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New genus and new species of spittlebugs (Hemiptera: Cercopidae) from the Philippines

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Abstract. The following new taxa are described from the Philippines: *Mioscarta nubisa* Crispolon & Soulier-Perkins sp. nov., *M. translucida* Crispolon & Yap sp. nov. and *Trigonoschema* Crispolon & Soulier-Perkins gen. nov. with three new species: *T. manoborum* Crispolon & Soulier-Perkins sp. nov. (as type species), *T. negrosensis* Crispolon & Yap sp. nov and *T. rubercella* Crispolon & Guilbert sp. nov. *Trigonoschema pallida* (Lallemand, 1927) comb. nov. is transferred from *Mioscarta* Breddin, 1901. Descriptions of male genitalia are illustrated and keys to species of Philippine *Mioscarta* and *Trigonoschema gen. nov.* are provided. Although phylogenetic results confirm the monophyly of all genera and *Trigonoschema* being a distinct genus from *Mioscarta*, relationships between genera remain uncertain. A checklist of the genera and species of Cercopidae found in the Philippines is included.

Key words. Auchenorrhyncha, Rhinaulacini, froghopper, Cicadomorpha, molecular phylogeny.

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Introduction

Currently 18 genera of Cercopidae are known from the Philippines with 65 species and 9 subspecies (Table 1). Three genera and most of these species are endemic to the Philippines and are generally recorded throughout its three main geographical regions: Luzon, Visayas and Mindanao. Thirteen species cannot be precisely located on the archipelago since no exact locations were provided in the original descriptions (Soulier-Perkins 2020). Luzon constitutes a distinct centre of endemism (Vallejo 2014), which could explain the high number of Cercopidae found on the island. The Visayas is composed of many islands and is located in the central part of the archipelago. Out of the 65 species known, only six are recorded from the Visayan Islands, three in Samar, two in Negros and one in Panay. Of the three main islands, Mindanao is said to be the least explored (Crispolon *et al.* 2019), this is most likely why so few cercopids are recorded from it. With a more extensive exploration especially in the central and south geographical parts of the archipelago, we expect to discover more species. Some recent explorations on the main island Luzon, Negros and Mindanao, led us to find two new species for *Mioscarta* Breddin, 1901 and a new genus *Trigonoschema* Crispolon & Soulier-Perkins gen. nov. for which three species are described here. This brings to a total of four genera endemic to the Philippines and 70 for the number of cercopid species known for this archipelago (Table 1) with 87% endemicity (Soulier-Perkins 2020).

In order to ease the identification of *Mioscarta* and *Trigonoschema* gen. nov. species present in the Philippines, keys are provided and if possible the male terminalia are described and illustrated. Since we hypothesized that *Trigonoschema* gen. nov is sufficiently morphologically distinct from *Mioscarta*, to be described as a new genus, we tested the species for which we had molecular samples using molecular characters in Bayesian inference and Maximum likelihood reconstruction analyses. Lallemand (1949) and Lallemand & Synave (1961) provided a generic key for the family, which remains the only complete key available. Interactive keys, for the Cercopidae genera found in the Philippines and for the *Poeciloterpa* Stål, 1870 species can be accessed throughout the web page dedicated to keys (https://hemiptera-databases.org/cool/id_keys.php) in the database Cercopoidea Organized On Line (COOL). A key to the species of *Poeciloterpa* is also available in Crispolon *et al.* (2019).

Cercopids are generally not confined to one host and not bound to oligophagy (Soulier-Perkins & Le Cesne 2016). They feed on diverse host-plants such as pastures crops, sugarcane, eucalyptus, rice and maize in Africa, America (Mello *et al.* 1996; Holmann & Peck 2002; Thompson 2004; Carvalho & Webb 2005; Paladini *et al.* 2008; Bartlett *et al.* 2018; Thompson *et al.* 2020), China and Southeast Asia (Chen & Liang 2015, Su *et al.* 2018) and they are also associated with nitrogen-fixing angiosperm (Thompson 2004; Deitz *et al.* 2008). In the Philippines, Crispolon *et al.* (2019) have recorded new host-plants associated to species of *Poeciloterpa.* However, collectors often used light traps so, very little information on the natural history is available for the species of *Mioscarta* and *Trigonoschema* gen. nov. and their host plants, biology and other ecological data remain very limited.

Material and Methods

Taxonomic study

Preparation of specimen for morphological observation

For type and other material examined, when label citations cannot be reliably interpreted and formatted they are cited verbatim in double quotation marks: “ ”. When the label is interpreted the data is placed in square brackets: [ ] e.g., coordinates interpreted from a locality, or translations of foreign text.

The abdomen of each specimen examined was cut off and cleared for 20 minutes in hot (85°C) 10% KOH. Dissections and cleaning of genital structures were performed in distilled water. If needed, a few drops of blue paragon for dying the ectodermic genital ducts were added for a few minutes. Observations were done in glycerol using a Leica MZ16 stereo microscope on which a camera lucida is attached in

Table 1. Checklist of genera, species and subspecies found in the Philippines.

Genera	**Species and subspecies**	**Philippine Islands**
Cosmoscarta Stål, 1869	*C. consociata* Distant, 1900	Main Island Luzon
	C. lateralis Jacobi, 1927	Samar Island
	C. nigroguttata Stål, 1870	Philippine Islands
	C. semimaculata Stål, 1870	Philippine Islands
	C. sexmaculata Stål, 1870	Philippine Islands
	C. sulukensis Distant, 1900	Sulu Islands
	C. whiteheadi Distant, 1900	Main Island Luzon
Ectemnonotum Schmidt, 1909	*E. luzonensis* (Lallemand, 1931)	Luzon Islands
Eoscarta Breddin, 1902	*E. borealis* (Distant, 1878)	Main Island Mindanao
	E. philippinica Lallemand, 1949	Main Island Mindanao
Euglobiceps Lallemand, 1923	*E. elongata* Lallemand, 1923	Main Island Mindanao
Gynopygoplax Schmidt 1909	*G. bicolor* Lallemand, 1956	Mindoro Island
	G. daphne (Stål, 1865)	Luzon Islands
	G. inclusa Lallemand, 1922	Balabac Island
	G. inclusiformis Schmidt, 1911	Palawan Island
	G. luzonensis Schmidt, 1909	Luzon Islands
	G. meyeri Schmidt, 1909	Philippine Islands
	G. mounseyi Lallemand, 1927	Palawan Island
	G. proserpina (White, 1845)	Luzon Islands
	G. proserpinella Schmidt, 1909	Luzon Islands
	G. theora (White, 1845)	Philippine Islands
	G. walkeri Metcalf, 1961	Luzon Islands
Homalostethus Schmidt, 1910	*H. dirce* (Breddin, 1901)	Sulu Islands
	H. sangaris (Jacobi, 1905)	Luzon Islands
	H. spectabilis (Burmeister, 1834)	Luzon Islands
Jacobsoniella Melichar, 1914	*J. bakeri* Schmidt 1920	Luzon Islands
Leptataspis Schmidt, 1910	*L. bukidnona* Lallemand 1923	Main Island Mindanao
	L. butuanensis Lallemand 1923	Main Island Mindanao
	L. insularis Lallemand 1927	Philippine Islands
	L. palawana Schmidt, 1911	Palawan Island
	L. philippinensis Schmidt, 1920	Luzon Islands
	L. proserpinopsis Schmidt, 1911	Luzon Islands
	L. rotundata (Walker, 1858)	Philippine Islands
	L. rufipes Stål, 1870	Philippine Islands
Mioscarta Breddin, 1901	*M. basilana* Jacobi, 1927	Basilan Island
	M. ferruginea (Walker, 1851)	Samar Island
	M. flavosalis Jacobi, 1927	Samar Island
	M. lutea Schmidt, 1925	Luzon Islands
	M. nubisa Crispolon & Soulier-Perkins sp. nov.	Main Island Luzon
	M. obscuripennis Schmidt, 1920	Main Island Luzon, Negros Island
	M. semperi Jacobi, 1905	Luzon Islands, Mindanao Islands
	M. translucida Crispolon & Yap sp. nov.	Main Island Luzon
Opistharsostethus Schmidt, 1911	*O. calypso* Lallemand, 1923	Polillo Island
Oxymegaspis Schmidt, 1911	*O. izzardi* Lallemand, 1954	Luzon Islands
	O. schultzei (Schmidt, 1931)	Luzon Islands

Paratrichoscarta Lallemand & Synave, 1953	*P. carinata* (Stål, 1870)	Philippine Islands
Phymatostetha Stål, 1870	*P. cincta* Lallemand, 1923	Balabac Island, Palawan Island
	P. perspicillaris (White, 1845)	Philippine Islands
	– *P. p. dapitana* Lallemand 1923	Basilan Island, Main Island Mindanao
	– *P. p. extensa* Lallemand, 1951	Mindanao Islands
	– *P. p. flavopicta* Distant, 1900	Luzon Islands
	– *P. p. iligana* Lallemand, 1923	Main Island Mindanao
	– *P. p. mactans* White, 1845	Luzon Islands
	– *P. p. montana* Schmidt, 1920	Main Island Luzon
	– *P. p. rubens* Lallemand, 1923	Main Island Luzon
	– *P. p. sibuyana* Lallemand, 1951	Sibuyan Island
	– *P. p. variegata* Lallemand, 1951	Mindanao Islands
Poeciloterpa Stål 1870	*P. altissima* Crispolon & Soulier-Perkins, 2019	Main Island Mindanao
	P. atra Jacobi, 1927	Polillo Island, Main Island Luzon
	P. conica Crispolon & Soulier-Perkins, 2019	Negros Island
	P. fusca Lallemand 1927	Philippine Islands
	P. gapudi Crispolon & Yap, 2019	Main Island Mindanao
	P. latipennis Schmidt, 1920	Main Island Luzon, Main Island Mindanao
	P. mangkas Crispolon & Yap, 2019	Negros Island
	P. minuta Lallemand, 1922	Main Island Luzon, Siargao Island
	P. montana Schmidt, 1927	Main Island Luzon
	P. nigrolimbata Stål 1870	Main Island Luzon
	P. obscura Schmidt, 1927	Main Island Luzon, Main Island Mindanao
	P. rufolimbata Schmidt, 1927	Panay Island
	P. unicolor Lallemand, 1922	Main Island Luzon
Radioscarta Lallemand, 1923	*R. surigaona* Lallemand, 1923	Main Island Mindanao
Serapita Schmidt, 1909	*S. charon* (White,1845)	Philippine Islands
	S. phillippinensis Lallemand,1922	Main Island Luzon
Suracarta Schmidt, 1909	*S. torquata* (Jacobi 1905)	Palawan Island
Trichoscarta Breddin, 1902	*T. luteomaculata* Lallemand 1922	Palawan Island
Trigonoschema Crispolon & Soulier-Perkins gen. nov.	*T. manoborum* Crispolon & Soulier-Perkins sp. nov.	Main Island Mindanao
	T. negrosensis Crispolon & Yap sp. nov.	Negros Island, Main Island Luzon
	T. pallida (Lallemand, 1927) comb. nov.	Philippine Islands
	T. rubercella Crispolon & Guilbert sp. nov	Negros Island

order to draw the terminalia. The photos of the habitus were taken using a stereo microscope Leica MZ16 with IC3D digital camera; final images were produced using Helicon 5.0 software. Schematic illustration of the head in frontal view (Fig. 1) for ocelli size and distance comparison and lateral view of the insect body for the pronotum angle (Fig. 2) were also done. Posterior wings of *Mioscarta* and *Poeciloterpa* were also illustrated (Fig. 3). Terminalia terminologies follow Soulier-Perkins & Kunz (2012) and Le Cesne *et al.* (2021). Specifically, the sterno-lateral plate often referred as the lateral plate in the previous literature. For each newly described species, two authors are selected for the authorship: the first author followed alternatively by one of the three other authors.

