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## **Treehoppers of Panguana (Peru), with additional faunistic remarks and 3D-SEM illustrations (Auchenorrhyncha, Membracoidea)**

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### **Abstract**

Altogether 74 species of treehoppers (Membracidae) and one species of Aetalonidae found in Panguana in the Amazon lowland of Peru are listed, 20 of these species were recorded only once with a single specimen. Information is given to their identification and distribution. Many species are illustrated, partly by 3D-SEM pictures. 39 of the species found in Panguana are new for Peru. Four more species, previously not known from Peru, are shown to occur in Peru. Additionally six species are recorded as new for Ecuador, three each for Venezuela and Bolivia, two each for Colombia and Costa Rica and one each for French Guyana and Brazil. It is assumed that restricted known distribution in South American treehoppers is probably more an artefact based on the lack of faunistic information than a sign of real endemism.

### **Introduction**

The biological field station Panguana in the Amazon lowland of Peru is an interesting research topic predominantly for zoology (Panguana website, <http://www.panguana.com>, DILLER 2015). It is located at about 260 m altitude in the Departamento de Huánuco, its geographical position is 9° 36' 49.3" S, 74° 56' 8.2" W. There are many different habitats, mostly dense rainforests, low hills, little creeks, swamps with palm trees and a small percentage of pastures. The river Llullapichis (= Yuyapichis) which originates from the Sira mountains passes through the area of Panguana. This river is usually only about one or two meters deep and some 40 m wide but it can become a rapid stream of six to seven meters depth within a few hours only. The mean air temperature in Panguana is about 24.5 °C, but in the dry season (October to April) temperatures of about 40 °C are quite common at noon. The annual precipitations are up to 3.000 mm with 180 days of rain per year. The humidity of the air is about 90 % within the forest (DILLER & BURMEISTER 2007, DILLER 2015). Panguana is protected by law, and therefore called ACP Panguana in Peru (ACP = Área de Conservación Privada, private nature reserve).

The treehoppers of South America are certainly some of the most remarkable and exotic insects that exhibit a tremendous variety of bizarre body forms with enigmatic function, but nevertheless the taxonomy and distribution of many species is not well known. Several genera are quite speciose and taxonomically not yet sufficiently investigated.

In Latin America there are about 1.250 species in nearly 200 genera. In Colombia in a recent publication 474 species could be recorded (FLÓREZ-V. et al. 2015). According to CEBALLOS 162 species were reported from Peru in 1967 and in 1980 he compiled 225 species (CEBALLOS, 1967, 1980). It is evident that quite more species await discovery; also in a recent investigation on the sharpshooters (Cicadellinae) of Panguana several species could be reported as new for Peru (SCHÖNITZER & FEUERABENDT 2014).

In this communication we present data on the treehoppers from Panguana, altogether we could prove 75 species to be found in the vicinity of this research station, although quite some additional specimens could not yet be determined to species level. A remarkably high number, 39 of these species was previously not reported for the country of Peru. Furthermore we give hints on the determination of the species found and give illustrations of a couple of them. An additional particular concern of this publication is the presentation of 3D-SEM pictures in addition to color illustrations (i.e. extended focus micrographs) to show the remarkable and interesting forms of the treehoppers. A preliminary report on this investigation was presented as poster (SCHULZE et al. 2014).

## Material and Methods

### Collection times and collectors

To avoid unnecessary repetitions the main collectors and their times in Panguana are listed below. The collecting (1) and export (2) permits of INRENA (Instituto Nacional de Recursos Naturales), DGFFS (Dirección General Forestal y de Fauna Silvestre) and SERFOR (Servicio Nacional Forestal y de Fauna Silvestre) are as follows:

**2003:** Apr. 06 - Apr. 17/2003: T. KOTHE, E.-G., H. and J. BURMEISTER, C. J. ZWAKHALS; (1) N° 0/6-2003-INRENA-IFFS-DCB; (2) N° 0002376-AG-INRENA.

**2004:** Sept. 21 - Oct. 04/2004: M. BREITSAMETER, T. KOTHE, K. SCHÖNITZER; (1) N° 063-2004-INRENA-IFFS-DCB; (2) N° 004329-AG-INRENA.

**2005:** Sept. 19 - Oct. 02/2005: M. BREITSAMETER, E.-G. BURMEISTER, E. DILLER, O. GRULER, T. KOTHE; (1) N° 073-2005-INRENA-IFFS-DCB; (2) N° 006298-AG-INRENA.

**2007:** Sept. 20 - Oct. 07/2007: E. DILLER; (1) N° 097-2007-INRENA-IFFS-DCB; (2) N° 010670-AG-INRENA.

**2008:** Nov. 23 - Dec. 11/2008: E. DILLER, F. GLAW, K. SCHÖNITZER, F. WACHTEL; (1) N° 124-2008-INRENA-IFFS-DCB; (2) N° 011855-AG-INRENA.

**2009:** Oct. 02 - Oct. 18/2009: E.-G. BURMEISTER; (1) N° 334-2009-AG-DGFFS-DGEFFS; (2) N° 001075-AG-DGFFS.

**2010:** Oct. 2010: E. DILLER; (1) N° 0427-2010-AG-DGFFS-DGEFFS (2) N° 003889-AG-DGFFS.

**2012:** Sep. 21 – Oct 8/2012: K. SCHÖNITZER (1) N° 0318-2012-AG-DGFFS-DGEFFS (2) N° 009708-AG-DGFFS.

**2013:** Sept. 20 - Oct. 06/2013: E. DILLER, E.-G. BURMEISTER; (1) N° 0276-2013-AG-DGFFS-DGEFFS; (2) N° 000521-MINAGRI-DGFFS.

**2014:** Sept 26 - Oct. 12/2014: E. DILLER, K. SCHÖNITZER; (1) N° 007-2014-SERFOR-DGGSPFS; (2) N° 0000326-SERFOR.

**2015:** May 01 - May 20/2015: E. DILLER; (1) N° 007-2014-SERFOR-DGGSPFS; (2) N° 0001757-SERFOR.

**2016:** April 17 - May 15/2016: E. DILLER, F. WACHTEL, S. FRIEDRICH; N° 007-2014-SERFOR-DGGSPFS (5 year permit); (2) N° 003052-SERFOR.

Most of the material was collected in Panguana by members of the Bavarian State Collection (ZSM) and accompanying zoologists. This material is deposited in ZSM, partly in Lima (MHNL). Additionally, material from the Center of Natural History, Hamburg, formerly Zoologisches Museum Hamburg (CeNak) could be used for comparison and for additional faunistic information.

If not stated otherwise, the general distribution remarks are according to MCKAMEY 1998. Furthermore, we list several species from other South American countries of the collection of ZSM and CeNak which are new records for their country respectively and some species new for Peru, although they were not found in Panguana.

### Abbreviations

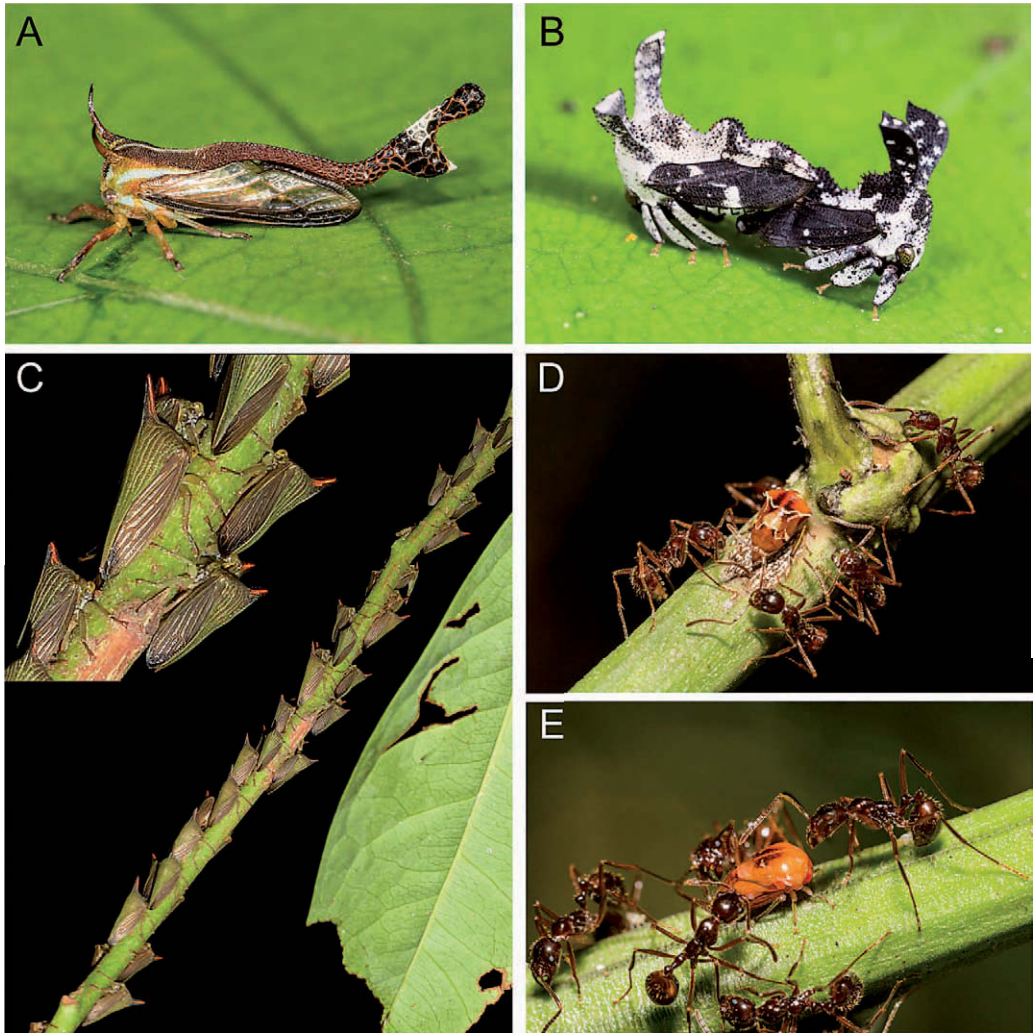
CeNak Centrum für Naturkunde (Center of Natural History, Hamburg, formerly ZMH, Zoologisches Museum Hamburg)  
 MHNL Museo de Historia Natural of the University San Marcos in Lima (Universidad Nacional Mayor de San Marcos)  
 NHM Naturhistorisches Museum Wien  
 SMNK Staatliches Museum für Naturkunde Karlsruhe (State Museum of Natural History Karlsruhe)  
 ZSM Zoologische Staatssammlung München (Bavarian State Collection of Zoology)

\* All species labeled with an asterisk are **new records for Peru**

### Determination

Although some treehoppers are unique and conspicuous in their appearance, quite many species are not easy to be determined. Thus also in our material quite some material is not yet determined and awaits scientific exploration. For a first information the book of GODOY et al. (2006) with focus on Costa Rica and the work of FLÓREZ-V. et al. (2015) on the Membracidae of Colombia are very useful. These two publications, however, are predominantly focused on the generic level. Very helpful, especially for the beginner, is the treehopper website by DEITZ & WALLACE (see weblink) with many pictures, literature and complete systematic outline. In many cases taxonomic revisions have been used, these are cited below as information for further investigations. Sometimes also the old illustrated literature may be helpful such as FOWLER (1894 - 1909), BUCKTON (1903) and FUNKHOUSER (1950). These can well be used together with the more recent catalogues of METCALF & WADE (1965) and MCKAMEY (1998) for nomenclature.

If not stated otherwise the material deposited in ZSM or MHNL was determined by K. SCHÖNITZER (ZSM).



**Fig. 1:** Live photos. **A)** *Heteronotus delineatus* (length 13.5 mm, height 4 mm), **B)** *Notocera spinidorsa* (length 5 mm, height 4 mm), in copula, **C)** *Potnia gladiator* (length 13 mm, height 6 mm), **D+E)** *Horiola picta* (length 5.5 mm, height 2 mm).

**Color photographs:** Most color images were taken with an Olympus Camedia C5060 digital camera on an Olympus SZX7 stereomicroscope. The needed animals were mounted in modeling clay for convenient orientation in front of colored paper; the zoom was adjusted to get full format images (between 1 x and 5.6 x). Every specimen was photographed in bright daylight 10 to 25 times, moving the focus plane from front to background planes in small steps. Subsequently the image stacks were subjected to extended focus image montage (EFI) using the freeware Combine Z. For some of the specimens the background was removed (i.e. cropped with photoshop) and the animal was mounted in front of a neutral background.

