; 9 – mesothoracic spiracle; 10 – 1st abdominal spiracle; 11 – asperities of thoracic plates.



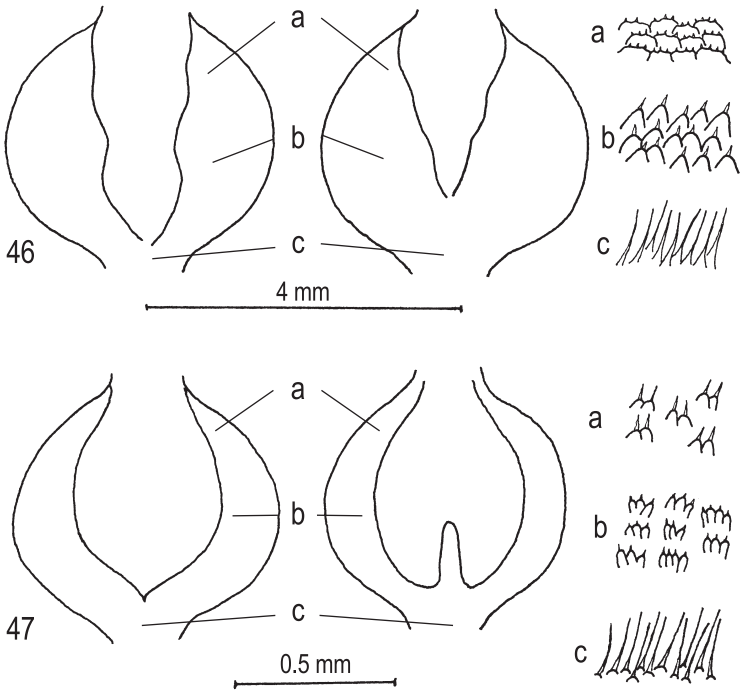
Figs. 12-23. Larva of *Ctenoderus chloris* Germain. 12 – last instar larva, dorsal view, 36.0 mm; 13 – thorax, ventral view; 14 – epistome, clypeus and labrum; 15– labiomaxillary complex; 16 – right mandible; 17 – right antenna; 18 – epipharynx; 19 – left maxilla; 20 – mesothoracic spiracle; 21 – 1st abdominal spiracle; 22 – asperities of prothoracic plates; 23 – rudiment of prothoracic leg.



Figs. 24-34. Larva of *Trigonogenium angulosum ruginosum* (Fairmaire). 24 – last instar larva, dorsal view, 47.8 mm; 25 – thorax, ventral view; 26 – left mandible; 27 – epistome, clypeus and labrum; 28 – labiomaxillary complex; 29 – right antenna; 30 – epipharynx; 31 – left maxilla; 32 – mesothoracic spiracle; 33 – 1st abdominal spiracle; 34 – inner armament of proventriculus.



Figs. 35-45. 35 – Larva of *Philandia valdiviana* (Philippi & Philippi). 35 – last instar larva, dorsal view, 18.5 mm; 36 – thorax, ventral view; 37 – epistome, clypeus and labrum; 38 – labiomaxillary complex; 39 – right mandible; 40 – epipharynx; 41 – right antenna; 42 – last abdominal segment, dorsal view; 43 – mesthoracic spiracle; 44 – 1st abdominal spiracle; 45 – asperities of prothoracic plates (a– posterior part of plates, b– anterior part of plates).



Figs. 46-47. Inner armament of proventriculus; dorsal side on the left, ventral side on the right. 46 – *Ctenoderus chloris* Germain, 1855; 47 – *Bilyaxia cupriceps* (Fairmaire & Germain).

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