Molecular study

Taxon and data sampling

A phylogenetic analysis based on molecular characters is performed in order to check if its results support our decision to describe *Trigonoschema* gen. nov. as a new genus distinct from *Mioscarta*. This study includes 16 exemplars of Cercopidae as ingroup representing genera *Eoscarta Breddin, 1902* (3), *Mioscarta* (3), *Trigonoschema* (3), *Poeciloterpa* (5), *Jacobsoniella Melichar, 1914*(1) and *Wawi Soulier-Perkins & Le Cesne, 2016* (1) and 14 terminals as outgroup selected from Aphrophoridae, Clastopteridae and Machaerotidae. Genera included in the ingroup are supposed to be phylogenetically as close as possible to *Mioscarta* and *Trigonoschema* gen. nov. in order to test our hypothesis. We have selected genera that belong to the same tribe, Rhinaulacini: *Poeciloterpa*, *Eoscarta* from the Philippines and *Wawi* from Papua New Guinea. *Jacobsoniella* is found in the Philippines but in the actual classification it is *incertae sedis* concerning its tribe placement. However, the male terminalia for this genus present the same characteristic sterno-lateral plates observed in most Rhinaulacini genera. For this reason, we used it in our analysis, included in the ingroup.

Most specimens sampled were stored into 95–100% ethanol otherwise dry. DNA extractions were conducted using standard protocols for QIAmp DNA microkit (Qiagen) from disarticulated legs. Intact voucher specimens from which the disarticulated legs were extracted were mounted on pins and are deposited in the MNHN. PCR reactions, with negative controls included to detect contamination, were conducted in 25 µl volume using Taq DNA Polymerase, from Taq Core kit (Qiagen) under standard thermocycler protocols (for Histone 3, 18S and 28S: initial denaturation for 3 minutes at 94°C, then 35 cycles of 94°C for 30 seconds, 49–56°C for 40 seconds and 72°C for 1 minute, then a final extension step at 72°C for 10 minutes, and finally held at 10°C before being removed from the cycler. For CO1, the thermal cycling protocol are the following: initial denaturation for 3 minutes at 94°C; five cycles of 30 seconds at 94°C, 40 seconds at 47°C, and 1 minute at 72°C; 30 cycles of 30 seconds at 94°C, 40 seconds at 52°C, and 1 minute at 72°C; 10 minutes at 72°C; and finally held at 10°C) and using Oligonucleotide primers (Table 3) targeting four loci: CO1, Histone 3, 18S, and 28S.

Amplified DNA was visualized using 1–2% agarose gel electrophoresis with midori green staining. Sequence fragments were imported into codoncode aligner V.5.1.4. (CodonCode Corporation, Dedham, Massachusetts, USA) and trimmed to remove primer sequence. After sequence inspection, contiguous sequences were assembled and edited based on chromatograms to ensure the accuracy of base calls. In addition, insertions/deletions and checking of contaminations were confirmed for accuracy by using a reference sequence for comparison in BLAST (https://blast.ncbi.nlm.nih.gov/Blast.cgi). All sequence data are accessioned into GenBank (Table 4).

Sequence alignment and Phylogenetic reconstruction

Consensus sequences were imported to Phylosuite v1.2.2 (Zhang *et al.* 2020) and aligned using MAFFT (Katoh & Standley 2013) and MACSE (Ranwez *et al.* 2011, 2018). Nuclear protein coding genes (H3) were aligned with MAFFT program, using the FFT-NS-i algorithm. Ribosomal genes (18S and 28S) were aligned using MAFFT with algorithm E-INS-I (suitable for sequences with long unalignable regions). Mitochondrial protein coding genes (CO1) were aligned using MACSE.

For the combined analyses all sequence alignments were concatenated into a single data set using Phylosuite v1.2.2 (Zhang *et al.* 2020). The resulting data matrix consisted of 3575 bp of DNA nucleotide sequence data for 30 Cercopiodea specimens used as terminals. Phylogenetic reconstructions were conducted using maximum likelihood (ML) criteria (Guindon *et al.* 2010) and Bayesian inference (BI). Under all reconstructions method, gaps were treated as missing data. Partitioned analyses were conducted with Partition Finder (Lanfear *et al.* 2012, 2016). Best fitting model was searched using partition finder with following configuration: branchlengths = linked, models = all, model_selection

AICc and the search = greedy. Codon code mode was activated for CO1 before running the analysis. Results obtained with the corrected Akaike Information Criterion (AICc) (Guindon *et al.* 2010; Lanfear *et al.* 2012, 2016) indicated that GTR+G was best fitting model for Histone 3; TRNEF+I+G for 18S; GTR+I+G, TRN+I and HKY+I+G for each codon base for CO1 and GTR+I+G for 28S.

For ML analysis the results were then imported to IQ tree (Guindon *et al.* 2010; Minh *et al.* 2013; Nguyen *et al.* 2015; Hoang *et al.* 2018) for fast and effective stochastic algorithm to reconstruct phylogenetic trees. Partition mode was selected,"Models" argument will be ignored and models and thread were automatically set to auto. Maximum likelihood phylogeny were inferred under edge-linked partition model for 1000 standard bootstraps, as well as the Shimodaira-Hasegawa-like approximate likelihood-ratio test (SH_aLRT branch test) with 1000 replicates (Guindon *et al.* 2010; Minh *et al.* 2013; Nguyen *et al.* 2015; Hoang *et al.* 2018).

BI analysis was conducted with MrBayes version 3.1.2 (Huelsenbeck & Ronquist 2001; Ronquist & Huelsenbeck 2003) as implemented in CIPRES (Miller *et al.* 2010). Because MrBayes only allows a relatively small collection of models, models in the analyses were approximated using GTR+I+G (nst = 6) for DNA, or 'wag' for Protein (Guindon *et al.* 2010; Lanfear *et al.* 2012, 2016). The analysis coupled with Metropolis Coupled Markov Chain Monte Carlo (MCMCMC) was implemented. These analyses were conducted with six-gene partition implemented across two independent runs each with four chains run (one cold and three heated) for 20 million generations with 1000 sampling frequency. Burn in fraction value was set to 0.25 in which the initial 25% of sampled data were discarded as burn-in. The final posterior probability tree was calculated as a 50% majority-rule consensus tree (Huelsenbeck & Imennov 2002; Huelsenbeck *et al.* 2002). Clade support was evaluated by their posterior probabilities (BPP). The IQ Tree analysis tree and the Bayesian inference analysis tree were visualized with FIGTREE v1.1.3 (Rambaut 2016).

Abbreviations used in text

ae	=	apical extension
Cua	=	cubital anterior vein
Cup	=	cubital posterior vein
IP	=	intermediate plate
m-cu	=	cross vein between Median and Cubital veins
PCR	=	polymerase Chain Reaction
pdp	=	postero-dorsal protrusion
pp	=	posterior protrusion
R	=	radial vein
Ra	=	radial anterior vein
Rp	=	Radial posterior vein
SLP	=	sterno-lateral plate
Sc	=	sub-costal vein

Acronyms

ECpc	=	Elorde Crispolon personal collection
MIZ	=	Museum and Institute of Zoology, Warszawa, Poland
MNHN	=	Muséum national d'Histoire naturelle, Paris, France
NHM	=	Natural History Museum, London, UK
SMTD	=	Staatliches Museum für Tierkunde, Dresden, Germany
UPLBMNH	=	University of the Philippines Los Baños Museum of Natural History, Philippines

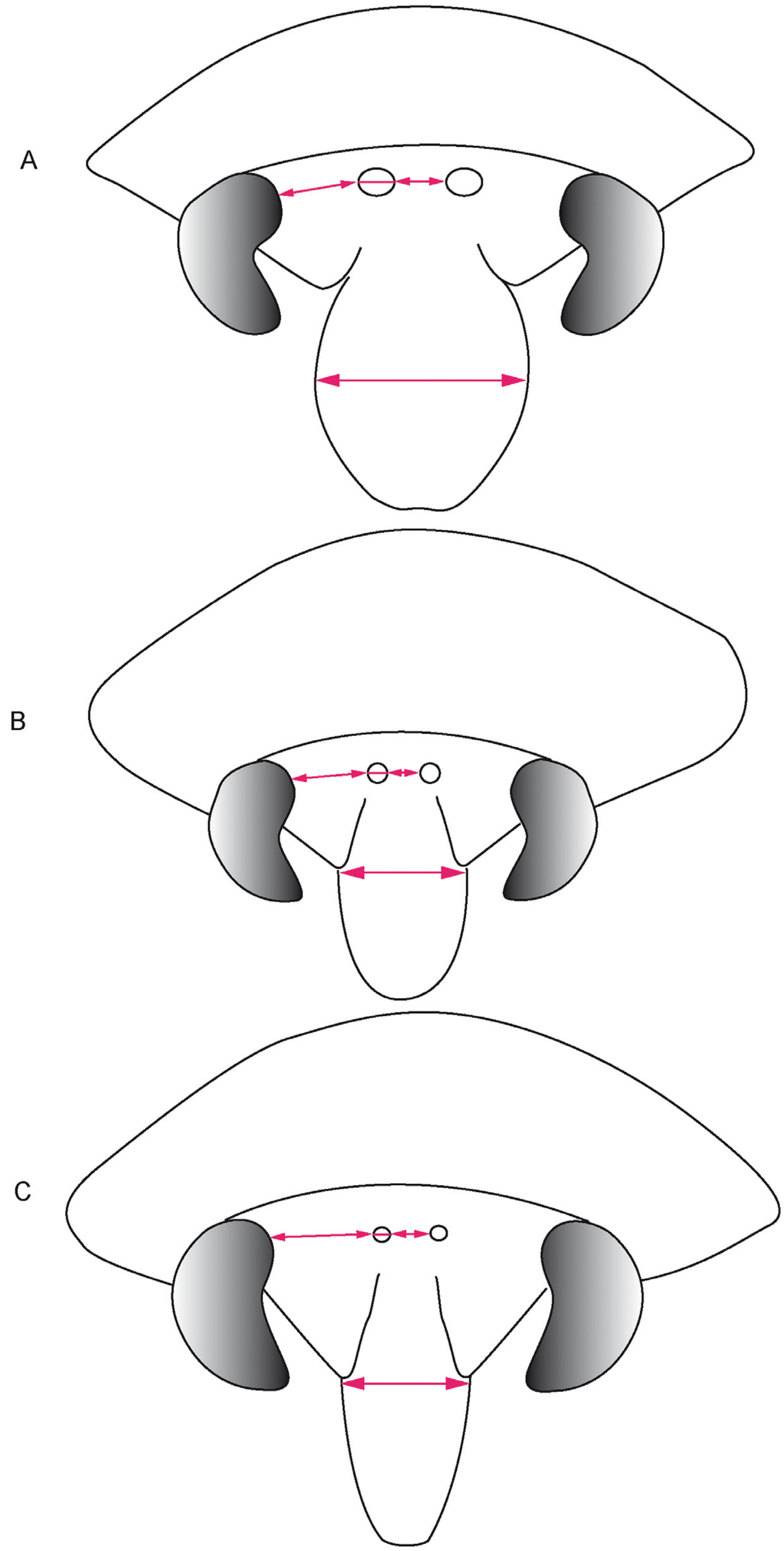

Fig. 1. Head schematic representation with diameter of ocelli compared to distance between them and between ocellus and compound eye. **A**. *Mioscarta* Breddin, 1901. **B**. *Trigonoschema* Crispolon & Soulier-Perkins gen. nov. **C**. *Poeciloterpa* Stål, 1870.