*Hemikyphta punctata* (Fig. 4A) and *Cladonata apicalis* (Fig. 5E) were photographed in daylight with a Canon EOS 650D (5.6/85 mm objective, M. SCHULZE) in 26 and 17 focal planes respectively, and subjected to EFI calculation as described above. *Heteronotus delineatus* (Fig. 3C), *H. albospinosus* (Fig. 3A), *Cladonota championi* (Fig. 5F), *Hypsoprora albopicta* (Fig. 5B), and *Hypsoprora albopleura* (Fig. 5C) were photographed with a Sony Nex 5 N mounted on an Olympus SZX12 (K. SCHÖNITZER). *Heteronotus delineatus* (*in vivo*, Fig. 1A), *Notocera spinidorsa* (*in vivo*, Fig. 1B), and *Horiola picta* (*in vivo*, Figs. 1D, E) with a Canon EOS 5D III (2.8/65 mm macro-objective, K. WOTHE), and *Potnia gladiator* (*in vivo*, Fig. 1C) with a Lumix digital camera and automatic flash light (S. FRIEDRICH).

**3D-SEM:** The specimens shown in figures 9 and 10-12 were mounted on aluminium SEM stubs with conductive adhesive carbon tabs or plastic conductive carbon cement (Leit-C-Plast), gold-sputtered (120 seconds at 20 mA/2400 V in a  $13 \times 10^{-5}$  bar argon atmosphere) and imaged on a Zeiss LEO 1430VP SEM at 15 kV in convenient perspective. For 3D anaglyphs every specimen was photographed two times, first in preferred orientation (grayscale lookup table saved in RGB format) and then tilted  $2.5^\circ$  around the z-axis counterclockwise. The latter image was copied in the red channel of the former image and centered if necessary by minimal translation and rotation (view Figure 9 with red-green-glasses, left eye: red filter).

## AETALONIDAE

### *Tropidaspis carinata* (FABRICIUS, 1803)

Panguana 42 specimens, 19.2.1974 leg. H. KURZ, CeNak.

Known from Brazil, Colombia, Rep. Guyana, Peru, and according to LINNAVUORI & DELONG (1978) also in Chile. Figure in FUNKHOUSER 1950 (Pl. IX, Fig. 124), head morphology in EVANS (1974).

## MEMBRACIDAE

### Darninae

#### \* *Atypa gibbosa* (WALKER, 1858)

Panguana one specimen, 2016 E. DILLER, ZSM.

So far reported from Brazil only, images at the treehopper website (DEITZ & WALLACE 2010).

#### *Cymbomorpha vaginata* (GERMAR, 1835)

Panguana 4 specimens, 2005, 2012, 2014, ZSM.

This species is widespread in South America (Argentina, Brasil, Columbia, Costa Rica, Rep. Guyana, Peru), it is depicted in GODOY et al. (2006).

#### \* *Cymbomorpha prasina* (GERMAR, 1835)

Panguana 12 specimens, 2004, 2005, 2008, 2013, 2014, ZSM, MHNL.

Although this species is known from several countries (Brazil, Ecuador, Guatemala, Rep. of Guyana, Mexico, Panama) it was not yet reported for Peru. This species is depicted in GODOY et al. (2006) and there is a key in GODING (1929). The drawing by FOWLER (1894 - 1909, pl. 6, Fig. 11, 11a, b) does not fit to the material from Panguana, in this drawing the median carina is white and with a groove, i.e. not simple and dark as in our material; the specimens from Panguana have a more or less obvious greenish glimmer (cf. GODOY et al. 2006). It seems possible that there are actually more species bearing this name, and a taxonomic investigation is needed or that there might be a misidentification in the material used by FOWLER.

#### *Darnis latior* FOWLER, 1894

Panguana 5 specimens, 2014, ZSM; 21.2.1974 leg. H. KURZ det. STRÜMPPEL, CeNak; **Figure 2A**.

Up to now known from Colombia, Ecuador, Rep. Guyana, Panama, Peru, and Venezuela. This species is figured by FOWLER (1894-1909), BUCKTON (1903) and at the treehopper website (DEITZ & WALLACE 2010).

There are very similar species (*D. lateralis*, *Leptosticta flavocephs*), but we follow the determination of STRÜMPPEL. Usually the yellow coloration in *D. latior* is only laterally (as in Fig. 2A), but in some specimens the yellow coloration forms a band over the posterior process in CeNak.

#### \* *Hebetica convoluta* (FABRICIUS, 1781) (syn: *Amastris convoluta*)

Panguana 10 specimens, 2003, 2007, 2008, 2009, ZSM; 15.7.1978 leg. W. FICK, CeNak; MHNL; **Figure 2B**.

Known from Argentina, Bolivia, Brazil, Colombia, and Uruguay. Another species of this genus, *H. limacodes*, is known from Peru but was not yet found in Panguana. See picture in GODOY et al. (2006).

#### \* *Hemikyptha punctata* (FABRICIUS, 1775)

Panguana 3 specimens, 2003, 2005 det. T. KOTHE, ZSM; **Figure 4A**.

Previously only reported from Brazil. Remarkable large species, see picture at the treehopper website (DEITZ & WALLACE 2010). Compared with material in Vienna (NHM).

\* *Hypheodana ursus* (FAIRMAIRE, 1846)

Panguana 1 specimen, 2005, ZSM; **Figure 4B**.

Up to now only known from Colombia and Brazil (SAKAKIBARA 2005), see there for description, key and figures.

*Stictopelta acutula* (FAIRMAIRE, 1846)

Panguana 5 specimens, 2005, 2008, 2009, 2010, ZSM; **Figure 2C**.

Known from Brazil, Colombia, Guatemala, Rep. Guyana, Mexico, Panama, Uruguay and Peru. Drawings in BUCKTON (1903) and FUNKHOUSER (1950). In CeNak also material from **Costa Rica**, new record for this country.

*Stictopelta fraterna* BUTLER, 1878

Panguana 3 specimen, 2005, 2007, 2008, ZSM; **Figure 2D**.

Known from Argentina, Bolivia, Colombia, Rep. Guyana, Mexico, and Peru. In CeNak also material from **Brazil**, new record for this country. Compared with material determined by FUNKHOUSER. Further specimens of this genus could not be determined.

## Heteronotinae

\* *Heteronotus albospinosus* HAVILAND, 1925

Panguana 1 specimen, 2005, ZSM; **Figure 3A**.

Previously only known from Rep. Guyana and Brazil (EVANGELISTA 2014), for pictures see also there.

*Heteronotus apricarius* STRÜMPEL, 1988

Panguana 1 specimen, 2014 leg. T. KOTHE, ZSM; **Figure 3B**.

Described from the vicinity of Pucallpa, Peru (STRÜMPEL 1988) and up to now reported from there only. One specimen in ZSM from **Venezuela**: Amazonas o-Puerto Ayacucho/Gavilan Rio Cataniapo ca. 110 m, 5°33,15 N, 67° 21,89 W; leg. F. WACHTEL, 29.-31.1.2009, new record for Venezuela.

\* *Heteronotus delineatus* WALKER, 1858

Panguana 15 specimens, 2004 leg. T. KOTHE, 2005, 2008, 2009, 2014 leg. R. MÖRTER, ZSM, MHNL; 1984 leg. J. KOEPKE, CeNak; **Figures 1A, 3C**.

Previously known from Brazil, Colombia, and Ecuador. This species was caught in several years, but mostly only in single specimens only. For pictures see EVANGELISTA (2014) and websites (DEITZ & WALLACE 2010, LANDMANN 2010).

*Heteronotus nodosus* (GERMAR, 1821)

Panguana 1 specimen, 2008 leg. K. SCHÖNITZER, ZSM; **Figure 3D**.

Known from Brazil, Costa-Rica, and Peru. Compared with old material from Brazil (ZSM). Description and figure in GERMAR (1821: 30f, Tab. 1, *Membracis nodosa*). A video showing the inner morphology of *Heteronotus nodosus* made with a  $\mu$ CT by Bernhard RUTHENSTEINER (ZSM) is to be found on the webpage of Panguana ([http://www.panguana.com/forschung\\_schwerpunkte.html#10](http://www.panguana.com/forschung_schwerpunkte.html#10)).

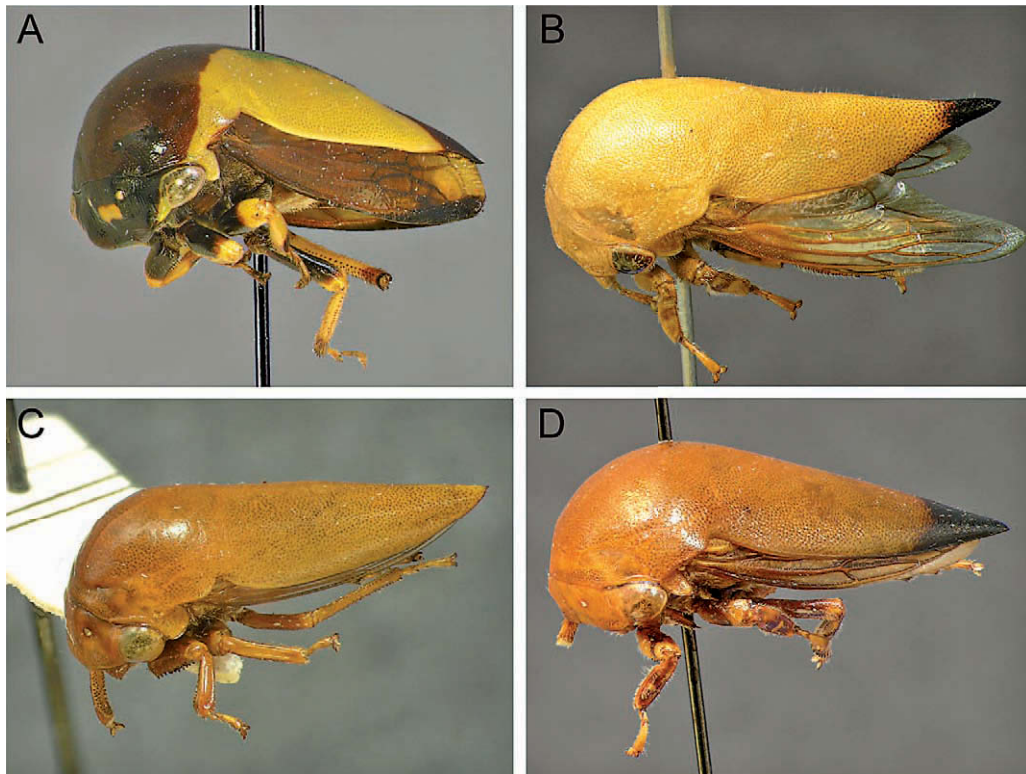
Furthermore one specimen in ZSM from **Ecuador** (Prov. Napo Limonococha I. leg. 6.VII. 1983, K. RIEDE) and one from **Bolivia** (Beni-region Guayamerin, 150 m, 16.5.1954, leg W. FORSTER). New records for Ecuador and Bolivia.

## Membracinae

*Aconophora cultellata* WALKER, 1858

Panguana 29 specimens, 2003, 2004, ZSM, MHNL; 29.6.-12.7.1987 leg. and det. STRÜMPEL, 15.7.1978 leg. W. FICK, CeNak; **Figure 5A**.

Up to now reported for Bolivia, Brazil, French Guiana, Guyana, Peru, and Mexico (MCKAMEY 1998, DIETRICH & DEITZ 1991). Also in Hamburg one specimen from Tingo Maria, Peru (Cueva de las Lechuzas), 3.10.1980 leg. and det. H. STRÜMPEL, CeNak. For description and figures refer to DIETRICH & DEITZ (1991).



**Fig. 2:** Light micrographs. **A)** *Darnis latior* (length 8 mm, height 4 mm), **B)** *Hebetica convoluta* (length 14 mm, height 5 mm), **C)** *Stictopelta acutula* (length 9 mm, height 3 mm), **D)** *Stictopelta fraternata* (length 11 mm, height 4 mm).

\* ***Bolbonota aspidistrae* HAVILAND, 1925**

Panguana 2 specimens, 29.6.-12.7.1987 leg. and det. H. & R. STRÜMPEL, CeNak.

This species was described with specimens from Rep. Guyana but up to now was not yet reported from other countries. Additional material from Colombia and Ecuador is in Hamburg. **Colombia:** Rio Grande 500-700 m, 4 specimens 9.-17.12.1941 det. H. & R. STRÜMPEL; Rio Guayariba, Ocos 1.200 m, 1 specimen 10.1946; Col. Guamal 500-700 m, 7 specimens 29.6.1942; Rio Güejar (Macarena), 1 specimen 1951. **Ecuador:** Rio Napo, Aliñahul, 450 m, 1 specimen 23.10.92 det. H. & R. STRÜMPEL; 7.11.92, 2 specimens; all CeNak. New for Colombia and Ecuador.

\* ***Bolbonota inaequalis* FABRICIUS, 1803**

Panguana 2 specimens, 25.2.1974 leg. H. KURZ, det. STRÜMPEL, CeNak.

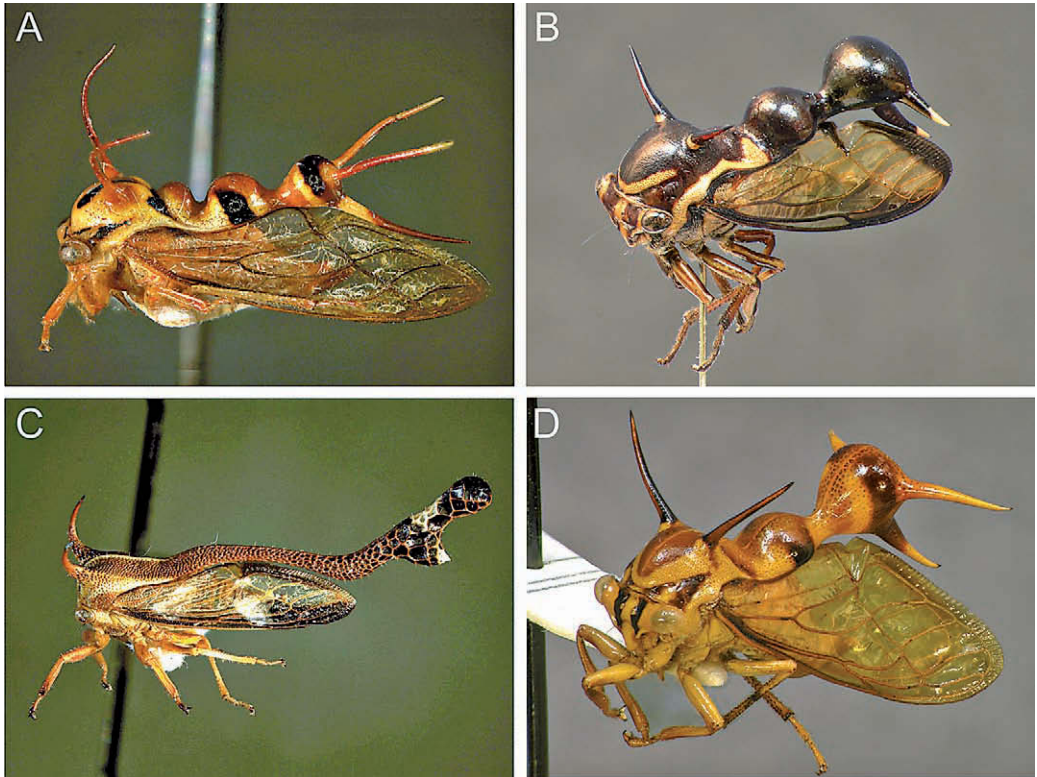
Wide spread species, reported for Argentina, Brazil, Costa Rica, Ecuador, Rep. Guyana, Panama, and Suriname, but previously not known for Peru. Also collected in Pucallpa, Peru (Yarinacocha) 3 specimens 17.9.1980, CeNak.

\* ***Bolbonota corrugata* FOWLER, 1894**

Panguana 29 specimens, most specimens 2003 leg. and det. T. KOTHE, 2004 (hand net), 2014, one specimen leg. E. DILLER in Malaise trap, ZSM, MHNL; **Figure 4C.**

Reported from several countries (Colombia, Ecuador, Rep. Guyana, Honduras, Panama), but previously not known for Peru. In Hamburg is further material from Peru: Tingo Maria, 2 specimens 30.9./1.10.1980 leg. and det. H. STRÜMPEL; Material from **Venezuela:** Rancho Grande, Maracay 1 specimen 29.3.1983 det. R. STRÜMPEL, CeNak. New records for Peru and Venezuela.





**Fig. 3:** Light micrographs. **A)** *Heteronotus albospinosus* (length 10 mm, height 6.5 mm), **B)** *Heteronotus apricarius* (length 10 mm, height 6 mm), **C)** *Heteronotus delineatus* (length 13.5 mm, height 4 mm), **D)** *Heteronotus nodosus* (length 11 mm, height 5 mm).

\* ***Bolbonota pictipennis* FAIRMAIRE, 1846**

Panguana 19 specimen, 2004, leg. K. SCHÖNITZER & T. KOTHE (partly Malaise trap), 2013, ZSM; 1972, 1973, 1974, 1987 leg. and det. H. STRÜMPEL, CeNak.

Wide spread species, reported from many countries (Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, French Guiana, Guatemala, Rep. Guyana, Mexico, Panama, Suriname, Venezuela), but surprisingly not yet from Peru. Furthermore 5 specimens from Tingo Maria (Peru) in CeNak. Figured e.g. in FUNKHOUSER (1950) and DEITZ & WALLACE (webpage).

\* ***Calloconophora caliginosa* (WALKER, 1858)**

Panguana 8 specimens, 29.6.-12.7.1987 leg. and det. H. STRÜMPEL, CeNak.

Up to now reported from Belize, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, Guyana, and Panama (DIETRICH & DEITZ 1991, MCKAMEY 1998). Described and figured in DIETRICH & DEITZ (1991, also color picture on cover) and in BUCKTON 1903 (as *Aconophora caliginosa* WALKER).

\* ***Cladonota (Falculifera) apicalis* (STÄHL, 1869)** (syn. *Sphongophorus amyoti* METCALF & WADE, 1965)

Panguana 8 specimens, 2013 leg. F. WACHTEL, 2016 leg. E. DILLER, ZSM; 29.6.-12.7.1987 leg. and det. H. STRÜMPEL, CeNak; **Figure 5E**.

Up to now reported for Colombia, Guatemala, Mexico, Panama, and Bolivia (STRÜMPEL 1973, as *Sphongophorus amyoti*; MCKAMEY 1998). For subgeneric arrangement of *Cladonota* see FLYNN (2003), for descriptions, drawings and key to the species from Colombia see STRÜMPEL (1973, 1991), pictures also in GODOY et al. (2006) and at the treehopper website (DEITZ & WALLACE 2010).

\* *Cladonota (Lecythifera) championi* (FOWLER, 1894)

Panguana 1 specimen, 2013 leg. F. WACHTEL, ZSM; **Figure 5F**.

Up to now reported for Guatemala and Mexico. One specimen from **Ecuador**: Puerto Orellana, Tiputini Biodiversity Station, 0° 38.2' S. 76° 08.9' W, Aug. 1999 leg. M. KOTRBA. New records for Peru and Ecuador. Picture at the treehopper website (DEITZ & WALLACE 2010).

*Cladonota (Lobocladisaca) livida* (BUCKTON, 1903) (syn. *Sphongophorus lividus*)

Panguana 2 specimens, 2005 det. T. KOTHE, 2013 leg. E. DILLER, Malaise trap, ZSM; **Figure 5D**.

Known from Brazil and Peru. Description and figure in BUCKTON (1903) and STRÜMPEL (1973), for taxonomy see FLYNN (2003).

*Enchenopa albidorsa* (FAIRMAIRE, 1806)

Panguana 13 specimens; 17.8.1985 leg. SCHWENKE, 21./22.2.1974 leg. KURZ, 29.6.-12.7.1987 leg. STRÜMPEL, all det. STRÜMPEL, CeNak.

Known from Argentina, Bolivia, Brazil, Ecuador, Guyana, Colombia, Peru, Suriname, and Venezuela (STRÜMPEL & STRÜMPEL 2014), check there also for key, description and figure. Further material from Peru: Pucallpa, Yarinacocha, 4 specimens 15.2.-10.3.1983 leg. STRÜMPEL, Tingo Maria 1 specimen 1.10.1980, 1 specimen 3.10.1980 leg. STRÜMPEL, Pakitza 1 specimen 24.6.1988 leg. P. LOZADA, all det. STRÜMPEL, CeNak.

*Enchenopa gladius* (FABRICIUS, 1803)

Panguana 2 specimens, 2013 leg. S. FRIEDRICH, E. DILLER, ZSM.

Known from Costa Rica, Brazil, French Guiana, Panama, Suriname, and Venezuela (MCKAMEY 1998), as well as Ecuador and Peru (STRÜMPEL & STRÜMPEL 2014); check there for description and drawings.

*Enchenopa squamigera* (LINNAEUS, 1758)

Panguana 1 specimen, 23.2.1974 leg. KURZ, det. STRÜMPEL, CeNak.

Known from Panama, Venezuela, French Guiana, Rep. Guyana, Suriname, Trinidad, Brazil, Colombia, Ecuador, Peru, Bolivia, and Paraguay (STRÜMPEL & STRÜMPEL 2014); check there also for taxonomy, key, description, and figure.

*Enchenopa concolor* (LINNAEUS, 1758)

Panguana 3 specimens, 29.6.-12.7.1987 leg. and det. H. & R. STRÜMPEL, CeNak.

Known from Brazil, Bolivia, Ecuador, French Guiana, Rep. Guyana, Colombia, Peru, Suriname, and Venezuela (STRÜMPEL & STRÜMPEL 2014); check there also for taxonomy, key, description and figure.

*Guayaquilia xiphias* (FABRICIUS, 1803)

Panguana 2 specimens, 2009, ZSM.

Known from Brazil, French Guiana, Guyana, Suriname, Paraguay, Colombia, Mexico, Guatemala, and Peru (DIETRICH & DEITZ 1991, MCKAMEY 1998). Description and figures in DIETRICH & DEITZ (1991), picture to be found at treehopper webpage (DEITZ & WALLACE 2010).

*Hypsoprora albopicta* FUNKHOUSER, 1922

Panguana 5 specimens, 2004, 2008, 2015 (all collected in Malaise trap), ZSM; **Figure 5B**.

This species was described from Brazil and Peru (Iquitos) and until now it was the only species of this genus known for Peru. In contrast to most species of this genus, *H. albopicta* has no dorsal protuberance, but the surface is typically coarsely punctured and the tibiae are flattened. Furthermore the species is rather large (overall length 7 mm), as compared to the other species of the genus. The illustration in FUNKHOUSER (1922) is somehow misleading because of the black and white pattern, but the description fits well with the specimens from Panguana.

\* *Hypsoprora albopleura* DA FONSECA, 1933

Panguana 3 specimens, 2004, 2012 leg. T. KOTHE, K. SCHÖNITZER, ZSM; 1987 leg. and det. H. STRÜMPEL, CeNak. **Figure 5C**.

Previously reported for Brazil and Colombia. In Hamburg additionally specimens from Tingo Maria and from Pucallpa, Yarinacocha 1987 (leg. STRÜMPEL) as well as from **Ecuador**, (Rio Napo), CeNak. New records for Peru and Ecuador. See drawing in DA FONSECA (1933 a,b, wrongly cited in METCALF & WADE 1965: 1358).



***Membracis foliatifasciata* DEGEER, 1773** (syn. *M. c-album* FAIRMAIRE, 1846)

Panguana 12 specimens, 2003 leg. C. J. ZWACKHALS, 2010 E. DILLER, 2014 K. SCHÖNITZER, ZSM, SMNK, MHNL. **Figure 6A.**

Known from Argentina, Brazil, Colombia, Rep. Guyana, Mexico, Peru, Venezuela, (MCKAMEY 1998) and Suriname. For nomenclature, taxonomy and figures refer to SAKAKIBARA & EVANGELISTA (2010). Drawings 5 and 6 in STRÜMPPEL & STRÜMPPEL (1991), also show this species, mislabeled as *M. foliata*. Pictures are also to be found at the treehopper website and Wikimedia Commons. Larger series of this species were collected in and near to the city of Pucallpa, Peru.

***Membracis tectigera* OLIVIER, 1792** (syn. *M. elevata*)

Panguana 8 specimens, 2005, 2008, ZSM, MHNL.

Reported from many South American countries (Argentina, Brazil, Colombia, Venezuela, Rep. Guyana, Suriname, Ecuador, Bolivia, Mexico, Caribbean Islands) including Peru. Figured in the treehopper webpage (DEITZ & WALLACE 2010). *M. tectigera* should be considered as a species complex, composed with several populations difficult to separate each other because of small (gradual) morphological differences between them. Therefore a thorough study is needed (SAKAKIBARA pers. comm.). Also in CeNak there are many specimens of this species complex (labeled „*elevata tectigera*”).

**\* *Membracis juncta* WALKER, 1858**

Panguana 2 specimens, 2008, ZSM; **Figure 6C.**

Previously only reported from Colombia. For taxonomy see SAKAKIBARA (1992), for drawing see Fig. 11 in RICHTER (1947) as „Tercera forma de *Membracis tectigera (confusa)*”. In ZSM furthermore 14 specimens from **Bolivia**: Trop. Prov. Chapare, 400 m, 15.X.1949, leg ZISCHKA; new for Bolivia.

One further specimen of *Membracis* from Panguana is probably belonging to a yet undescribed species (SAKAKIBARA pers. comm.).