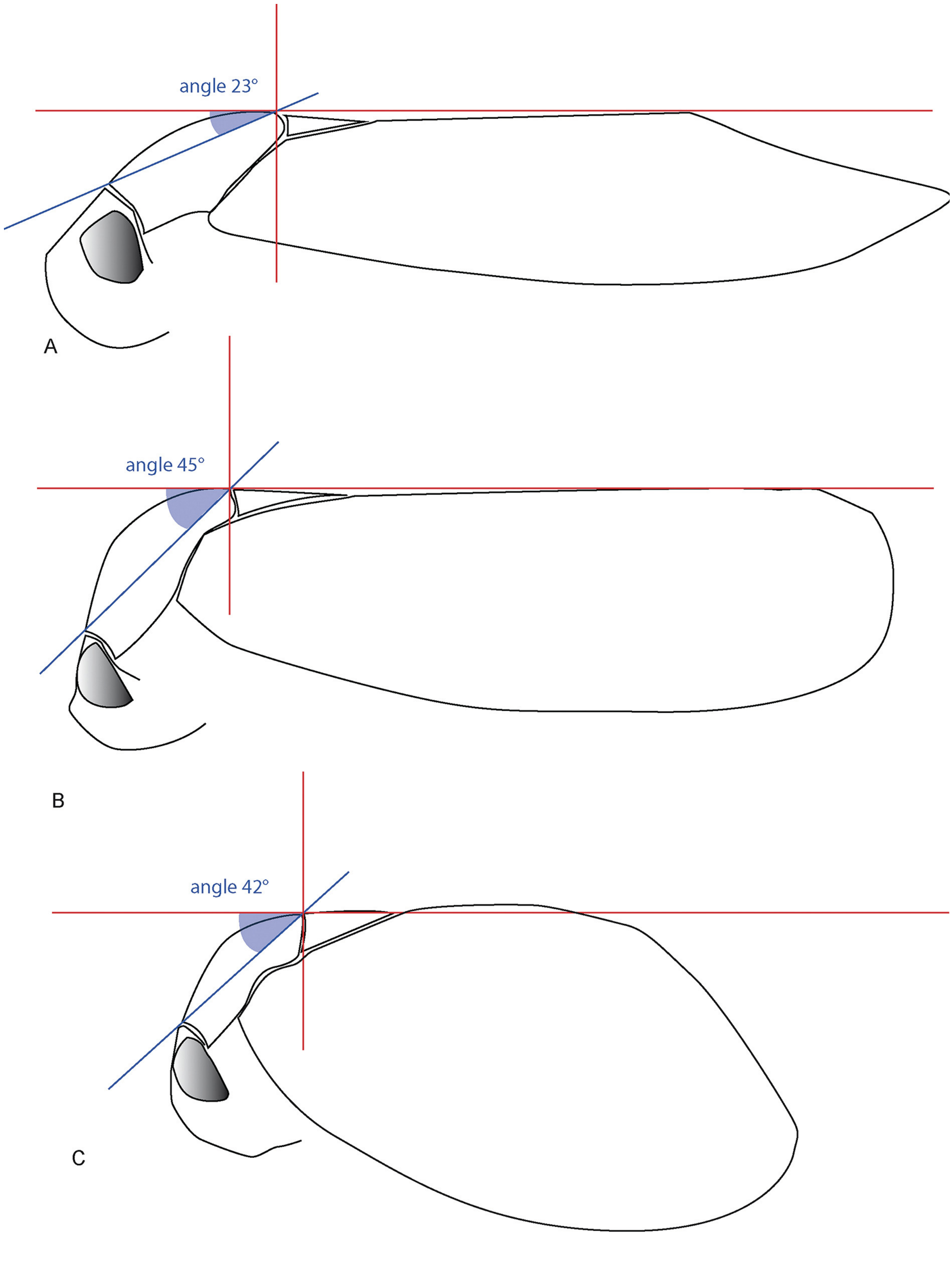

Fig. 2. Schematic representation of the pronotum angle. **A**. *Mioscarta* Breddin, 1901. **B**. *Trigonoschema* Crispolon & Soulier-Perkins gen. nov. **C**. *Poeciloterpa* Stål, 1870.

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Hemiptera Linnaeus, 1758
Suborder Auchenorrhyncha Duméril, 1806
Infraorder Cicadomorpha Evans, 1946
Family Cercopidae Leach, 1815
Subfamily Cercopinae Oshanin, 1916
Tribe Rhinaulacini Kirkaldy 1906
Subtribe Poeciloterpina Schmidt, 1920

Genus ***Mioscarta*** Breddin, 1901

Mioscarta Breddin, 1901: 123 (new genus), 183 (Zoogeography).

Type species

Mioscarta forcipata Breddin, 1901.

Diagnosis

The genus can be identified by the following combination of characters:

Habitus general shape dorso-ventrally flattened, in lateral view total length nearly 4 times height (Figs 2, 4–11A). Pronotum angle not more than 25° (Figs 2, 4–11A). Distance between ocellus and compound eye 2 times ocellus diameter (Fig. 1A). Ocelli large, distance between eyes less than 8 times ocellus diameter (Fig. 1A). Apical reticulation of the tegmen generally developed and reduced in few cases (Figs 4–11A–C). Widest part of postclypeus in frontal view is at midheight (Fig. 1A). Apical curve of tegmen visible in dorsal view (Figs 4–11C). Widest part of habitus in dorsal view at midlength of tegmen (Figs 4–11C). Male subgenital plates is at least 1.5 times longer than pygofer height. Male subgenital plates appendage always present, longer than main plate (Figs 5, 7–8, 10–11F).

Among the Rhinaulacini, *Mioscarta* closely resembles *Trigonoschema* Crispolon & Soulier-Perkins gen. nov. with respect to the distance between ocelli, postclypeus shape in frontal view, postclypeus

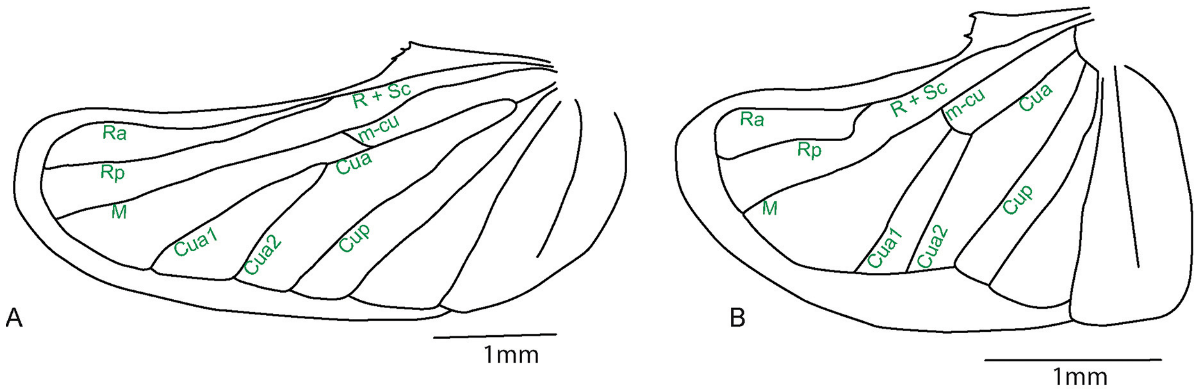

Fig. 3. Posterior wings. **A**. *Mioscarta* sp. **B**. *Poeciloterpa* sp.

longitudinal groove, apical cells of the tegmen, Rp posterior wing, absence of r-m crossvein, and presence of sterno-lateral plate between subgenital plate and pygofer while *Peociloterpa* with respect to postclypeus longitudinal groove, absence of r-m crossvein, presence of sterno-lateral plate between subgenital plate and pygofer and paramere general shape, but they differ by the following characters presented in Table 2 below.

Distribution

India, Indonesia (Borneo, Flores and Sulawesi), Malaysia (Borneo), and Philippines.

Key to the species of Philippine *Mioscarta* Breddin, 1901

1. Tegmen containing red coloration (Figs 4–6, 10) 2
– Tegmen without red coloration (Figs 7–9, 11) 5
2. Basal third of tegmen yellowish (Figs 4, 10) 3
– Basal third of tegmen brown or reddish (Figs 5–6) 4
3. Narrow brown transverse band following basal third then tegmen getting darker and redder toward apex (Fig. 10) .... ***M. semperi*** Jacobi, 1905
– No narrow transverse band but a brown patch within basal area, a large reddish band underlines costal and apical margins (Fig. 4) .... ***M. basilana*** Jacobi, 1927
4. Basal third of tegmen reddish, rest of the tegmen darker brown with red underlining veins (Fig. 5) .... ***M. ferruginea*** (Walker, 1851)
– Tegmen with basal third brown getting lighter in second third and slightly darker in last apical third with red underlying veins (Fig. 6) .... ***M. lutea*** Schmidt, 1925
5. Tegmen coloration containing some black (Figs 8–9) 6
– Tegmen coloration from yellowish to brown only (Figs 7, 11) 7
6. Tegmen entirely black except for the very orange base (Figs 8–9) ***M. obscuripennis*** Schmidt, 1920
– Tegmen basally yellowish brown and apically black .... ***M. flavobasalis*** Jacobi, 1927
7. Tegmen brownish and opaque, darker toward apex, pronotum brownish (Fig. 7) .... ***M. nubisa*** Crispolon & Soulier-Perkins sp. nov.
– Tegmen yellow with some brown and translucent parts, pronotum yellowish with darker irregular patch in middle (Fig. 11) .... ***M. translucida*** Crispolon & Yap sp. nov.

Mioscarta basilana Jacobi, 1927
Fig. 4

Mioscarta basilana Jacobi, 1927: 550.

Mioscarta basilana – Lallemand 1949: 84–85.

Material examined

PHILIPPINES • 3♀♀; "Island of Basilan Baker"; "1926"; "Typus"; "coll. A. Jacobi", "basilana Jac.", "Museum für Tierkunde Dresden (MTD)"; SMTD.

Distribution

Philippines: Mindanao: Basilan.

Remarks

The description provided by Jacobi (1927) was based on four females. Here we provide photographs of a female syntype and its labels. Male remains unknown.

Mioscarta ferruginea (Walker, 1851)
Fig. 5

Triecphora ferruginea Walker, 1851: 672.

Cercopis ferruginea – Stål 1870: 721.
Eoscarta ferruginea – Distant 1908: 132.
Mioscarta ferruginea – Lallemand 1912: 299.