**\* *Notocera spinidorsa* GODING, 1929**

Panguana 25 specimens, 2003 leg. T. KOTHE, 2012, 2014 SCHÖNITZER, May 2013 E. DILLER (Malaise trap), Sept. 2015 E. DILLER (Malaise trap), ZSM, MHNL; **Figures 1B, 4E/F, 9A, 10A.**

Up to now reported for Costa Rica, Ecuador (MCKAMEY 1998), and Colombia (STRÜMPPEL 1972), for drawing and description refer to STRÜMPPEL (1972). One specimen of our material is mostly brownish, only partly black, and lacking most of the white wax coating (Fig. 4F).

Two more specimens of this genus could not be determined to species level.

***Phyllotropis cingulata* (GERMAR, 1835)**

Panguana 7 specimens, 2003, 2004, 2008 leg. T. KOTHE, K. SCHÖNITZER, ZSM, SMNK, MHNL; 10.7.1972 leg. KAISER, det. STRÜMPPEL, 17.5.1978 leg. W. FICK, det. STRÜMPPEL, CeNak; **Figure 6D.**

Known from Bolivia, Brazil, Colombia, Ecuador, French Guiana, Suriname, and Peru. Compared with material from CeNak. There is also material from Pucallpa, Yarinacocha (1983, leg. and det. STRÜMPPEL, *Membracis cingulata*).

**\* *Potnia gladiator* (WALKER, 1851)**

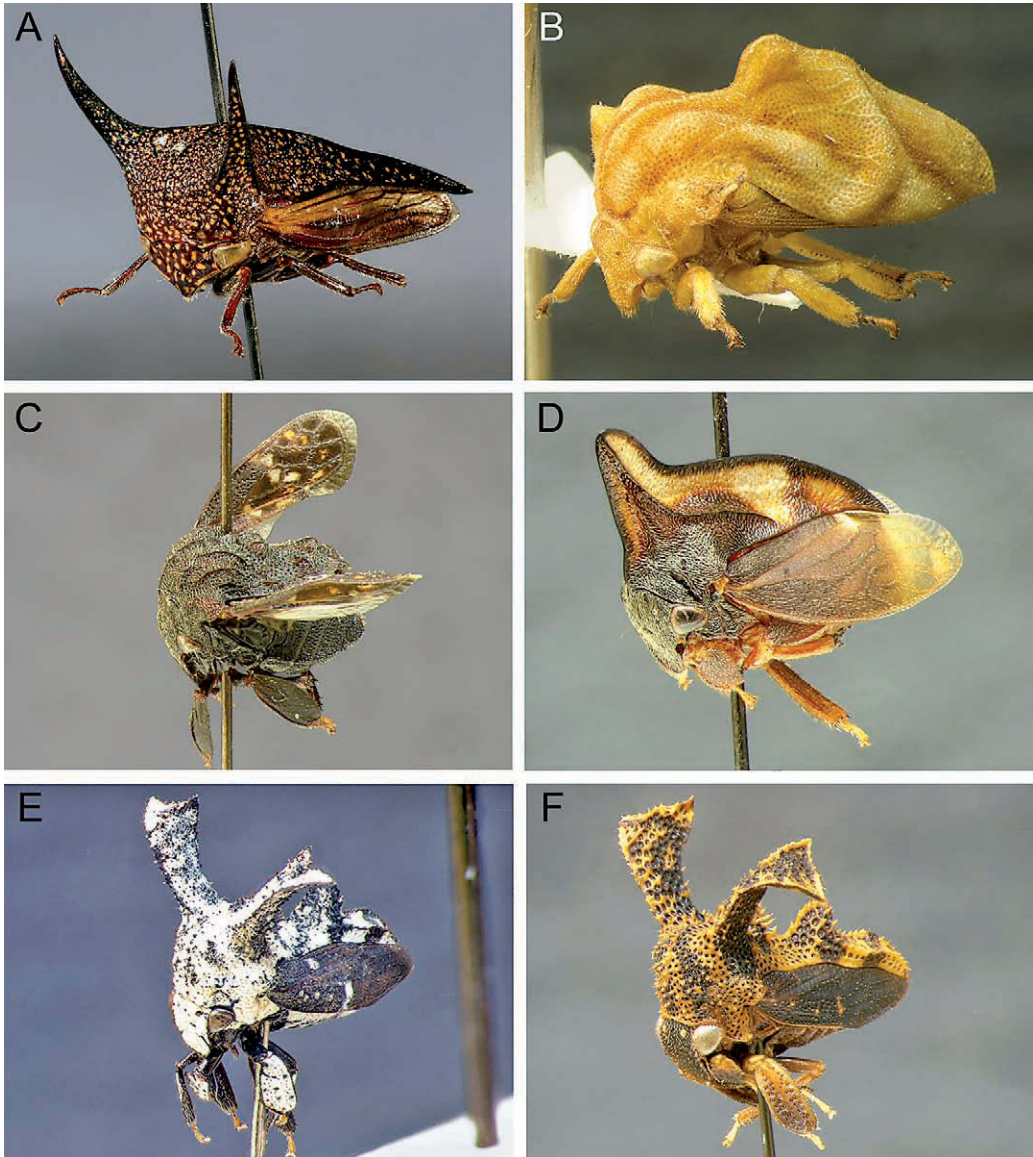
Panguana 10 specimens, 2015 leg. F. WACHTEL, ZSM; **Figure 1C.**

Up to now reported from Brazil, Rep. Guyana, and Panama. For key and description see CREÃO-DUARTE & SAKAKIBARA (1996). It is known that species of this genus often show subsocial behavior (GODOY et al., 2006). The only report of this species in Panguana was a group of animals on a twig (Fig. 1C), only few of them have been collected as voucher; see also picture on the treehopper webpage (DEITZ & WALLACE 2010).

**\* *Tritopidia bifenestrata* (FUNKHOUSER, 1922)**

Panguana 23 specimens, 2003 leg. T. KOTHE, 2014 K. SCHÖNITZER, det. T. KOTHE, ZSM, MHNL; 29.6.-12.7.1987 leg. and det. STRÜMPPEL, CeNak; **Figure 4D.**

Previously reported from Brazil, Colombia, and Rep. Guyana. For key see GODING (1928), for picture see LANDMANN (2010, website).



**Fig. 4:** Light micrographs. **A)** *Hemikyphya punctata* (length 18 mm, height 10 mm), **B)** *Hypheodana ursus* (body length 7.5 mm, body height 3.5 mm), **C)** *Bolbonota corrugata* (body length 3 mm, body height 2 mm), **D)** *Tritropidia bifenestrata* (body length 5 mm, body height 3 mm), **E+F)** *Notocera spinidorsa* (length 5 mm, height 4 mm).

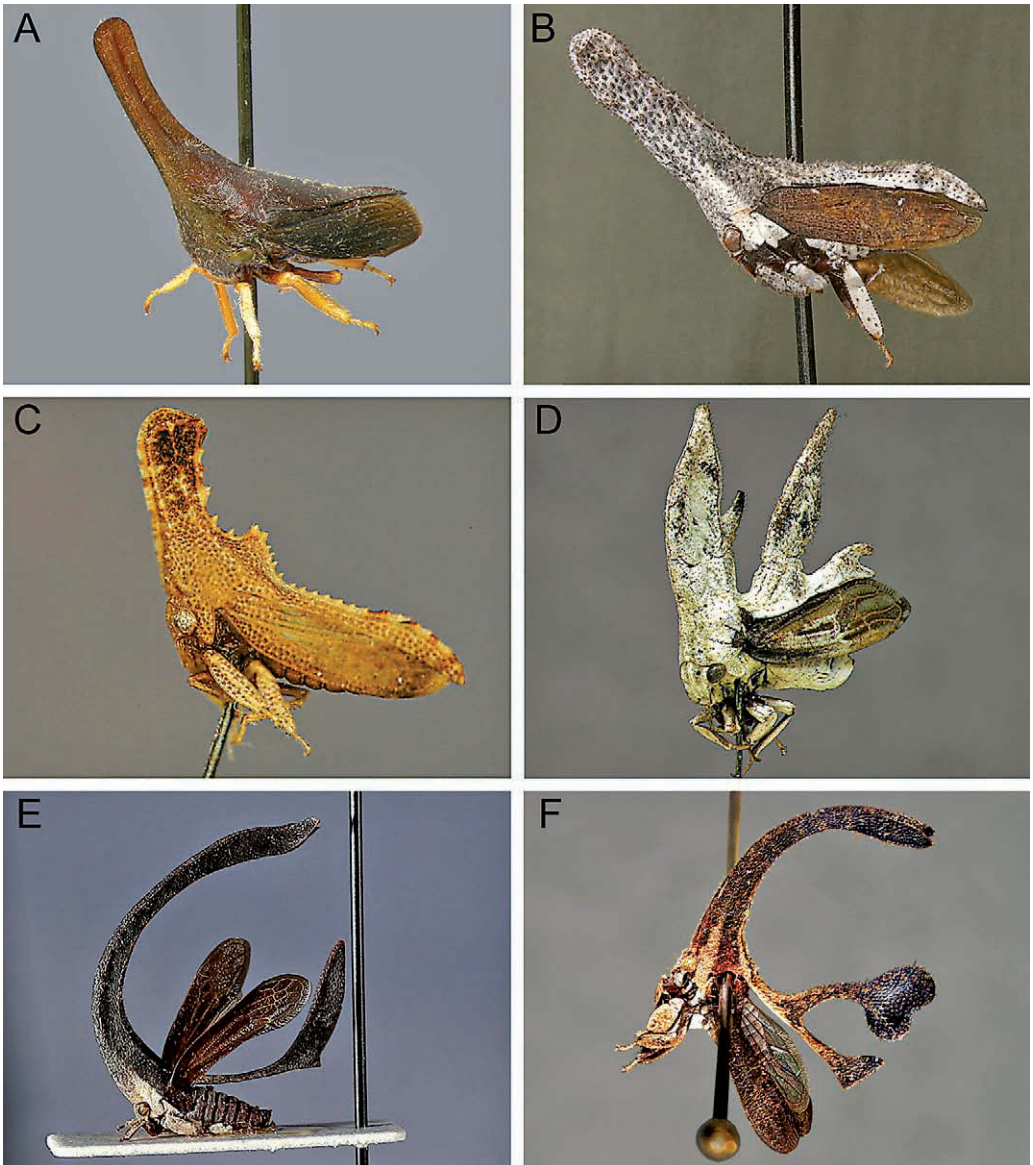
### Nicomiinae

#### \* *Tolania dira* ALBERTSON, 2006

Panguana 4 specimens, 2013 light trap, 2015 Malaise trap, ZSM.

Up to now only known from the original description by ALBERTSON from Rep. Guyana and French Guiana, see there also for pictures (ALBERTSON & DIETRICH 2006).

Two closely related species, *T. inca* ALBERTSON, 2006 and *T. calista* ALBERTSON, 2006 are known from Peru (ALBERTSON & DIETRICH 2006) but were not found in Panguana yet. One specimen of this genus could



**Fig. 5:** Light micrographs. **A)** *Aconophora cultellata* (length 10 mm, height 9 mm), **B)** *Hypsoprora albopicta* (length 4.5 mm, height 5.8 mm), **C)** *Hypsoprora albopleura* (length 4.5 mm, height 3 mm), **D)** *Cladonota livida* (length 8 mm, height 9 mm), **E)** *Cladonota apicalis* (length 10 mm, height 12 mm), **F)** *Cladonota championi* (length 9 mm, height 13 mm).

not be determined; it looks like two specimens in Vienna (NHM) from Venezuela, labeled *Scaptomoraea tuberosa*, an invalid name of unclear meaning.

***Tolania obtusa* FOWLER, 1896 (syn. *T. fraterna* Stål)**

Panguana 5 specimen, 15.7.1978 leg. W. FICK, det. ALBERTSON, CeNak.

Known from Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Panama, Peru, and Suriname (ALBERTSON & DIETRICH 2006), see there also for description and figures.

## Smiliinae

### *Amastris elevata* FUNKHOUSER, 1922

Panguana 6 specimens, 2003 leg. T. KOTHE, 2008, ZSM.

Known from Brazil, Rep. Guyana, and Peru. Description, key and figures in BROMFIELD (1976).

### \* *Anobilia guianae* (HAVILAND, 1925) (syn. *A. guinea*)

Panguana 4 specimens, 17.3.-21.3.1973 leg. KURZ, CeNak.

Previously only known from Republic of Guyana and Colombia (TODE 1966). According to MCKAMEY (1988) *A. guinea* as used in TODE (1966) and FLÓREZ-V. et al. (2015) is a misspelling. See TODE (1966) for description and figures, also depicted in FLÓREZ-V. et al. (2015, Fig. 49a), although there not listed for Colombia. In Hamburg is further material from Peru and Ecuador. Peru: Pucallpa, Yarinacocha 21.9.80 7 specimens, 15.2.-10.3.1983 2 specimens, leg. and det. R. & H. STRÜMPEL, **Ecuador**: Rio Negro, Aliñahul 450 m 9.11.1992, leg. and det. STRÜMPEL, CeNak. New record for these countries.

### \* *Anobilia impercepta* TODE, 1966

Panguana 8 specimens, 2003 leg. T. KOTHE, ZSM; 17.1.- 20.2.1974 leg. H. KURZ, CeNak.

Previously only known from Colombia (TODE 1966, FLÓREZ-V. et al. 2015). Description and figure in TODE (1966). Further material from Peru: Pucallpa, Yarinacocha Chicosa 10 specimens 15.2.-10.3.1983, leg. and det. R. & H. STRÜMPEL, CeNak.

### \* *Anobilia invariabilis* TODE, 1966

Not found in Panguana, but new for Peru.

Up to now only reported for Colombia (TODE 1966, FLÓREZ-V. et al. 2015). Description and figure in TODE (1966). In Hamburg also a specimen from Peru: Tingo Maria 30.9.1980, leg. and det. STRÜMPEL, CeNak.

### \* *Anobilia minima* TODE, 1966

Panguana 1 specimen, 23.2.1974 leg. H. KURZ det. H. STRÜMPEL, CeNak.

Up to now only reported for Colombia (TODE 1966 description and figure, FLÓREZ-V. et al. 2015). According to FLÓREZ-V. et al. (2015) this species might possibly belong to the genus *Stilbophora*, as other species of the former genus *Anobilia*. In Hamburg one further specimen from Peru: Pucallpa, Yarinacocha Chicosa 15.2.-10.3.1983, leg. and det. H. STRÜMPEL, CeNak.

### \* *Anobilia nigra* TODE, 1966

Not found in Panguana, but new for Peru.

Up to now only reported for Colombia (TODE 1966, FLÓREZ-V. et al. 2015). Also depicted in FLÓREZ-V. et al. (2015). In Hamburg one specimen from Peru: Pucallpa, Yarinacocha Chicosa 15.2.-10.3.1983, leg. and det. H. STRÜMPEL, CeNak.

### \* *Anobilia splendida* TODE, 1966

Panguana 14 specimens, 2003, ZSM; 11.2.-22.2.1974 leg H. KURZ, det. STRÜMPEL, CeNak.

Up to now only reported for Colombia (TODE 1966 description and figure, FLÓREZ-V. et al. 2015). In Hamburg further material from Peru: 15 specimens, Pucallpa, Yarinacocha, Chicosa 15.2.-10.3.1983, leg. and det. STRÜMPEL, CeNak.

### *Antoniae guttipes* WALKER, 1858

Panguana 36 specimens, 2008, 2012, 2014, 2015 (partly Malaise trap, E. DILLER), ZSM, MHNL; **Figures 7A, 9B, 11A.**

Known from Bolivia, Brazil, Ecuador, and Peru. *A. guttipes* is similar to *A. nodosa* FUNKHAUSER 1914 which is also known from Peru, but occurs in higher altitudes in rather dry surroundings (RICHTER 1958), for determination see GODING (1929).

### \* *Aphetea inconspicua*, FOWLER, 1895

Panguana 9 specimens, 2003, 2008, 2013, all leg. E. DILLER Malaise trap, ZSM, MHNL.

This species is known from many countries (Colombia, Ecuador, Guatemala, Mexico, Trinidad, USA), but not yet reported from Peru. For pictures see the treehopper website (DEITZ & WALLACE 2010) and FUNK-

HOUSER (1950). The key in GODING (1929: 287) is not really helpful. For characterization of the genus see SAKAKIBARA (1996).

Some further specimens of this genus could not be identified to species, a revision of this genus seems necessary.

***Ceresa amazonica* ANDRADE, 2002**

Panguana 6 specimens, 2004, 2005, 2012, 2014, ZSM; **Figure 7B.**

Known from Brazil and Peru (ANDRADE 2002, 2004), see there for taxonomy, figures and distribution. Although this species was collected in several years, mostly only one specimen was found.

***Ceresa distans* BUTLER, 1877** (syn. *C. peruensis* REMES-LENICOV, 1973, ANDRADE 2004)

Panguana 121 specimens, 2003, 2004 (partly Malaise trap), 2005, 2008, 2012, 2014, ZSM, MHNL. In Karlsruhe 8 specimens 16.-19.10.1984, leg. S. RIETSCHEL, det. H. STRÜMPEL (as *C. peruana*) SMNK; **Figure 7C.**

Known from Colombia, Suriname, Brazil, Ecuador, Bolivia, and Peru (ANDRADE 2004). In Peru known from Huánuco (Tingo Maria, Iparia), Ucayalli (Pucallpa, Atalaya), Loreto, Pasco, Madre de Dios, Cuzco, and Junin (ANDRADE 2004), see there for description, figures and key. This is one of the most common treehopper species in Panguana, which may be found regularly in the low vegetation.

***Ceresa mulsa* REMES-LENICOV, 1973**

Panguana 1 specimen, 15.10.1984 leg. S. RIETSCHEL, det. H. STRÜMPEL, SMNK.

Known from Ecuador, Peru (Huánuco: Tingo Maria, Pasco: Pichanaz, Iscozacín, San Juan de Cacazú, Junin: Perené), and Bolivia (ANDRADE 2004), according to MCKAMEY (1998) also reported from Brazil. For description, key and figures see ANDRADE (2004).

***Ceresa vitulus* (FABRICIUS, 1775)**

Panguana 4 specimens, 2004, 2005, 2009, 2014, ZSM.

Known from Colombia, Venezuela, Suriname, Brazil, Ecuador, Argentina, and Peru (ANDRADE 2004), see there for description and figures. Drawings also in KOPP & YONKE (1979). Pictures at the treehopper website (DEITZ & WALLACE 2010) and in Wiki Commons. In Peru known from Loreto, Ucayalli, Pasco, Madre de Dios, Huánuco, and Junin (ANDRADE, 2004).

In ZSM there is also a large series from **French Guiana** (150 specimens, labeled: „French Guyana, Maroni”, collector unknown). In Hamburg: **Costa Rica** one specimen 10. VII. 1902 P. SCHILD leg. and vend., San José, 3 specimens 24.5.1928, Ebene von Limos bei Las Mercedes (lowland of Limos near to Las Mercedes) 2 specimens 9.3.1922; **Bolivia**: Tipuani, one specimen A. v. LEONHARD ded. 24.X.1890; Montevideo, 1 specimen ERHARD vend., CeNak. New records for French Guiana, Costa Rica and Bolivia.

***Chelyoidea aenea* (PERTY, 1833)**

Panguana 1 specimen, 2008, ZSM.

Known from Bolivia, Brazil, Colombia, and Peru. Compared with material from Colombia (CeNak). In TODE (1966) erroneously: *Ch. nitida* BUCKTON, 1903, see there for description and illustration.

**\* *Chelyoidea intermedia* TODE, 1966**

Panguana 24 specimens, 2003 (1 specimen, T. KOTHE), 2008, ZSM, MHNL.

Up to now only known from Colombia (TODE 1966). Compared with material from Colombia, CeNak. Description and illustration see TODE (1966). Collected in two different years but in one year only one single specimen.

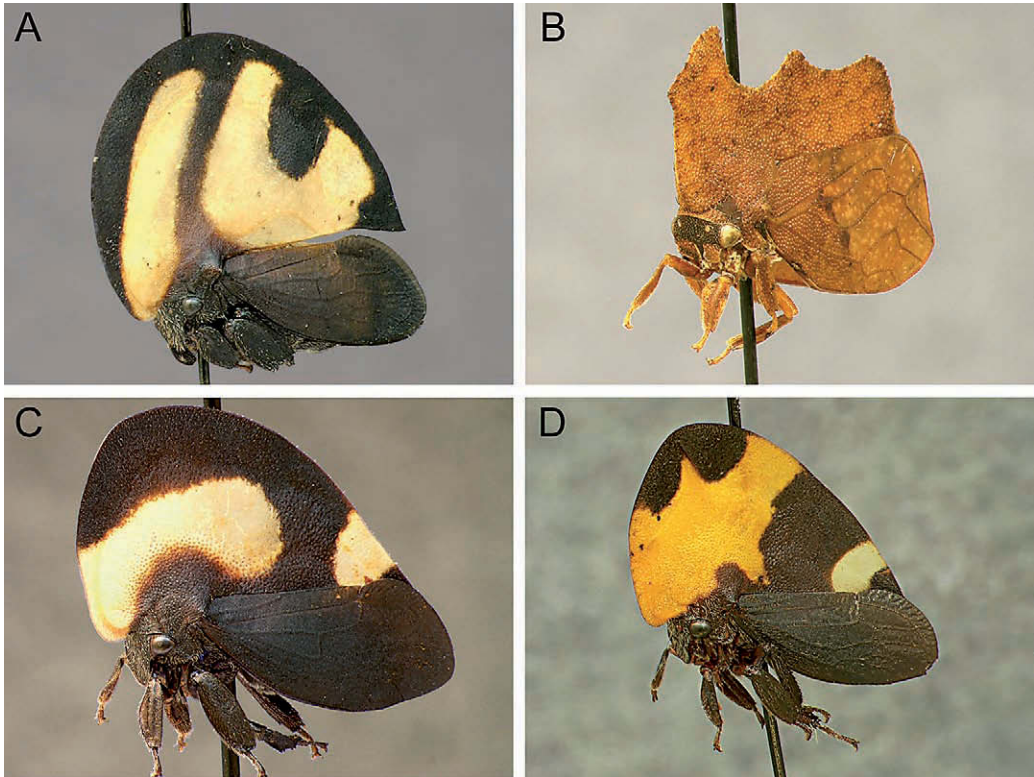
**\* *Chelyoidea lineata* TODE, 1966**

Panguana 1 specimen, 2003 (ZSM).

Up to now only known from Colombia (TODE 1966). Compared with material from Colombia, CeNak. Description and illustration see TODE (1966).

There is quite some material from Panguana determined as *Chelyoidea* spec. in ZSM and in CeNak which deserves more detailed study.





**Fig. 6:** Light micrographs. **A)** *Membracis foliatofasciata* (length 11 mm, height 9 mm), **B)** *Stegaspis fronditia* (length 8.5 mm, height 7 mm), **C)** *Membracis juncta* (length 10 mm, height 7 mm), **D)** *Phyllotropis cingulata* (length 12 mm, height 6 mm).

**\* *Cyphonia clavata* (FABRICIUS, 1787)**

Panguana 32 specimens, 2003 (leg. and det. T. KOTHE), 2004, 2005, 2013, 2014, 2015, ZSM, SMNK, MHNL; 17.3.73 leg. KURZ, det. STRÜMPEL, 12.2.74, 28.1.74, and 26.2.74 leg. and det. STRÜMPEL, CeNak; **Figures 8A, 9C, 12A.**

Frequent species in Panguana; known from many countries (Argentina, Brazil, Colombia, Costa Rica, Ecuador, Guatemala, Rep. Guyana, Honduras, Mexico, Nicaragua, Panama, Suriname, Venezuela), but surprisingly previously not yet reported for Peru. Pictures see GODOY et al. (2006) and treehopper website (DEITZ & WALLACE 2010). Also collected near Pucallpa, Yarinachocha, 6 specimens 2012, 2014, leg. SCHÖNITZER, ZSM; Yarinachocha, La Cabaña, 4 specimens 22.6.-25.6.87 leg. and det. H. & R. STRÜMPEL, CeNak and Tingo Maria, Cueva de las Lechuzas, 10 specimens 3.10.1980 leg. and det. STRÜMPEL, CeNak.

**\* *Cyphonia clavigera* (FABRICIUS, 1803)**

Panguana 1 specimen, 2012 leg. K. SCHÖNITZER, ZSM; **Figures 8B, 9D, 11B.**

Previously reported from Argentina, Brazil, Colombia, Venezuela, and Chile (SAKAKIBARA 1972). See drawings in KOPP & YONKE (1979).