Material examined

PHILIPPINES • ♀; "Leyte Mt. Pangasugan Elev. 300 m; 6 May 1952; C. R. Baltazar", "*Eoscarta* sp. Bal 53" "UPLBMNH HEM-04043" • ♂; "Mt. Maquiling Elev. 200 m.; 23 Jan. 1954; J.N. Gibe", "UPLBMNH HEM-04044" • ♂♀; "Odell Pltn. Tagum, Davao; 16 Jan. 1956; G.B. Viado", "UPLBMNH HEM-04045, 04047" • ♀; "Odell Pltn. Tagum, Davao; 17 Jan. 1956; S.M. Cendaña"; "UPLBMNH HEM-04046" • ♀; "Puting Lupa, Cal.; 3 Aug. 1986; Chantana B. coll."; "UPLBMNH HEM-04997" • ♀; "Ex. grasses CES, Laguna; 2 Jan. 1981; M.A. Tabasa", "Cercopidae", "UPLBMNH HEM-04062" • ♀; "PH. MT. APO, Lake Agco, Kidapawan, Cotabato, Min; 30 Jul. 2015; E.S. Crispolon", "Muséum Paris; MNHN (EH) 24853" • ♂♀; "PH. Lake Sebu, South Cotabato, Mindanao; 20 Jul. 2016; E.S. Crispolon"; "Muséum Paris; MNHN (EH) 24854 to 24855" • 2 ♀♀; "PH. Paniki Falls, Balabag, Kidapawan,

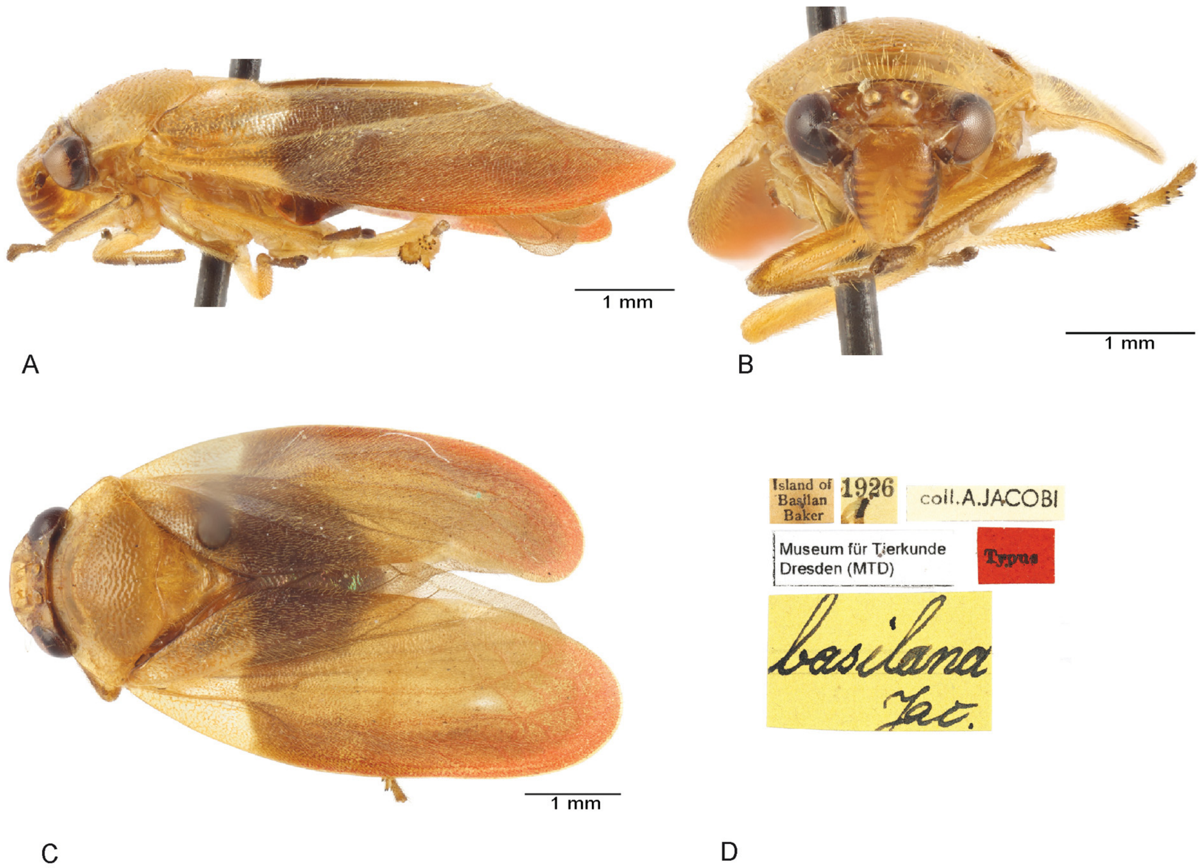

Fig. 4. *Mioscarta basilana* Jacobi, 1927 ♀ syntype habitus. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels.

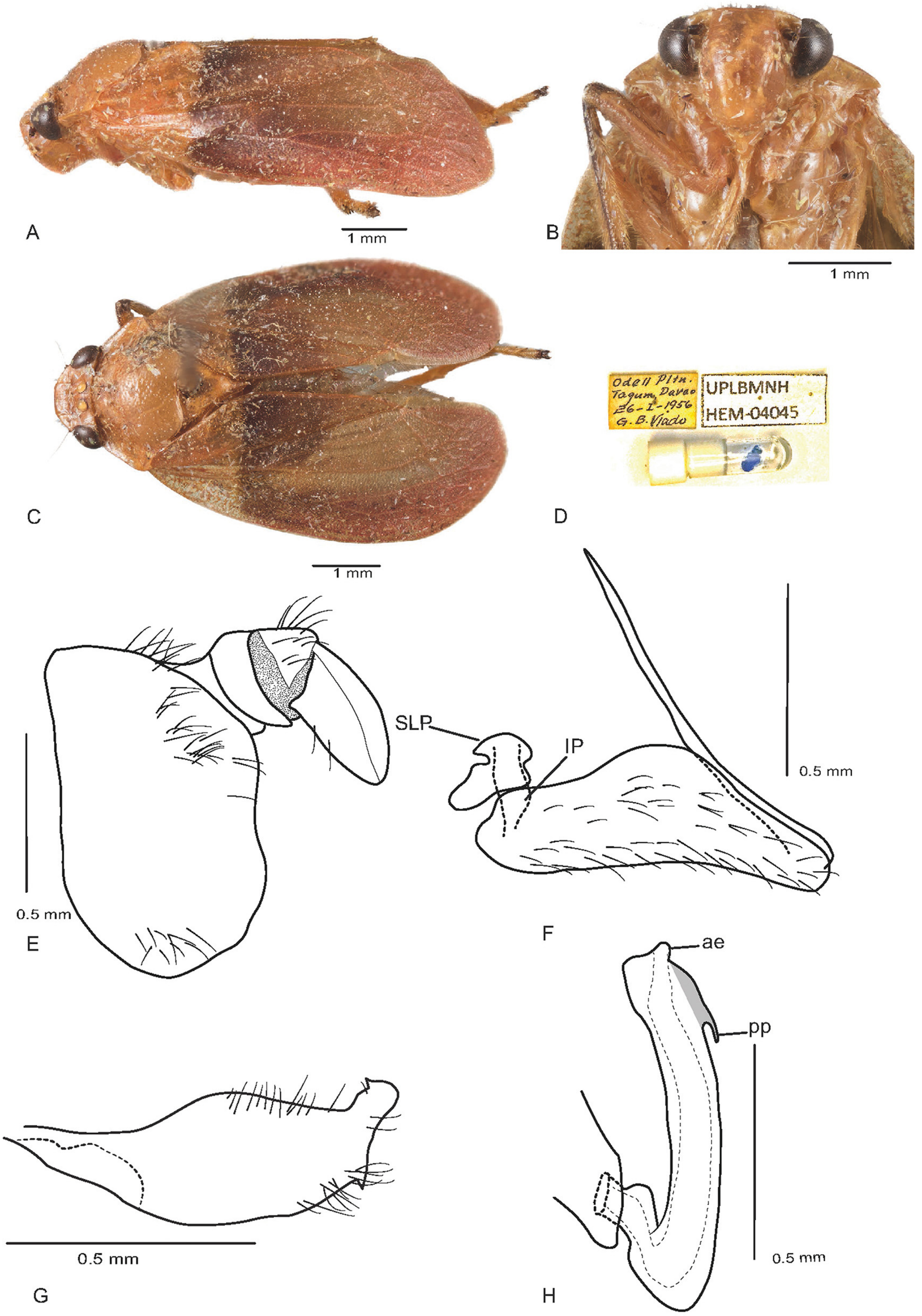

Fig. 5. *Mioscarta ferruginea* (Walker, 1851) habitus and ♂ terminalia in lateral view. **A.** Lateral view. **B.** Frontal view. **C.** Dorsal view. **D.** Labels. **E.** Pygofer and anal tube. **F.** Sterno-lateral, intermediate and subgenital plates. **G.** Paramere. **H.** Aedeagus.

Table 2. Character diagnosis for the three closely related genera from the Philippines.

		Genera		
No.	**Characters**	***Mioscarta***	***Poeciloterpa***	***Trigonoschema* gen. nov.**
1	Habitus general shape in lateral view	dorso-ventrally flattened, total length nearly 4 times height (Figs 2, 4–11A)	globulous, total length around 2.5 times height (Fig. 2C)	not dorso-ventrally flattened, in lateral view total length around 3 times height (Figs 2, 12–16B)
2	Total lenght of the specimen	8 mm – 11 mm	not exceeding 8 mm	9.5 mm – 12.5 mm
3	Pronotum angle	not more than 25° (Figs 2, 4–11A).	42° (Fig. 2C)	around 45° (Figs 2B, 12–16A)
4	Distance between ocellus and compound eye	2 times ocellus diameter (Fig. 1A)	6 times ocellus diameter (Fig. 1C)	less than 4 times ocellus diameter (Fig. 1B).
5	Distance between ocelli	1.5 ocellus diameter (Fig. 1A)	at least 2 times ocellus diameter (Fig. 1C)	1.5 ocellus diameter (Fig. 1B)
6	Size of ocelli evaluated according to the distance between eyes using ocellus diameter	large, distance between eyes less than 8 times ocellus diameter (Fig. 1A)	very small, distance between eyes 16 times ocellus diameter (Fig. 1C)	small, distance between eyes 9-10.5 times ocellus diameter (Fig. 1B)
7	Postclypeus shape in frontal view	ovoid (Fig. 1A)	compressed laterally with lateral sides almost straight (Fig. 1C)	ovoid (Fig. 1B)
8	Widest part of postclypeus in frontal view	mid height (Fig. 1A)	close to frons (Fig. 1C)	close to frons (Fig. 1B)
9	Apical reticulation of the tegmen	generally developed and reduced in few cases (Figs 4–11A, C)	reduced	reduced (Figs 12–16A, C)
10	Apical curve of tegmen in dorsal view	visible (Figs 4–11C)	rarely visible	rarely visible (Figs 12–16C)
11	Widest part of habitus	midlength of tegmen (Figs 4–11C)	before midlength of tegmen	before midlength of tegmen (Figs 12–16C)
12	Apical cells of the tegmen	not concave (Figs 4–11A, C)	concave	not concave (Figs 12–16 A, C)
13	Rp posterior wing	Rp separating from SC+Ra nearly at midlength (Fig. 3A)	Rp separating from SC+Ra after midlength and making a strong bend after separating from SC+ Ra (Fig. 3B)	Rp separating from SC+Ra nearly at midlength, (Fig. 3A (Fig. 13E))
14	Subgenital plates length	at least 1.5 times longer than pygofer height (Figs 5, 7–8, 10–11F).	slightly longer than pygofer height	clearly shorter than 1.5 times longer than pygofer height (Figs 12, 14, 16F)
15	Subgenital plates fine appendage	always present, longer than the main plate (Figs 5, 7–8, 10–11F).	generally absent, if present shorter than the main plate	generally present but shorter than the main plate (Figs 12, 14 & 16F)
16	Paramere general shape	not globose and without protrusion on lateral side (Figs 5, 7–8, 10–11G).	not globose and without protrusion on lateral side	globose with protrusion on lateral side (Figs 12, 14, 16G).