**\* *Cyphonia longispina* SAKAKIBARA, 1968**

Panguana 4 specimens, 2004, leg. and det. T. KOTHE, Malaise trap, ZSM; **Figures 8C, 9E, 12B.**

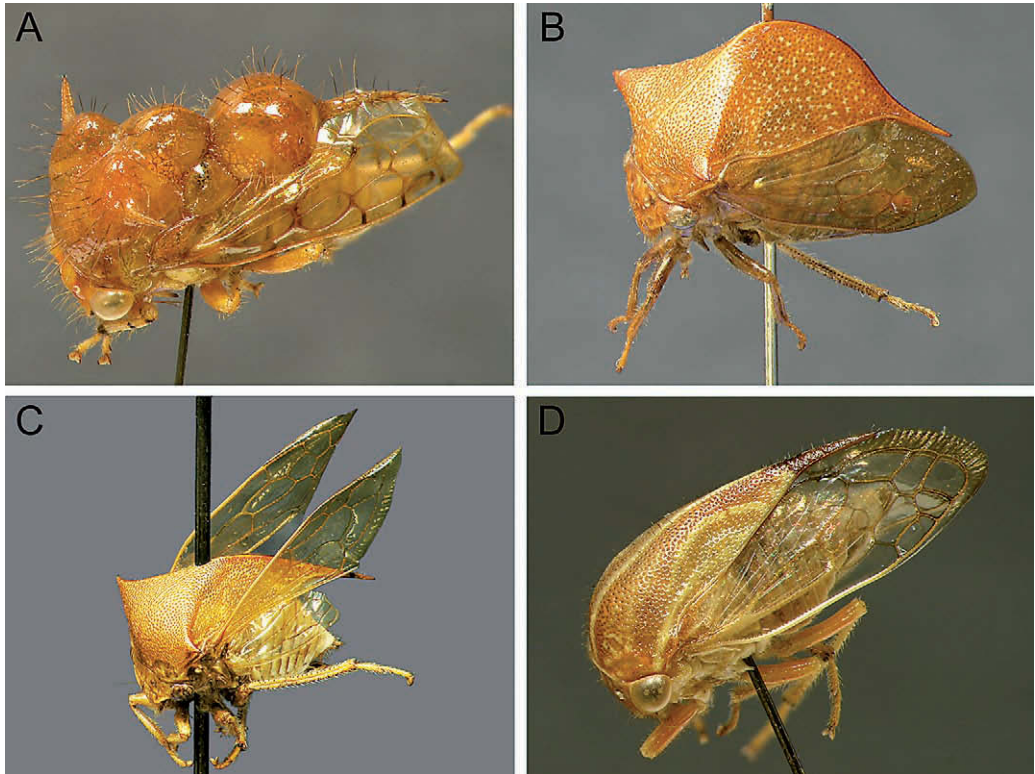
Described with material from Brazil, for description and drawings refer to SAKAKIBARA (1968).

***Cyphonia trifida* (FABRICIUS, 1794)**

Panguana 3 specimens; 2008, Sept. 2015 leg. E. DILLER, Malaise trap, ZSM, MHNL; **Figure 8D.**

Widespread all over South America (reported from Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Rep. Guyana, Mexico, Panama, Trinidad, and Peru). In Peru known from Tingo Maria (SAKAKIBARA





**Fig. 7:** Light micrographs. **A)** *Antonae guttipes* (length 6.5 mm, height 4 mm), **B)** *Ceresa amazonica* (length 9.5 mm, height 6.5 mm), **C)** *Ceresa distans* (length 9 mm, height 5 mm), **D)** *Tapinolobus fasciatus* (length 5 mm, height 2.5 mm).

1972). Description, key and drawing see SAKAKIBARA (1968), drawings also in RICHTER (1958) and KOPP & YONKE (1979). In ZSM also material from **Venezuela**: Roraima 1900 m, 2 specimens 1.-5.9.1977, Edo. Barinas, Barenitas, San Esidro 1500 m, one specimen 16.-19.1.2007 leg. F. WACHTEL. New for Venezuela.

**\* *Hemiptycha obtecta* (FABRICIUS, 1803)**

Panguana 12 specimens, 2003, leg. T. KOTHE, ZSM, MHNL.

Previously only known from Rep. Guyana and Brazil (SAKAKIBARA 1996), see there also for figure. Compared with material in Hamburg (CeNak).

There is abundant material from **Columbia**, **Ecuador**, and Peru. Colombia: Rio Guayariba, Villavicencio, 500-700 m 5 specimens 16.4.1945 leg. L. RICHTER, Rio Guayariba 20 specimens 1942-1946, Rio Guayariba, Caño Grande, 500-700 m 13 specimens 13.8.1941, one specimen 14.9.44, Rio Guayariba, El Buque, 650-800 m 5 specimens, Rio Guayariba, Manzares 1.330 m 5 specimens 19.7.1940, Rio Guayariba, Ocoa, 450 m 7 specimens 27.4.1945, Rio Ortegua, 8 specimens 10.8.-19.9.47, Rio Ortegua, Compuesta ca. 15 specimens 10.8.-19.9.1947, Leticia 10 specimens 14.4.1946 and 27.3.1946, Camacayá, Putumayo 4 specimens Dec. 1948, 2 specimens Nov. 1948, Rio Tacana (Amaconas), 180 m, 3 specimens 8.11.46.; Ecuador: Rio Negro, Aliñahui 6 specimens 22.10.1992, leg. and det. R. & H. STRÜMPEL; Peru: Tingo Maria 8 specimens 30.9.1980, leg. and det. H. STRÜMPEL, all CeNak. New for these countries.

**\* *Hemiptycha cultrata* (CONQUEBERT, 1801)**

Not found in Panguana, but new for Peru and Ecuador.

Known from Argentina, Colombia, Brazil, and Rep. Guyana. In Hamburg there is material from Ecuador and Peru. Peru: Tingo Maria, 5 specimens 30.9.1980, leg. and det. H. STRÜMPEL; **Ecuador**: Rio Napo, Aliñahui, 450 m, one specimen 25.10.1992, CeNak.

***Horiola picta* CONQUEBERT, 1801** (syn. *H. arcuata*)

Panguana 10 specimens, 2003, 2004, 2008, 2015 leg. E. DILLER Malaise tap, ZSM, SMNK; **Figures 1D/E**.

This species is known from many countries of South America, including Peru (Brazil, Ecuador, Bolivia, Colombia, Costa Rica, Ecuador, Rep. Guyana, MCKAMEY 1998). Compared with material from Vienna (NHM); pictures at the treehopper website (DEITZ WALLACE 2010), key in GODING (1929). Illustrations are also in BUCKTON (1903) and FUNKHOUSER (1950), the latter, however, are not very helpful.

**\* *Lallemandia nodosa* FUNKHOUSER, 1927**

Panguana 1 specimen, 2009, ZSM.

Reported from Brazil, Colombia, Costa Rica, French Guiana, Rep. Guyana, and Panama (FLÓREZ-V. et al. 2015), but new for Peru. This distinct species is figured and described in FUNKHOUSER (1950), FLÓREZ-V. et al. (2015) and DEITZ & WALLACE (2010). Of this species only one specimen was collected in a place which was frequently visited for investigation (Antioquia, Caucasia, hacienda La Candelaria, FLÓREZ-V. et al. 2015) and also in Panguana only one single specimen could be found during years of investigation.

***Neotynelia pubescens* (FABRICIUS, 1803)** (syn. *Tynelia pubescens*)

Panguana 1 specimen, 2009, ZSM.

Known from Brazil, Rep. Guyana, French Guiana, Suriname, Panama, Venezuela, Colombia, and Peru (MCKAMEY 1998, CREA-DUARTE & SAKAKIBARA 2000, FLÓREZ-V. et al. 2015), for taxonomy, description and figures refer to CREA-DUARTE & SAKAKIBARA (2000), for pictures also DEITZ & WALLACE (2010). This is a species with very variable color pattern (CREA-DUARTE & SAKAKIBARA 2000).

***Stilbophora luteimacula* FUNKHOUSER, 1914** (syn. *Anobilia luteimacula*)

Panguana ca. 100 specimens, 2003, ZSM; 17.-21.3.1973 leg. H. KURZ, 17.1.1974-11.2.1974 leg. H. KURZ, 29.6.-12.7.87 leg. and det. STRÜMPEL, CeNak.

Reported from Colombia, Ecuador, and Peru. In Hamburg is further material from Peru: Tingo Maria, Cueva las Pavas, 1.-7.10.1980, leg. and det. STRÜMPEL (as *Anobilia luteimacula*), CeNak. For taxonomy and nomenclature see FLÓREZ-V. et al. (2015), description in FUNKHOUSER (1914) and TODE (1966, as *Anobilia luteimacula*), picture on the treehopper website (DEITZ & WALLACE 2010) and FLÓREZ-V. et al. (2015).

**\* *Stilbophora sagittata* TODE, 1966** (syn. *Anobilia sagittata*)

Not found in Panguana but new for Peru.

Previously only known from Colombia (TODE 1966 description and figure, FLÓREZ-V. et al. 2015). In Hamburg material from Peru: Pucallpa, Yarinacocha, Chicosa, 15.2.-10.3.1983, 15 specimens, leg. and det. STRÜMPEL, CeNak.

**\* *Stilbophora tripartita* FAIRMAIRE, 1846** (syn. *Anobilia tripartita*)

Panguana 1 specimen, 21.3.1974, leg. K. HARZ, det. STRÜMPEL, CeNak.

Previously known from Brazil, Colombia, French Guiana, Rep. Guyana. For description and illustration refer to TODE (1966).

***Stilbophora flava* TODE, 1966** (syn. *Anobilia flava*)

Panguana 5 specimens, 21.-25.2.1974, leg. H. KURZ, det. STRÜMPEL, CeNak.

Known from Colombia and Peru (Satipo), (TODE 1966), see there for description and figure. For generic position refer to FLÓREZ-V. et al. (2015). Additional material from Peru: Pucallpa, Yarinacocha Chicosa, 15.2.-10.3.83, 21 specimens, 19./20.9.1980, 17 specimens, leg. and det. STRÜMPEL, CeNak.

**\* *Tapinolobus fasciatus* SAKAKIBARA, 1969**

Panguana 45 specimens, 2003, 2004, 2014, ZSM, MHNL; **Figures 7D, 9F, 10B**.

Previously reported from Brazil and Paraguay. For description and illustrations see SAKAKIBARA (1969) and KOPP & YONKE (1979). In SCHULZE et al. (2014) erroneously listed as *Trichaetypiga junipenna* aff. In some years a rather frequent species in Panguana, but only collected in three years.

***Todea cimicoides* (CONQUEBERT, 1801)**

Panguana 4 specimens, 2003, ZSM.

Known from Brazil, Colombia, Ecuador, Rep. Guyana, Suriname, and Peru. For description and illustration see TODE (1966, as *Richteria cimicoides*) and the treehopper website (DEITZ & WALLACE 2010).

\* *Todea incerta* (TODE, 1966) (syn. *Richteria incerta*)

Panguana 3 specimens, 2004, 2009, 2014, ZSM.

This species was up to now only known from Colombia (TODE, 1966), check there for description and figures. The material of this species in CeNak is very variable. It is probably necessary to investigate the genitals for further determination. In ZSM and CeNak there is quite some material only determined to genus level.

\* *Tropidolomia imperfecta* TODE, 1966

Panguana 1 specimen, 2013 leg. E. DILLER Malaise trap, ZSM.

See TODE (1966) for description, key and figures. Described from Colombia, Rio Tacana and Leticia near the tripoint of Brazil, Colombia and Peru. Compared with type material in CeNak.

\* *Tropidolomia auriculata* (OLIVIER, 1792)

Panguana 11 specimens, 20.2.1974 leg. H. KURZ, det. K. SCHÖNITZER, CeNak.

Known from Brazil, Colombia, French Guiana, and Suriname. Description and figure in FUNKHOUSER (1950) and TODE (1966). Further material from Peru: Tingo Maria, 30.9.1980, leg. and det. STRÜMPEL, CeNak.

\* *Tropidolomia cristata* (TODE, 1966)

Panguana 1 specimen, 6.2.1974 leg. H. KURZ, det. K. SCHÖNITZER, CeNak.

Described from Colombia (TODE 1966), picture at the treehopper website (DEITZ & WALLACE 2010), compared with type material in Hamburg.

\* *Tynelia godoyae* (CREAÓ-DUARTE & SAKAKIBARA, 2000)

Panguana 1 specimen, 2008, ZSM.

Known from Brazil and Colombia (CREAÓ-DUARTE & SAKAKIBARA 2000, FLÓREZ-V. et al. 2015), check there also for description and figures.

*Tynelia longula* (BURMEISTER, 1835) (syn. *Boethoos nitida* FUNKHOUSER, 1922)

Panguana 1 specimen, 2003, leg. T. KOTHE, ZSM.

Known from Brazil and Peru (CREAÓ-DUARTE & SAKAKIBARA 2000), see there also for description and figure. Pictures also to be found on the treehopper website (DEITZ & WALLACE 2010).