Cotabato, Min; 18 March 2017; N. Melano", "Muséum Paris, MNHN (EH) 24856 to 24857" • ♀; "PH. Lapan, Kidapawan, N.C.; 5 May 2017; D.M. Cantil"; ECpc 054 • ♂; "Ph. Kansal, Kid. Cot.; 18 Nov. 2017; Pasion C.A."; ECpc 056 • ♂; "PH. Lake AGCO; 21 Dec. 2017; ESC"; Philippines; ECpc 057 • ♂; "Philippines, Mt. Apo, Bongolanon, Magpet N. Cotabato"; "27 to 28 Jun. 2019; JS Ramos"; "séquençage par Elorde Crispolon C-00027"; "Muséum Paris, MNHN (EH) 24858".

Description

Male Terminalia

In lateral view, posterior margin of pygofer slightly undulating (Fig. 5E). Subgenital plate (Fig. 5F) very long relative to height of pygofer with fine tapering appendage slightly longer than main plate, dorsal margin of plate largely rounded, sterno-lateral plate present, largely concave subapically on dorsal and ventral margins. Intermediate plate present, rectangular, linking internal side of lateral and subgenital plates. Paramere (Fig. 5G) not globose, dorsal margin rounded and regularly curving, apex with a sharp spine pointing dorsally, ventral margin regularly rounded with subapical part bearing a spiniform process pointing ventrally. Aedeagus (Fig. 5H) with basal third of dorsal margin angled and sharply bent in acute angle and last $^2/_3$ vertical and roughly C-shaped, slightly humped in apical part of dorsal margin before apical extension, apical extension pointing postero-dorsally, posterior protrusion thin and hook-shaped, postero-dorsal protrusion absent.

Type Locality

Philippines: Visayas: Samar.

Distribution

Philippines: Luzon Island, Visayas: Samar and Leyte, Mindanao Island.

Remarks

Walker (1851) based his description on two male specimens "a" and "b" from the "Philippine Islands" coming from the collections of Mr Cuming and Mr Wood. Both specimens are currently kept in the NHM. According to Walker' description and Lallemand' key (1949), we identified specimens, for which we provide photographs and male terminalia description and drawings.

Mioscarta lutea Schmidt, 1925
Fig. 6

Mioscarta lutea Schmidt, 1925: 36.

Mioscarta lutea – Lallemand 1949: 84–85.

Type Locality

Philippines: Luzon: Baguio, Benguet province.

Distribution

Philippines: Luzon Island.

Remarks

Schmidt (1925) described this species based on a single female specimen. Therefore, the description does not contain any information on the male terminalia. Here, we provide photographs of the female holotype and labels. Male remains unknown.

Mioscarta nubisa Crispolon & Soulier-Perkins sp. nov.
urn:lsid:zoobank.org:act:17979C2C-D071-44EA-9D16-974A742808A1
Fig. 7

Diagnosis

General shape of *M. nubisa* is similar to *M. obscuripennis* but are distinctly different in color. *M. nubisa* in dorsal view presents a brownish and opaque tegmen, darker toward apex, pronotum brownish and yellowish or brown legs while *M. obscuripennis* has a dark brown or black tegmen, brown or orange pronotum and orange legs.

Etymology

Species name refers to the light to darker coloration forming a cloudy pattern on the tegmen and is the female superlative of the latin word "nubis" which means cloudy.

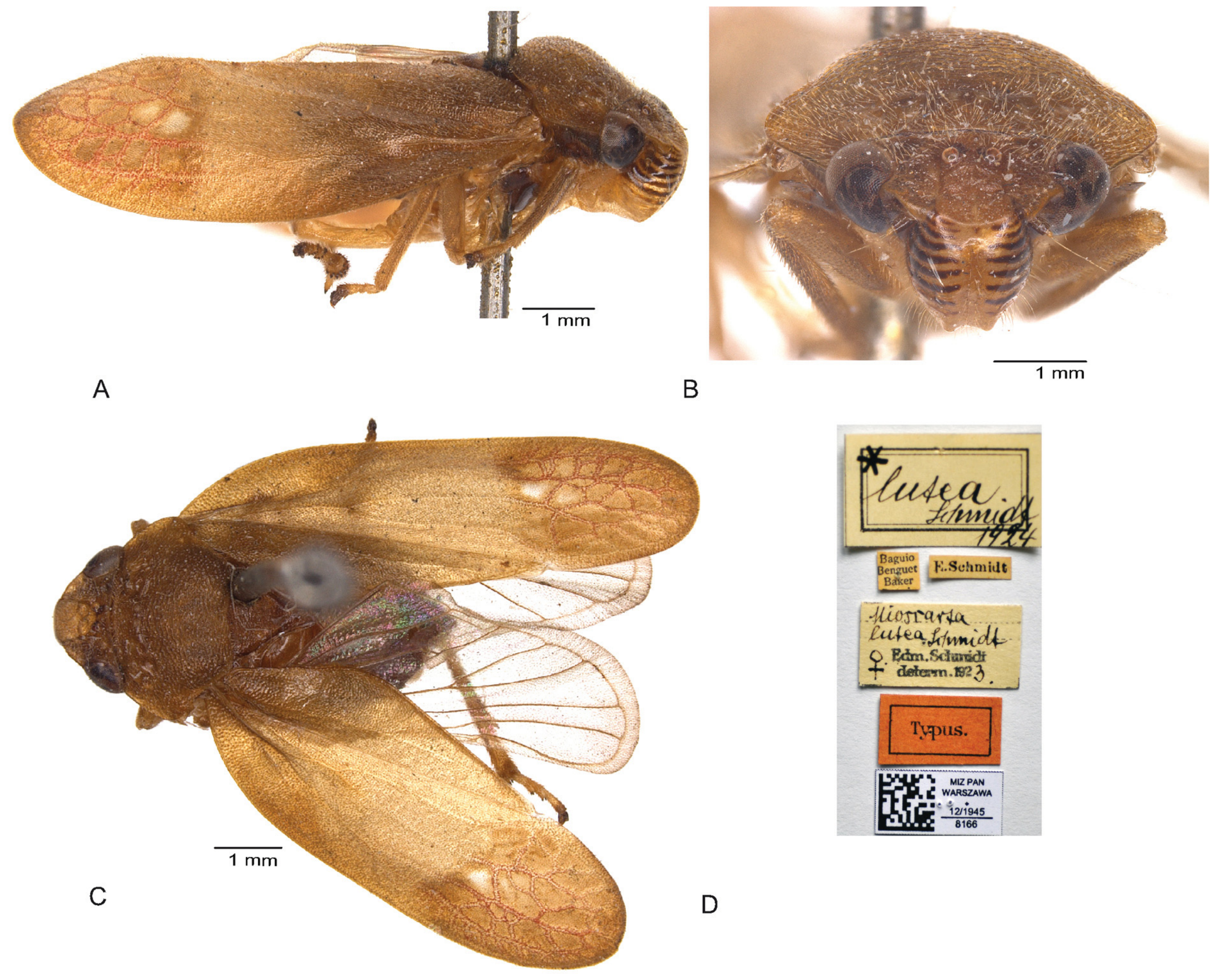

Fig. 6. *Mioscarta lutea* Schmidt, 1925, ♀ holotype habitus. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels.

Material examined

Holotype

PHILIPPINES • ♂; "Philippines, Camarines Sur, Luzon isl. Mt Isarog Natural Park, Panicuason Naga"; "Muséum Paris; 1 May 2011; S. A. Yap, M.V. Yngente, O.L. Eusebio rec."; UPLBMNH HEM-05052"; UPLBMNH.

Paratypes

PHILIPPINES • ♀; "Trinidad; 22 June 1951; C.R. Baltazar"; "UPLBMNH HEM 04064"; UPLBMNH • ♂; "Philippines, Camarines Sur, Luzon isl. Mt Isarog Natural Park, Panicuason Naga"; "Muséum Paris, 1 May 2011; S.A. Yap, M.V. Yngente, O.L. Eusebio rec."; UPLBMNH HEM-05053"; UPLBMNH • 16 ♂♂; "Philippines, Luzon, mount Isarog, Light trap"; "Muséum Paris; 31 May 2011; S. Yap Rec."; "Muséum Paris, MNHN (EH) 23645 to 23646, 23648, 24748, 24859 to 24870"; MNHN • ♂; "Philippines, Luzon isl, Laguna, Los Banos, Mount Makiling; 14º082' 29" N, 121º12.242" E; "Muséum Paris; 7 Nov. 2008; 605 m, Primary forest, at sight, A. Soulier-Perkins, S. Yap Rec."; "Muséum Paris, MNHN (EH) 23644"; MNHN.

Description

Body. Length 10 mm (tegmina included), width 5 mm.

Head (Figs 1A, 7B). In dorsal view, large ocelli, distance between eyes less than 8 times ocellus diameter, distance between ocelli equals one ocellus diameter, distance between ocellus and compound eye 2 times ocellus diameter, ocelli closer to each other than from compound eyes. Eyes not prominent, length 1.44 times than wide. Vertex and frons longitudinal median carina absent. Vertex slightly longer than wide with 3 times ocellus diameter in between two vertex grooves outside ocelli and 3.5 times ocellus diameter between anterior and posterior vertex margins. Postclypeus with longitudinal furrow, slightly swollen and ovoid shape in frontal view, widest part at mid height (Figs 1A, 7B), not receding and prior to anteclypeus where it bends forming obtuse angle in lateral view (Fig. 7A). Rostrum long, reaching but not surpassing mesocoxae. Thorax (Figs 2A, 7A–C). In dorsal view, pronotum with anterior concavities on each side, anterior margin of pronotum as wide as posterior margin of head including eyes, anterolateral margin curved, posterior margin grooved, postero-lateral margin slightly concave, longer than anterolateral margin, humeral angle rounded. In lateral view, pronotum curving not more than 25º (Figs 2, 7A). Scutellum as long as wide with large median dimple (Fig. 7C). Tegmen (Fig. 7A–C). R bifurcates on apical half, M bifurcate on basal third, apical reticulation well developed without concave apical cells. Posterior wing (Fig. 3A), Rp separating from SC+Ra nearly at midlength, M reaches ambient vein, Cua and Cup fused at base and m-cu links M to Cua before Cua bifurcation, common base for Cup and Cua originate at base of wing, posterior wing with 7 longitudinal veins and 5 apical cells between SC+Ra and Cup, angular protrusion of costal margin near its base present. Metafemur with apical spine in inner margin, metatibiae bearing 1 lateral spine.

Male terminalia. In lateral view, posterior margin of pygofer largely convex in middle with slight curved on last third (Fig. 7E). Subgenital plates (Fig. 7F) very long relative to height of pygofer with fine tapering appendage longer than main plate, dorsal and ventral margin of main plate straight, sterno-lateral plate present, slightly elongated. Intermediate plate present, elongated, roughly oblong shaped, linking internal sides of lateral and subgenital plates. Paramere (Fig. 7G) not globose, dorsal margin convex and regularly curving finishing by a sharp process pointing dorsally, ventral margin convex and largely angled subapically, apex with spiniform process pointing postero-ventrally. Aedeagus (Fig. 7H) with basal third of dorsal margin regularly bent without angle before the bent part, last $^2/_3$ vertical and S-shaped, ventral margin regularly curved, apical extension pointing posteriorly, posterior protrusion axe-shaped with edge prolonged ventrally by a straight, long and thin extension, postero-dorsal protrusion absent.