## Stegaspidae

*Bocydium globulare* FABRICIUS, 1803 (syn. *B. globuliferum* (PALLAS, 1766))

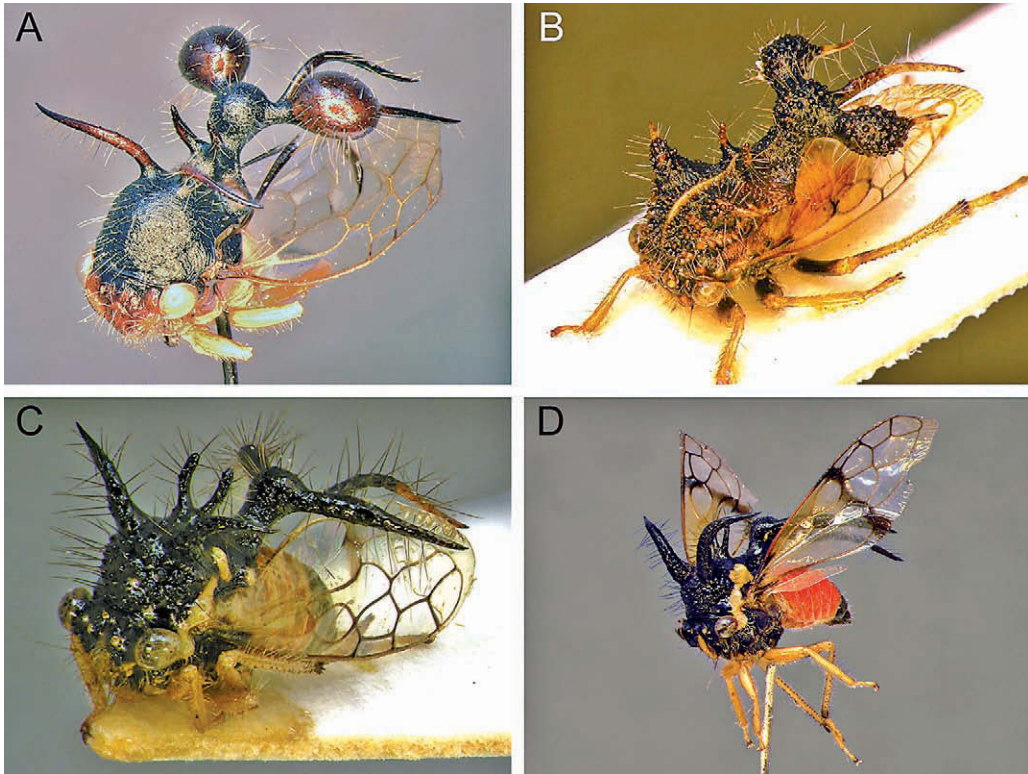
Panguana 1 specimen, 15.7.1978, leg. W. FICK, det. STRÜMPEL, CeNak.

*Bocydium* is a very remarkable and distinct genus. *B. globulare* is reported from Brazil, Colombia, French Guiana, Rep. Guyana, Suriname, and Peru. This species is repeatedly depicted on the internet (e.g. LANDMANN 2010), for SEM picture refer to STRÜMPEL (1983: 24, *B. globuliferum*), description and drawing in RICHTER (1954, *B. globuliferum*), for nomenclature and key refer to CRYAN & DEITZ (1999 a).

*Stegaspis fronditia* (LINNAEUS, 1758) (syn. *Stegaspis insignis* BUCKTON, 1901)

Panguana 13 specimens, 2003, leg. and det. T. KOTHE, ZSM; 17.3.1973, leg. VILLOCK, 21.3.1973, 21.1./5.2.1974, leg. H. KURZ, 15.7.1978, leg. W. FICK, 29.6.-12.7.1987, leg. and det. H. & R. STRÜMPEL, CeNak; **Figure 6B**.

Known from Bolivia, Brazil, Colombia, Ecuador, Rep. Guyana, French Guiana, Panama, Suriname, Venezuela, Trinidad, and Peru. Distinct species with clear sexual dimorphism, figured e.g. in GODOY et al. (2006, *S. insignis*), FLÓREZ-V. et al. (2015), LANDMANN (2010, website) and at the treehopper website (DEITZ & WALLACE 2010), SEM picture in STRÜMPEL (1983: 23, *S. insignis*). For nomenclature, key and figures refer to CRYAN & DEITZ (1999b). Further material from Peru: Pucallpa, Yarinacocha, 15.2.-10.3.1983 and 22.6.-25.6.1987, leg. and det. STRÜMPEL, CeNak



**Fig. 8:** Light micrographs. **A)** *Cyphonia clavata* (length 4.5 mm, height 2.8 mm), **B)** *Cyphonia clavigera* (length 6 mm, height 3 mm), **C)** *Cyphonia longispina* (length 5 mm, height 3 mm), **D)** *Cyphonia trifida* (length 6 mm, height 3.5 mm).

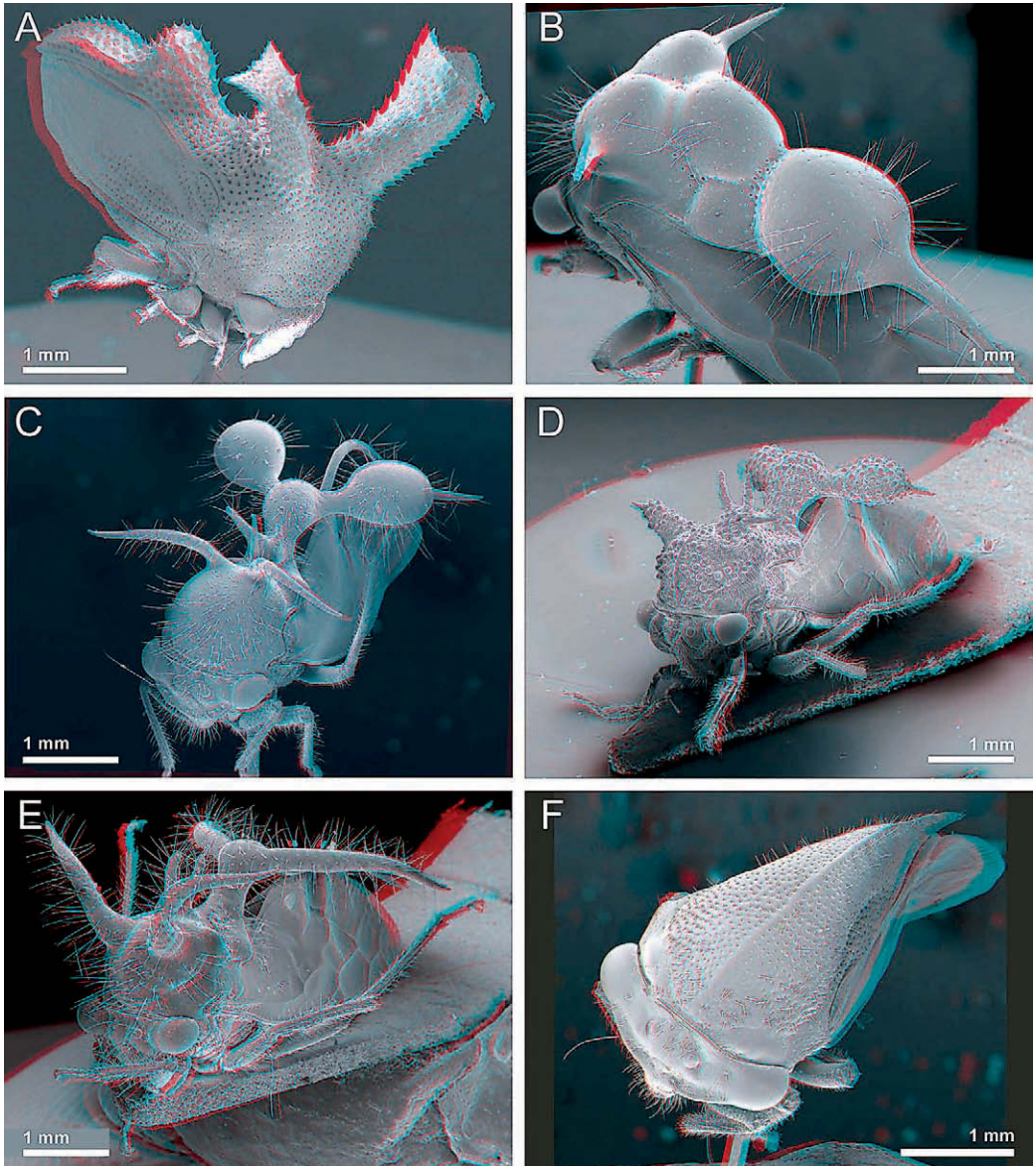
### Discussion

Most of all, the data presented here demonstrate that the fauna of treehoppers in Amazonian Peru is very rich in species. The absolute number of 75 species shown to live in Panguana is high, compared to the 225 species which CEBALLOS (1980) listed for Peru as a whole, according to MCKAMEY (1998) some 300 species are recorded for Peru. But this also shows that the treehopper fauna of Peru is still very insufficiently investigated; what is also illustrated by the very high percentage of species recorded for the first time in Peru within this publication (more than half of the number of species). It is obvious that quite several species await for description but this was beyond the scope of this investigation.

In Panguana 75 species were found in total, it is remarkable that quite many of these species (20, i.e. more than a quarter!) were verified only through one single specimen throughout the many years of investigation. Of 54 species only ten or less specimens were collected. Some species were found in a number of individuals, but in only one collecting trip: *Tropidaspis carinata*, *Hemiptycha obtecta* and *Potnia gladiator*, these species are gregarious but seldom. Only few species may be found more or less regularly: *Ceresa distans* and *Cyphonia clavata*. Rather frequently found are furthermore *Antonae guttipes* and *Notocera spinidora*. We have to point out, that most entomologists who contributed to this work are specialists of other insect groups and collected the treehoppers en passant. This causes that the larger and more conspicuous species are certainly better represented than the small ones. But some of the small species could be found in Malaise traps as for example *Aphetea inconspicua*.

Most of the species found in Panguana (which were already known for Peru) were also known for Brazil. This is not really surprising, since Brazil is the very big neighbor country, which comprises most of the Amazon rainforest. Quite many of those species, which were previously not known for Peru were known from Colombia. This is, however, not due to a special similarity of the fauna of these two countries but probably





**Fig. 9:** Scanning electron micrographs (3D anaglyphs, view with red-green-glasses, left eye: red filter).

**A)** *Notocera spinidorsa* (cf. Fig. 4F), **B)** *Antonae guttipes* (cf. Fig. 7A), **C)** *Cyphonia clavata* (cf. Fig. 8A), **D)** *Cyphonia clavigera* (cf. Fig. 8B), **E)** *Cyphonia longispina* (cf. Fig. 8C), **F)** *Tapinolobus fasciatus* (cf. Fig. 7D).

more due to the material of CeNak in Hamburg with extensive collections of Colombian treehoppers and the works of RICHTER, STRÜMPEL as well as the recent publication of FLOREZ-V. et al. (2015).

More species were found both in Peru and in the Guianas (Rep. Guyana, Suriname, and French Guiana) than in Peru and its neighbor Ecuador, as well as in Peru and Venezuela. It might be that this is rather because of good touristic development than due to faunal similarities.

Those species which were new reports for Peru within this communication tend to be known from less countries (mean 4.67, median 4, including Peru) than those species which were already known from Peru

(mean 6.36, median 6). Remarkably not a single species was found in Panguana which was previously only reported from Peru, but not for another country, i.e. it might potentially be endemic to Peru. For *Heteronotus apricarius*, which was up to now only known from Peru, it is shown in this communication to exist also in Venezuela. *Bolbonota aspidistrae* which was previously only known from the Republic of Guiana was found in this communication to inhabit also Colombia, Ecuador, and Peru! Although it was not the main focus of this investigation, we found “en passant” 18 species records as new for a country other than Peru, i.e. six species as new for Ecuador, three for Venezuela and Bolivia, two for Colombia and Costa Rica and one each for French Guyana and Brazil.

GOLDANI et al. (2002) state for their investigation on the distribution patterns of the Neotropical treehopper tribe Hoplophorioni eight “predetermined areas of endemism”. It is not clear whether their Area A5 (“Central Andes”) contains the area of Panguana or only the southern Peruvian areas (e.g. Cusco and Madre de Dios). The authors also do not explain how these areas were determined. But their area A5 has most similarities to the adjacent northern area (A4), which coincides to our result of many species occurring both in Colombia and Peru. On the other hand, our results give the idea that restricted distribution in South American treehoppers is probably more an artefact based on the lack of faunistic information than a sign of real endemism.

As a whole our results clearly demonstrate how insufficiently the distribution of Neotropical treehoppers is known, thus the need of further faunistic investigation is obvious.

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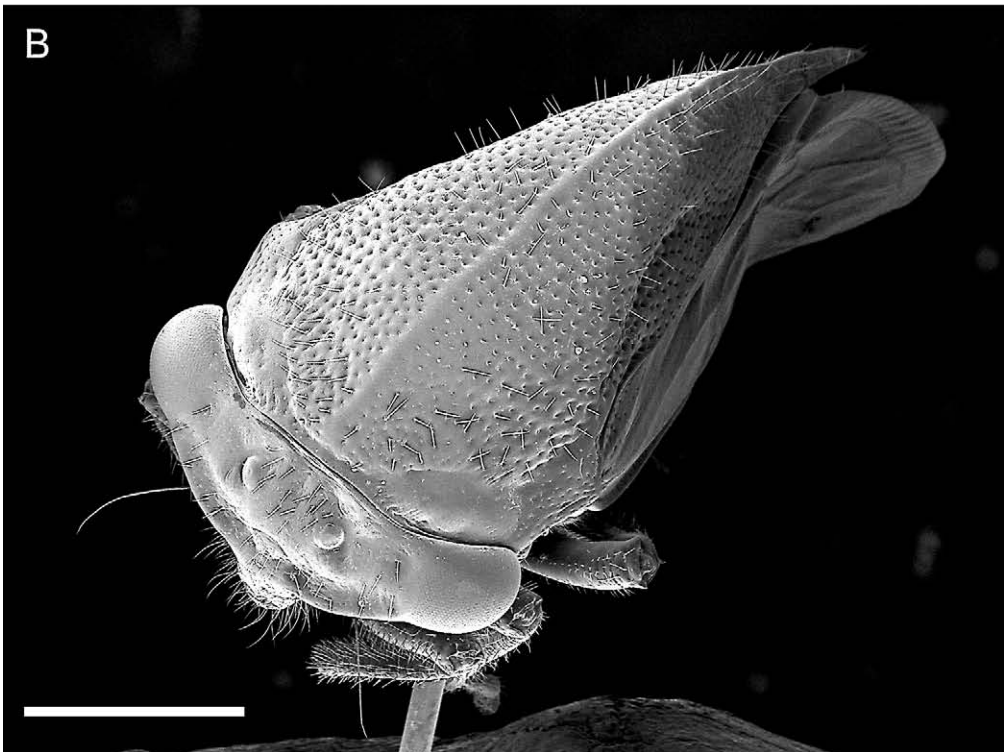
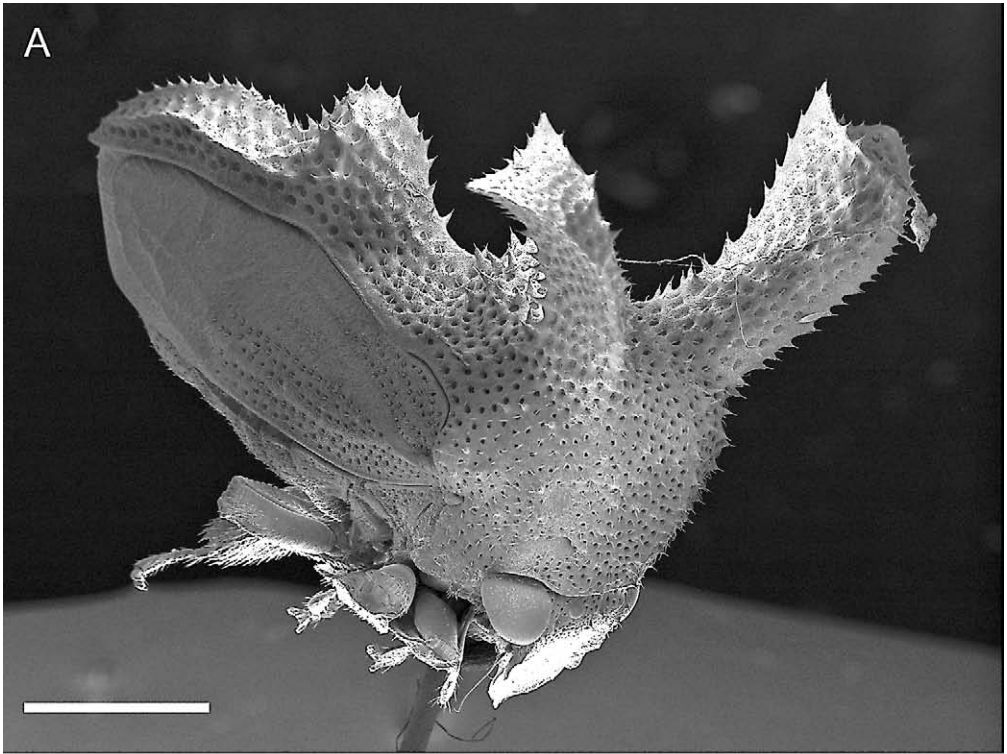
### Zusammenfassung

In der vorliegenden Arbeit werden insgesamt 74 Arten von Buckelzikaden (Membracidae) und eine Art der Aetalonidae aus dem privaten Schutzgebiet Panguana im Amazonas Regenwald von Peru aufgelistet und Informationen über ihre Verbreitung und Bestimmung gegeben. Viele Arten sind abgebildet, teilweise mit 3D-REM Bildern (Anaglyphen).

Zwanzig Arten von Membracidae wurden nur einmal durch ein einziges Tier nachgewiesen, 39 Arten sind Neunachweise für Peru, weitere vier Arten werden neu für Peru berichtet. Außerdem werden sechs Arten neu für Ecuador, je drei für Venezuela und Bolivien, je zwei für Kolumbien und Costa Rica und je eine für Französisch Guyana und Brasilien nachgewiesen. Es wird vermutet, dass begrenzte bekannte Verbreitungsareale einzelner Arten eher auf den mangelnden faunistischen Untersuchungsstand, als auf wirklich eingeschränkte Verbreitung (Endemismen) zurückzuführen sind.

**Figures 10-12 (next pages): Scanning electron micrographs (2D)**





**Figure 10:** A) *Notocera spinidora*, B) *Tapinolobus fasciatus*. Scale bar: 1 mm.

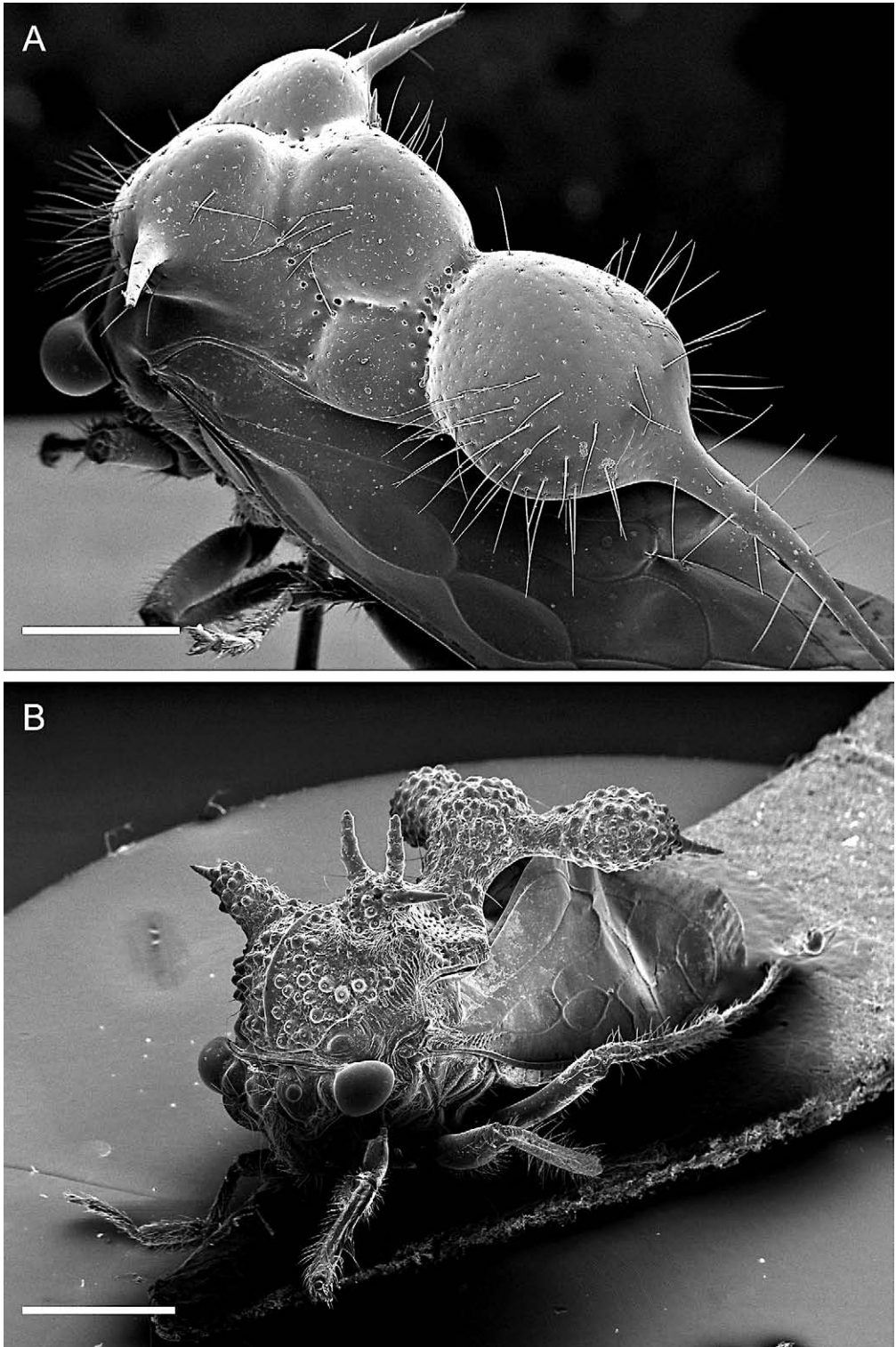


Figure 11: A) *Antonae guttipes*, B) *Cyphonia clavigera*. Scale bar: 1 mm.

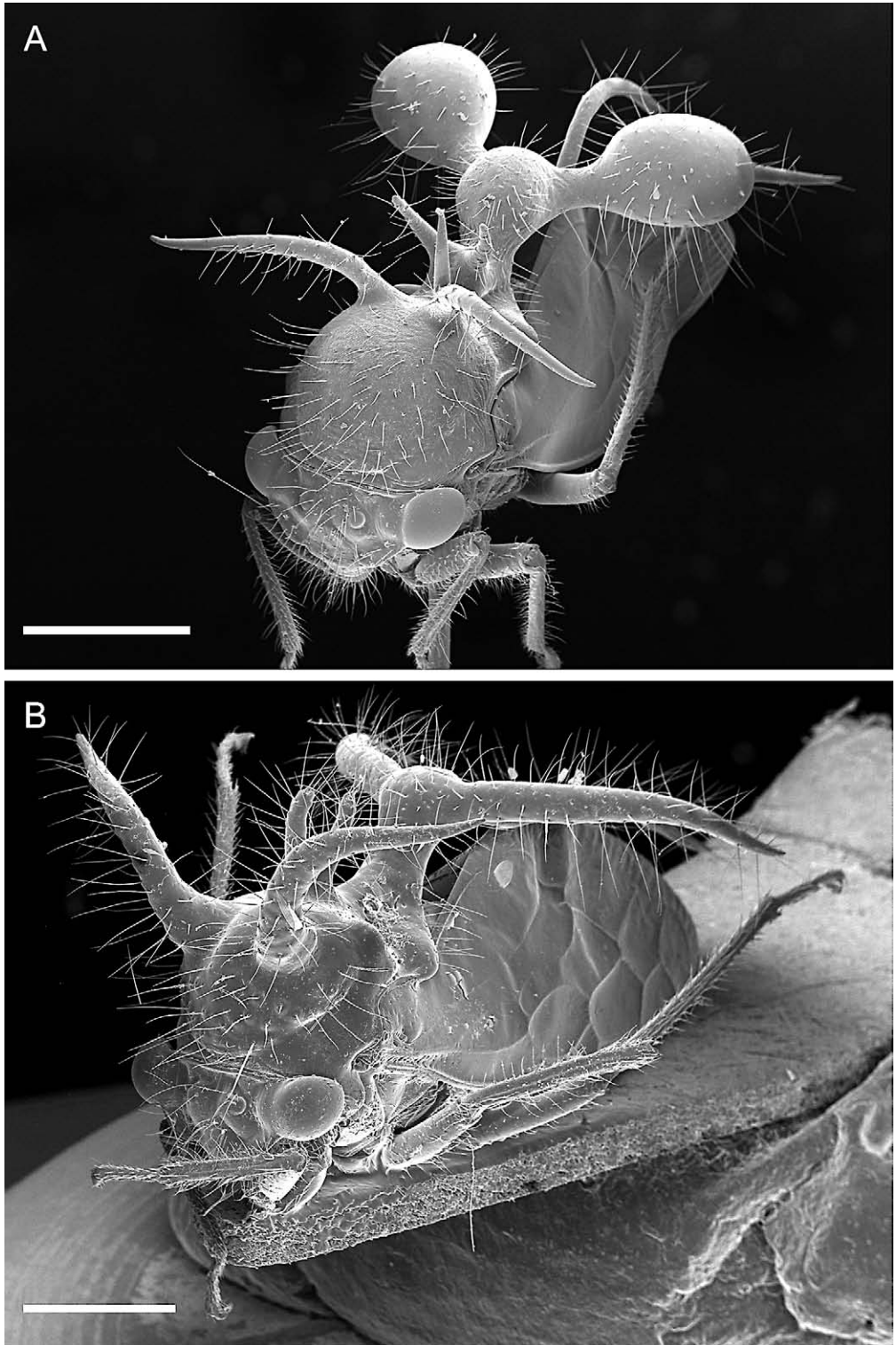


Figure 12: A) *Cyphonia clavata*, B) *Cyphonia longispina*. Scale bar: 1 mm.

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