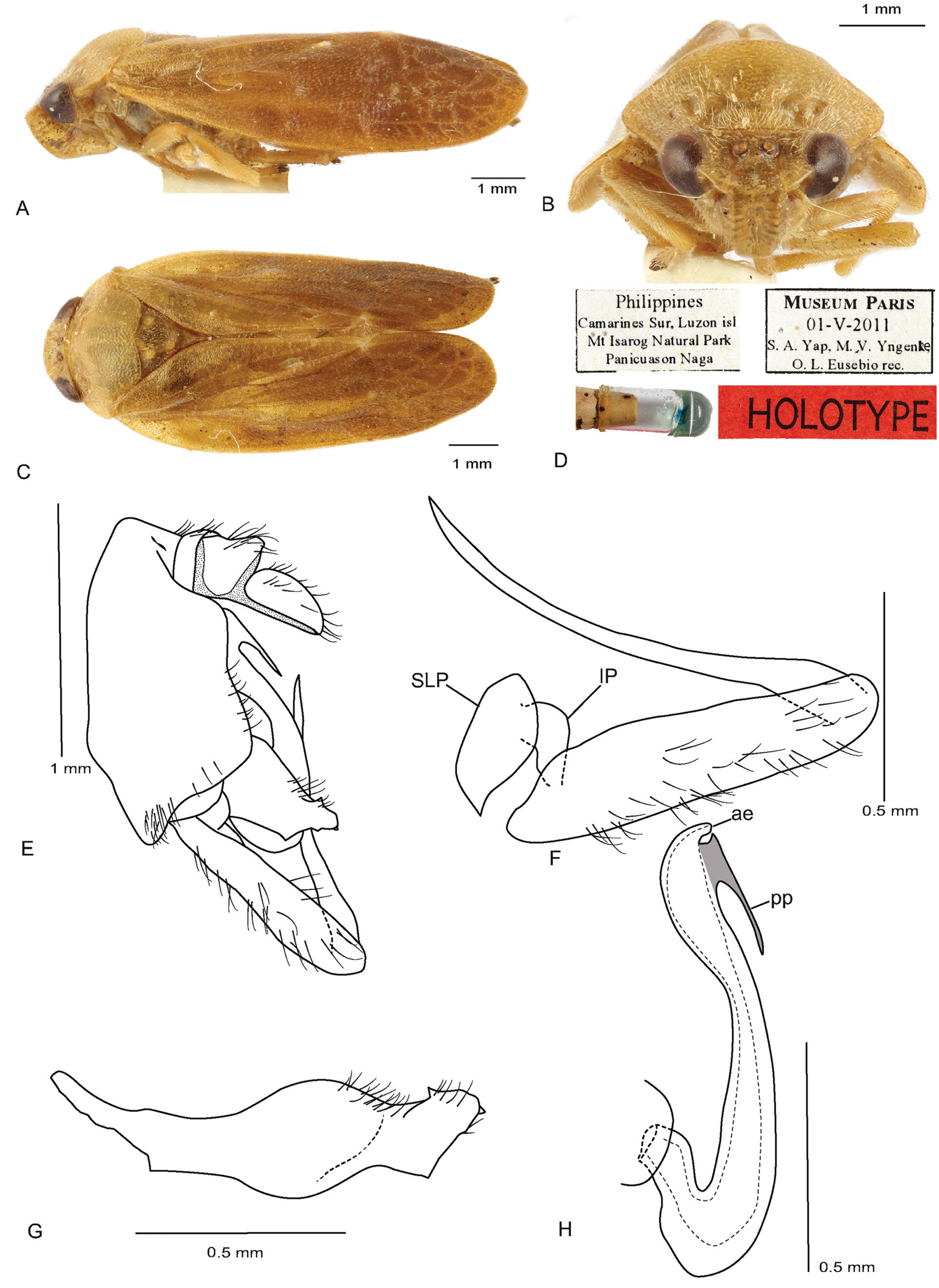

Fig. 7. *Mioscarta nubisa* Crispolon & Soulier-Perkins sp. nov. holotype, habitus and ♂ terminalia in lateral view. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels. **E**. Terminalia. **F**. Sterno-lateral, intermediate and subgenital plates. **G**. Paramere. **H**. Aedeagus.

Table 3. Primers used for amplifying and sequencing the molecular markers.

Primers	Sequence	References
	Mitochondrial coding genes	
COI		
LCO1490-JJ	CHACWAAYCATAAAGATATYGG	Astrin & Stûben 2008
HCO2198-JJ	AWACTTCVGGRTGVCCAAARAATCA	Astrin & Stûben 2008
	Nuclear Ribosomal genes	
18S		
a2.0 (F)	ATGGTTGCAAAGCTGAAAC	Whiting *et al.* 1997
9R (R)	GATCCTTCCGCAGGTTCACCTAC	Whiting 2002
28S		
EE (F)	CCGCTAAGGAGTGTGTAA	Hillis & Dixon 1991; Cryan *et al.* 2000
MM (R)	GAAGTTACGGATCTARTTTG	Hillis & Dixon 1991; Cryan *et al.* 2000
Lalt (F)	CCTCGGACCTTGAAAATCC	Dietrich *et al.* 2001
Galt (R)	TGTCTCCTTACAGTGCCAGA	Dietrich *et al.* 2001
V (F)	GTAGCCAAATGCCTCGTCA	
X (R)	CACAATGATAGGAAGAGCC	Hillis & Dixon 1991; Cryan *et al.* 2000
	Nuclear protein coding genes	
Histone 3		
HexAF (F)	ATGGCTCGTACCAAGCAGACGGC	Colgan *et al.* (1998)
HexAR (R)	ATATCCTTGGGCATGATGGTGAC	Colgan *et al.* (1998)

Color. Head, antennae, pronotum, abdomen, legs scutellum light brown, rostrum brownish highlighted with white. Tegmen opaque light brown to brown.

Type locality

Philippines: Camarines Sur, Luzon isl. Mt Isarog Natural Park, Panicuason Naga.

Distribution

Philippines: Luzon Island.

Mioscarta obscuripennis Schmidt, 1920
Figs 8–9

Mioscarta obscuripennis Schmidt, 1920: 47.

Mioscarta obscuripennis – Lallemand 1949: 84–85.

Material examined

PHILIPPINES • 4 ♂♀; "Baguio, Phil.; 22 Jun. 1952; L.B. Uichanco", "UPLBMNH-HEM 04053, 04057 to 04059, 04063" • ♀; "Mt. Trail 6000 ft; 25 Jun. 1957; R. LUIS"; "UPLBMNH HEM 04048" • ♂; "EX. grasses; 27 Jan. 1980; NBG REAL, QUEZON J.B. BALATIBAT "UPLBMNH-HEM 04060" • ♂; "MSAC; 12 Aug. 1984; A.U. MANCIA", "UPLBMNH-HEM 04990" • ♀; "QUEZON: NBG; 19 Aug. 1989; VP Gapud"; "UPLBMNH-HEM 04991" • ♂; "MSAC; 12 Aug. 1984; A.U. MANCIA"; "UPLBMNH-HEM 04992" • 2 ♂♂; "Mt. Polis, Baubo Mtn. Province 22 Dec. 2000; Shem Padua"; "UPLBMNH-HEM 04993 to 04994" • ♂; "QUEZON REAL Nat. Bot. Garden; 1–2 Apr. 1977; V.P.GAPUD"; "UPLBMNH-HEM 04995" • ♀; "Philippines, Negros volcan Canlaon, champ de coqs, 10º25'29" N, 123º05'36" E"; "Muséum Paris, 1050 m; 28 Oct. 2010; D. Ouvrard Rec.", "Muséum

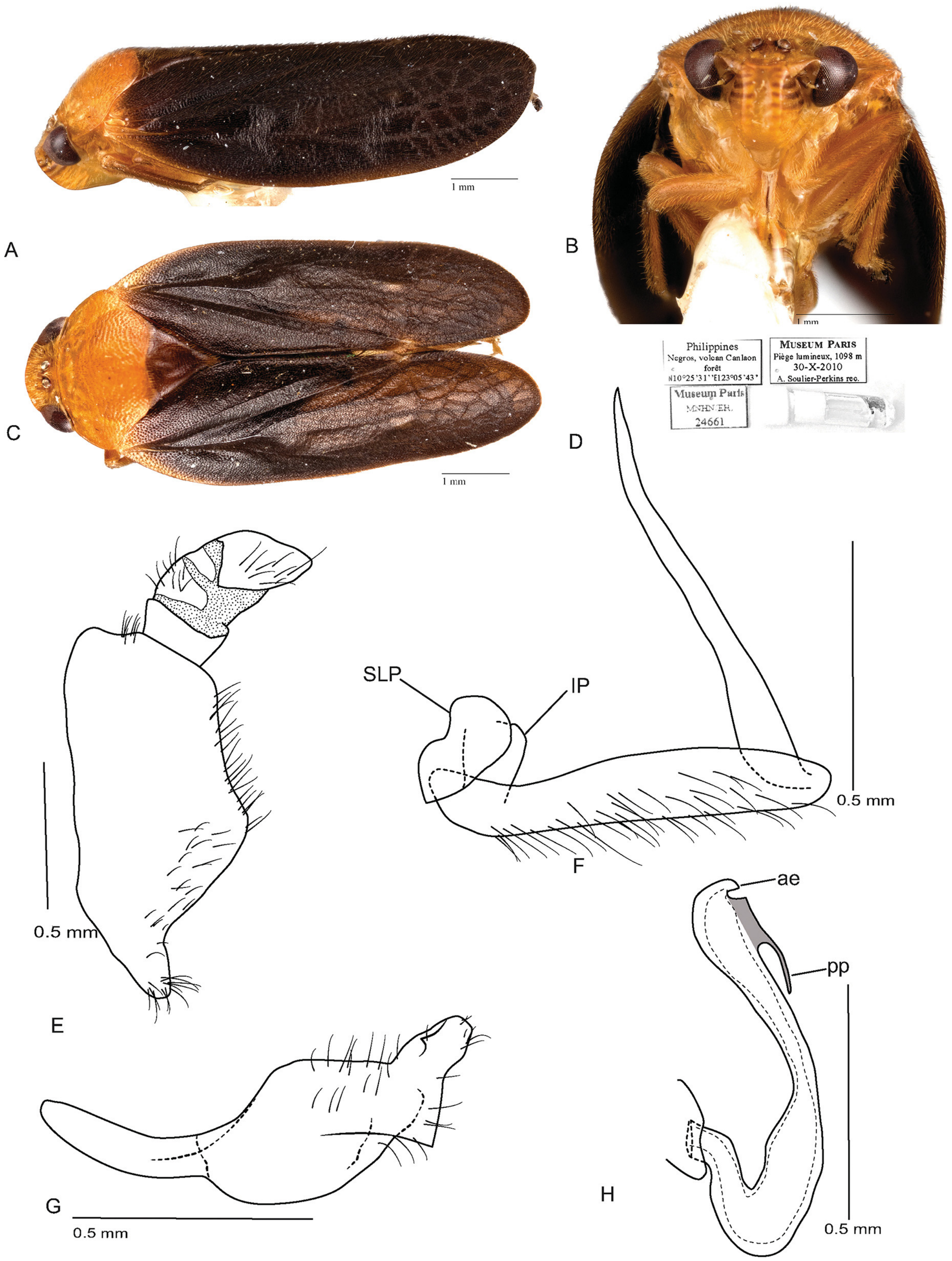

Fig. 8. *Mioscarta obscuripennis* Schmidt, 1920, habitus and ♂ terminalia in lateral view. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels. **E**. Pygofer and anal tube. **F**. Sterno-lateral, intermediate and subgenital plates. **G**. Paramere. **H**. Aedeagus.

Paris, MNHN (EH) 24809” • ♀; “Philippines, Negros volcan Canlaon, champ de coqs, 10º25'29" N, 123º05'36" E”; “Muséum Paris, 1050 m; 28 Oct. 2010; A Soulier-Perkins Rec.”; “Muséum Paris, MNHN (EH) 23650” • 3 ♂♂; “Philippines, Negros volcan Canlaon, forêt, 10º25'34" N, 123º05'37" E”, “Muséum Paris, 1070 m; 29 Oct. 2010; D. Ouvrard Rec.” “Muséum Paris, MNHN (EH) 24814 to 24816” • 3 ♂♂; “Philippines, Negros volcan Canlaon, forêt; 10º25'31" N, 123º05'43" E”; “Muséum Paris, 1098 m; 30 Oct. 2010; D. Ouvrard Rec.” “Muséum Paris, MNHN (EH) 24805 to 24807” • 17 ♂♀; “Philippines, Negros volcan Canlaon, forêt, 10º25'31" N, 123º05'43" E”; “Muséum Paris, Piège lumineux 1098 m; 30 Oct. 2010; A. Soulier-Perkins rec.”, “Muséum Paris, MNHN (EH) 24661, 24872 to 24886, 24808” • 3 ♂♂; “Philippines, Negros volcan Canlaon, forêt, 10º25'36" N, 123º05'37" E”; “Muséum Paris, Piège lumineux 1057 m; 31 Oct. 2010; D. Ouvrard Rec.” “Muséum Paris, MNHN (EH) 24900 to 24902” • 14 ♂♀; “Philippines, Negros volcan Canlaon, forêt, 10º25'36" N, 123º05'37" E”; “Muséum Paris,

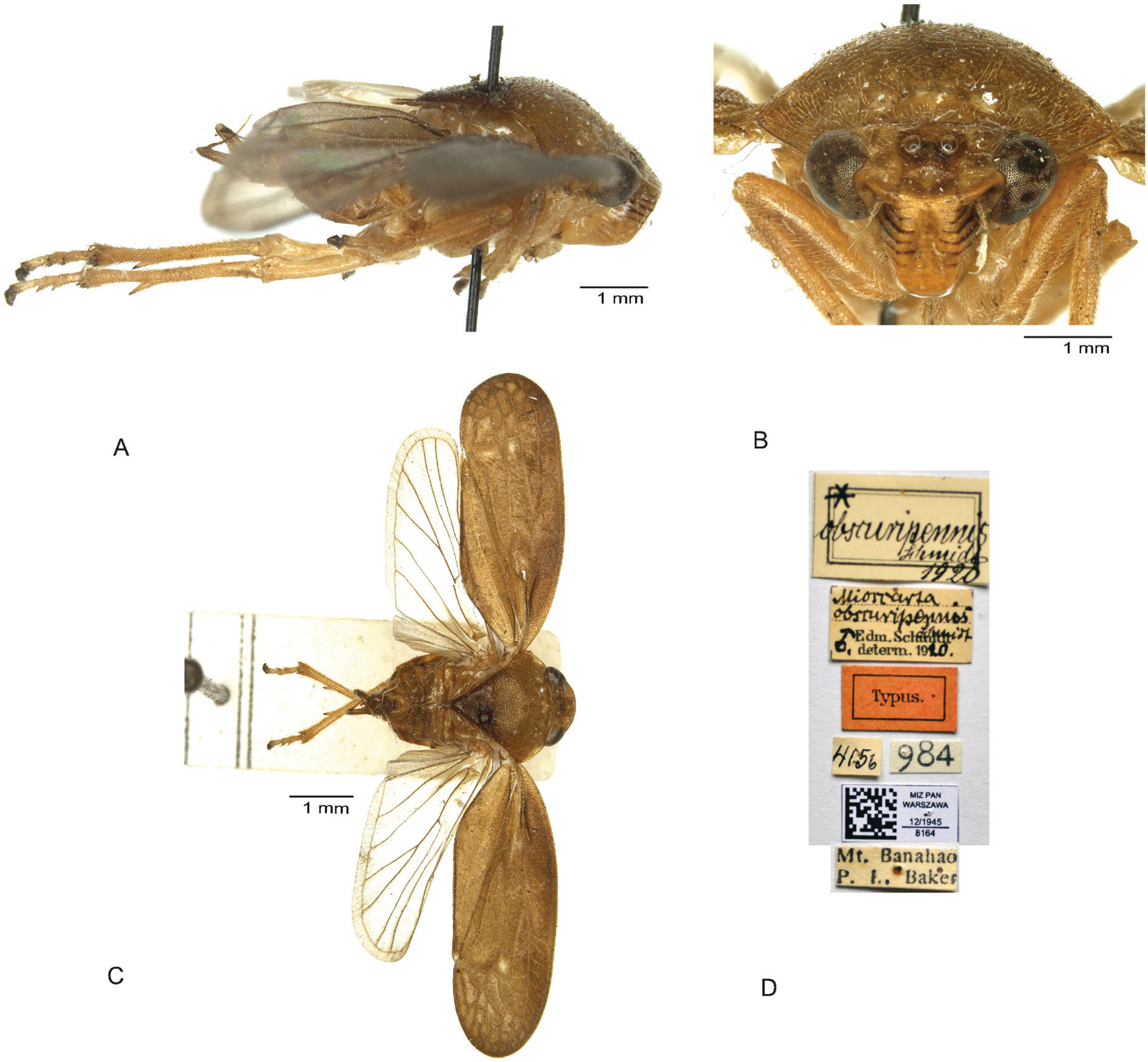

Fig. 9. *Mioscarta obscuripennis* Schmidt, 1920, ♂ holotype habitus. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels E.

Table 4. Taxa included in the phylogeny with their voucher code, geographical origin and GenBank accession number for each marker used. [a]Isolates; [b]From GenBank; – Indicating absence of sequence.

Taxa	Voucher Code	Geographical origin	GenBank Acession Number			
			H3	COI	18S	28S
Ingroup (Cercopidae)						
Eoscarta philippinica	C-00060[a]	Philippines	OK266891	OK094471	–	OK111059
Eoscarta borealis	C-00105[a]	Thailand	OK266892	–	OK111085	OK111060
Eoscarta borealis	C-00087[a]	Vietnam	OK266893	OK094467	–	OK111062
Eoscarta liternoides	C-00106[a]	Thailand	–	OK094472	OK111086	OK111061
Jacobsoniella bakeri	C-00008[a]	Philippines	OK266894	OK094466	OK111087	OK111063
Mioscarta ferruginea	C-00027[a]	Philippines	–	–	OK111088	OK111064
Mioscarta semperi	C-00017[a]	Philippines	–	–	OK111090	OK111066
Mioscarta semperi	C-00022[a]	Philippines	–	OK094469	OK111091	OK111067
Mioscarta obscuripennis	C-00166[a]	Philippines	–	–	OK111089	OK111065
Poeciloterpa altissima	C-00042[a]	Philippines	OK266895	–	OK111092	OK111068
Poeciloterpa atra	C-00023[a]	Philippines	–	OK094465	OK111093	OK111069
Poeciloterpa latipennis	C-00026[a]	Philippines	–	OK120386	OK111094	OK111070
Poeciloterpa mangkas	C-00012[a]	Philippines	–	OK094470	OK111095	OK111071
Poeciloterpa minuta	C-00038[a]	Philippines	–	–	OK111096	OK111072
Trigonoschema manoborum	C-00148[a]	Philippines	–	OK094468	OK111097	OK111073
Trigonoschema negrosensis	C-00167[a]	Philippines	–	OK094463	OK111098	OK111074
Trigonoschema rubercella	C-00075[a]	Philippines	–	OK094464	OK111099	OK111075
Wawi mehi	C-00095[a]	Papua New Guinea	OK266896	–	OK111100	OK111076
Outgroups Aphroporidae						
Aphrophora alni	C-00190[a]	France	OK266889	OK094476	OK111082	OK111056
Aphrophoridae sp.	C-00161[a]	Vietnam	OK266890	–	OK111083	OK111057
Clovia sp.	C-00004[a]	Philippines	OK266887	OK094478	OK111080	OK111054
Clovia sp.	C-00005[a]	Philippines	OK266888	OK094477	OK111081	OK111055
Perinoia sp.	C-00001[a]	Philippines	OK266884	OK094474	OK111077	OK111051
Perinoia sp.	C-00002[a]	Philippines	OK266885	OK094475	OK111078	OK111052
Perinoia sp.	C-00003[a]	Philippines	OK266886	OK094473	OK111079	OK111053
Clastopteridae						
Clastoptera brunnea	01-07-18-58[b]	USA	AY744862	–	AY744790	AY744824
Clastoptera xanthocephala	01-07-15-06[b]	USA	GU447121	–	GU446795	GU446885
Iba sp.	C-00013[a]	Philippines	–	OK094479	OK111084	OK111058
Machaerotidae						
Apomachaerota reticulata	06-02-15-17[b]	Malaysia	GU447197	–	GU446882	GU446977
Grypomachaerota turbinata	06-02-15-19[b]	Malaysia	GU447198	–	GU446883	GU446978
Machaerota pugionata	04-05-11-45[b]	Australia	–	–	GU446815	GU446906
Machaerota takeuchii	04-10-15-80[b]	Japan	–	–	GU446828	GU446918

Piège lumineux 1057 m; 31 Oct. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN (EH) 23651, 24887 to 24899" • 2 ♂♂; "Philippines, Negros volcan Canlaon, forêt; 10º25'35" N, "123º05'51" E"; "Muséum Paris, 1117 m; 2 Nov. 2010; D. Ouvrard Rec.", "Muséum Paris, MNHN (EH) 24810 to 24811" • ♂; "Philippines, Negros volcan Canlaon, forêt; 10º25'35" N, "123º05'51" E"; "Muséum Paris, 1117 m; 2 Nov. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN (EH) 24812" • ♂; "Philippines, Negros volcan Canlaon, milieu anthropisé; 10º25'23" N, 123º04'46" E"; "Muséum Paris, Piège lumineux 745 m; 3 Nov. 2010; D. Ouvrard Rec.", "Muséum Paris, MNHN (EH) 24813" • 3 ♂♀; "Philippines, Luzon, mount Isarog, Light trap'", "Muséum Paris; 31 May 2011; S. Yap Rec.", "Muséum Paris, MNHN (EH) 23649, 24803 to 24804".

Description

Male terminalia. In lateral view, posterior margin of pygofer hump shaped in middle, last third abruptly truncated (Fig. 8E). Subgenital plates (Fig. 8F) very long relative to height of pygofer with fine tapering appendage longer than main plate, dorsal margin regularly convex and slightly curving on basal part, ventral margin roughly straight. Sterno-lateral plate present and roughly bean-shaped. Intermediate plate present, square shaped with a corner truncated, linking internal sides of lateral plate and subgenital plate. Paramere (Fig. 8G) dorsal margin rounded then regularly curving up to apex. Lateral margin with spine located subapically pointing dorsally, ventral margin rounded then sharply angled subapically pointing ventrally, apex without any spines. Aedeagus (Fig. 8H) with basal third of dorsal margin regularly bent, basal half enlarged then largely narrowed in the middle and gradually enlarging up to apex, roughly C-shaped, ventral margin regularly curved, apical extension pointing posteriorly, posterior protrusion axe-shaped with long thin extension prolonging the edge ventrally and slightly curving, postero-dorsal protrusion absent.

Type Locality

Philippines: Luzon: Mount Banahao, Quezon Province.

Distribution

Philippines: Luzon Island, Baguio, Quezon province, Mountain province; Visayas, Negros Island.

Remarks

Schmidt (1920) described this species from a single male specimen with few details on the male terminalia. Here, we provide, a detailed illustration and description of male terminalia from identified specimens using Schmidt description (Fig. 8), along with photographs of the male holotype and its labels (Fig. 9). The coloration of the specimen we identified and the holotype are different but the specimen from which we illustrated the male terminalia (Fig. 8) has a brighter coloration and is the closest to the description given by Schmidt while the holotype has a faded coloration.

Mioscarta semperi Jacobi, 1905
Fig. 10

Mioscarta semperi Jacobi, 1905: 21.

Mioscarta semperi – Schmidt 1909: 239–240. — Lallemand 1912: 117; 1949: 84–85. — Jacobi 1927: 549.

Material examined

PHILIPPINES • ♀; "Samar Calbayog Elev. – Sea level; 8 May 1950; R. Araneta Jr.", "*Eoscarta* sp. Bal '53" "UPLBMNH HEM-04054" • ♂; " Calambog Ala Valley Elev.; 8 June 1950 S;. M Cendaña"

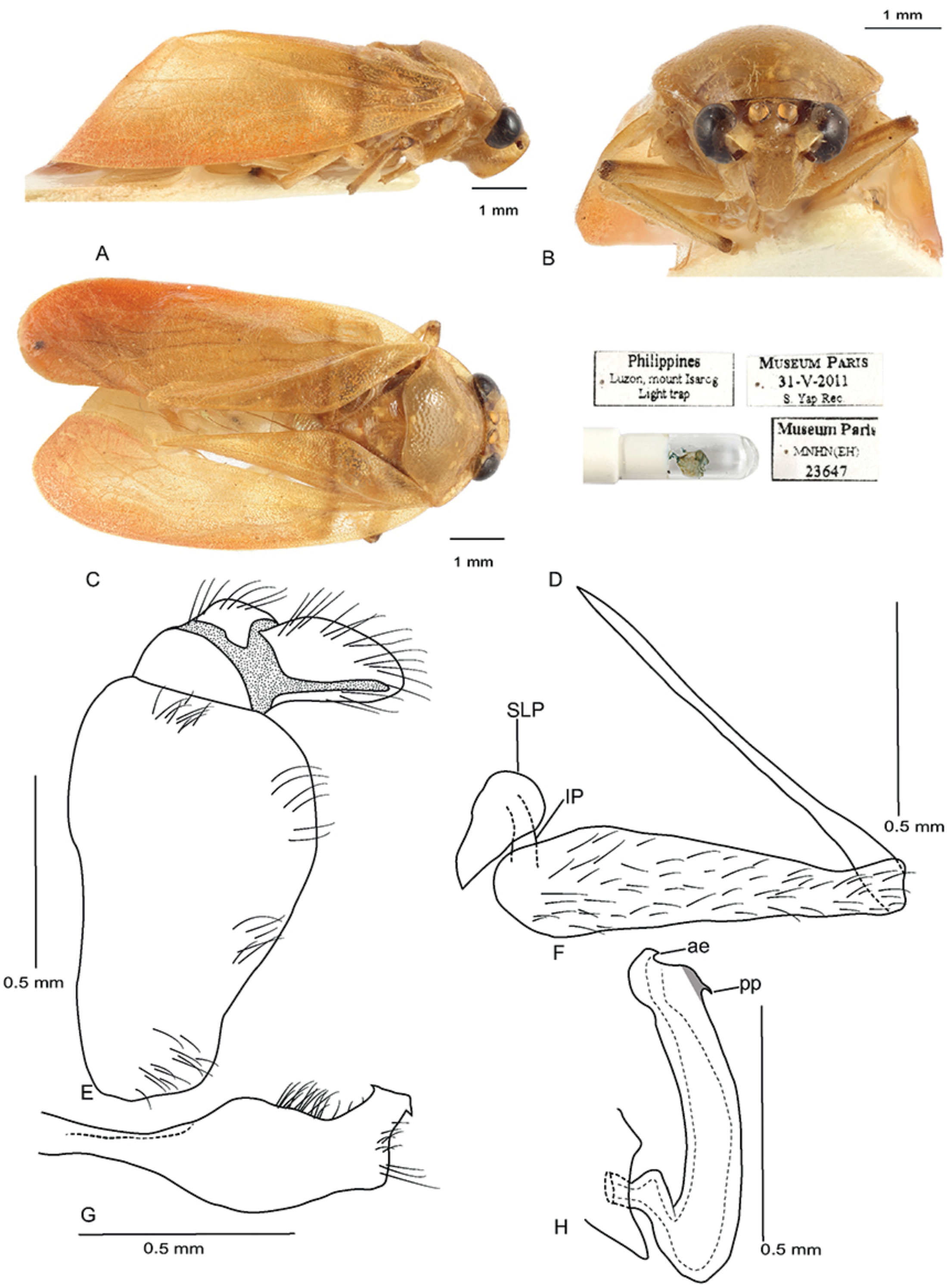

Fig. 10. *Mioscarta semperi* Jacobi, 1905 habitus and ♂ terminalia in lateral view. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels. **E**. Pygofer and anal tube. **F**. Sterno-lateral, intermediate and subgenital plate. **G**. View paramere. **H**. View aedeagus.

"*Eoscarta* sp.1" "UPLBMNH HEM-04061" • ♀♂; "BUKIDNON Impalitaw BFD; 19 Nov. 1988; VPG" "UPLBMNH HEM-04996, 04998"• 2 ♂♂; "Philippines, Camarines Sur, Luzon isl. Mt Isarog Natural Park, Panicuason Naga", "Muséum Paris; 1 May 2011; S.A. Yap, M.V. Yngente, O.L. Eusebio rec.", "Muséum Paris, MNHN (EH) 24821 to 24822" • 3 ♂♂; "Philippines Luzon Mount Isarog Light trap", " Muséum Paris; 31 May 2011; S. Yap Rec", "Muséum Paris, MNHN (EH) 23647, 24823 to 24824" • ♀; "PH. MT. Makiling Los Baños, Laguna Luz; 21 Nov. 2016; WS HWANG", "séquençage par Elorde Crispolon C-00085", "Muséum Paris, MNHN (EH) 24817" • ♀; "Brgy. Irosin, Sorsogon; 2 Feb. 2017; Coll. AK AMARGA"; "Muséum Paris, MNHN (EH) 24818" • ♀; "Ph. Brgy Perez, Kidapawan City; 5 May 2017; C.S. Satohito", "ECpc 057", "Ph. Mt. Akir Akir, Pigcawayan, North Cotabato; 8–9 Sept. 2018; G. Biacolo, K.C. Crispolon & R. Guillermo"; "séquençage par Elorde Crispolon C-00017", "Muséum Paris, MNHN (EH) 24819", "Ph. Brgy Kidama, Matalam, North Cotabato; 14 Mar. 2019; K.C. Crispolon", "séquençage par Elorde Crispolon C-00022", "Muséum Paris, MNHN (EH) 24820".

Description

MALE TERMINALIA. In lateral view, posterior margin of pygofer regularly convex last third slightly curved (Fig. 10E). Subgenital plates (Fig. 10F) very long relative to height of pygofer with fine tapering appendage slightly longer than main plate, dorsal margin of plate regularly rounded, ventral margin straight. Sterno-lateral plate present, slightly elongated. Intermediate plate present, cylindrical, linking internal side of lateral and subgenital plates. Paramere (Fig. 10G) not globose, dorsal margin rounded and regularly curving, apex with a sharp spine pointing antero-dorsally, ventral margin regularly rounded then subapical part largely rounded, protruding and finishing with a sharp spine pointing ventrally. Aedeagus (Fig. 10H) with basal third of dorsal margin angled and sharply bent in acute angle and last ⅔ vertical and roughly C-shaped, slightly humped in apical part of dorsal margin before apical extension, apical extension pointing posteriorly, posterior protrusion thin very short and spine-shaped, postero-dorsal protrusion absent.

Type Locality

Philippines: Philippine Islands.

Distribution

Philippines: Luzon, Visayas and Mindanao Islands.

Remarks

According to what Jacobi (1905) mentioned at the end of the description "Mus. Berol. Nr. 9107: Semper coll., 2 Ex.". He examined two specimens and described this species from atleast one female without a description of the male terminalia. We illustrate and describe them here based on a specimen identified using Lallemand's (1949) key.

Mioscarta translucida Crispolon & Yap sp. nov.

urn:lsid:zoobank.org:act:7D16117A-699D-4C7E-B037-E290B274EA8C

Fig. 11

Diagnosis

M. translucida is the only species with tegmen translucid without any other coloration.

Etymology

The species name refers to the translucid tegmen and is based on the latin word "translucidus" which means allowing light to pass through.

Material examined

Holotype

PHILIPPINES • ♂; "Philippines, Camarines Sur, Luzon isl. Mt Isarog Natural Park, Panicuason Naga", "Muséum Paris; 1 May 2011; S.A. Yap, M.V. Yngente & O.L. Eusebio rec."; "Muséum Paris, MNHN (EH) 24749"; MNHN.

Description

Body. Length 10 mm (tegmina included), width 4 mm.

Head (Figs 1A, 11B). In dorsal view, large ocelli, distance between eyes less than 8 times ocellus diameter, distance between ocelli equals one ocellus diameter, distance between ocellus and the compound eye 2 times ocellus diameter, ocelli closer to each other than from compound eyes. Eyes not prominent, length 1.44 times than wide. Vertex and frons longitudinal median carina absent. Vertex as long as wide with 3 times ocellus diameter in between two vertex grooves outside ocelli and 3 times ocellus diameter between anterior and posterior vertex margins. Postclypeus with longitudinal furrow, slightly swollen and ovoid shape in frontal view, widest part at mid height (Figs 1A, 11B), not receding and prior to anteclypeus where it bends forming right angle in lateral view (Fig. 11A). Rostrum long, surpassing mesocoxae. Thorax (Figs 2A, 11A-C). In dorsal view, pronotum with anterior concavities on each side, anterior margin as wide as posterior margin of head including eyes, anterolateral margins curved, posterior margin grooved, postero-lateral margins slightly concave, longer than anterolateral margins, humeral angle rounded. In lateral view, pronotum curving not more than 25º (Figs 2, 11A) Scutellum as long as wide with large median dimple (Fig. 11C). Tegmen (Fig. 11A–C). R bifurcates on apical half, M bifurcate on basal third, apical reticulation not well developed without concave apical cells. Posterior wing (Fig. 3A). Rp separating from SC+Ra nearly at midlength, M reaches ambient vein, Cua and Cup fused at base and m-cu links M to Cua before Cua bifurcation, common base for Cup and Cua originate at base of wing, 7 longitudinal veins and 5 apical cells between SC+Ra and Cup, angular protrusion of costal margin near its base. Metafemur with apical spine in inner margin, metatibiae bearing 1 lateral spine.

Male terminalia. In lateral view, posterior margin of pygofer slightly undulating in the middle with slight curved on the last third (Fig. 11E). Subgenital plates (Fig. 11F) dorsal and ventral margin of main plate roughly straight, sterno-lateral plate present, slightly elongated, intermediate plate present, elongated slightly triangular shaped, linking internal sides of lateral and subgenital plates. Paramere (Fig. 11G) not globose, dorsal margin convex and regularly curving finishing with rounded apex with very minute groove, ventral margin convex, apex with spiniform process pointing antero-ventrally. Dorsal and ventral margins of aedeagus undulating. Aedeagus (Fig. 11H) with basal third of dorsal margin regularly bent without angle before the bent part and last ⅔ vertical and S-shaped, ventral margin regularly curved then slightly concaved before the base, apical extension sharp pointing postero-ventrally, posterior protrusion sharp at the apex hook-shaped, postero-dorsal protrusion absent.

Color. Head and pronotum brown with yellow patches, rostrum yellowish white, pedicel of antenna brown, legs yellowish and abdomen light brown. Tegmen partially translucid, opaque parts being yellowish with darker patches.

Type Locality

Philippines: Luzon, Camarines Sur, Mount Isarog Natural Park.

Distribution

Philippines: Luzon Island.

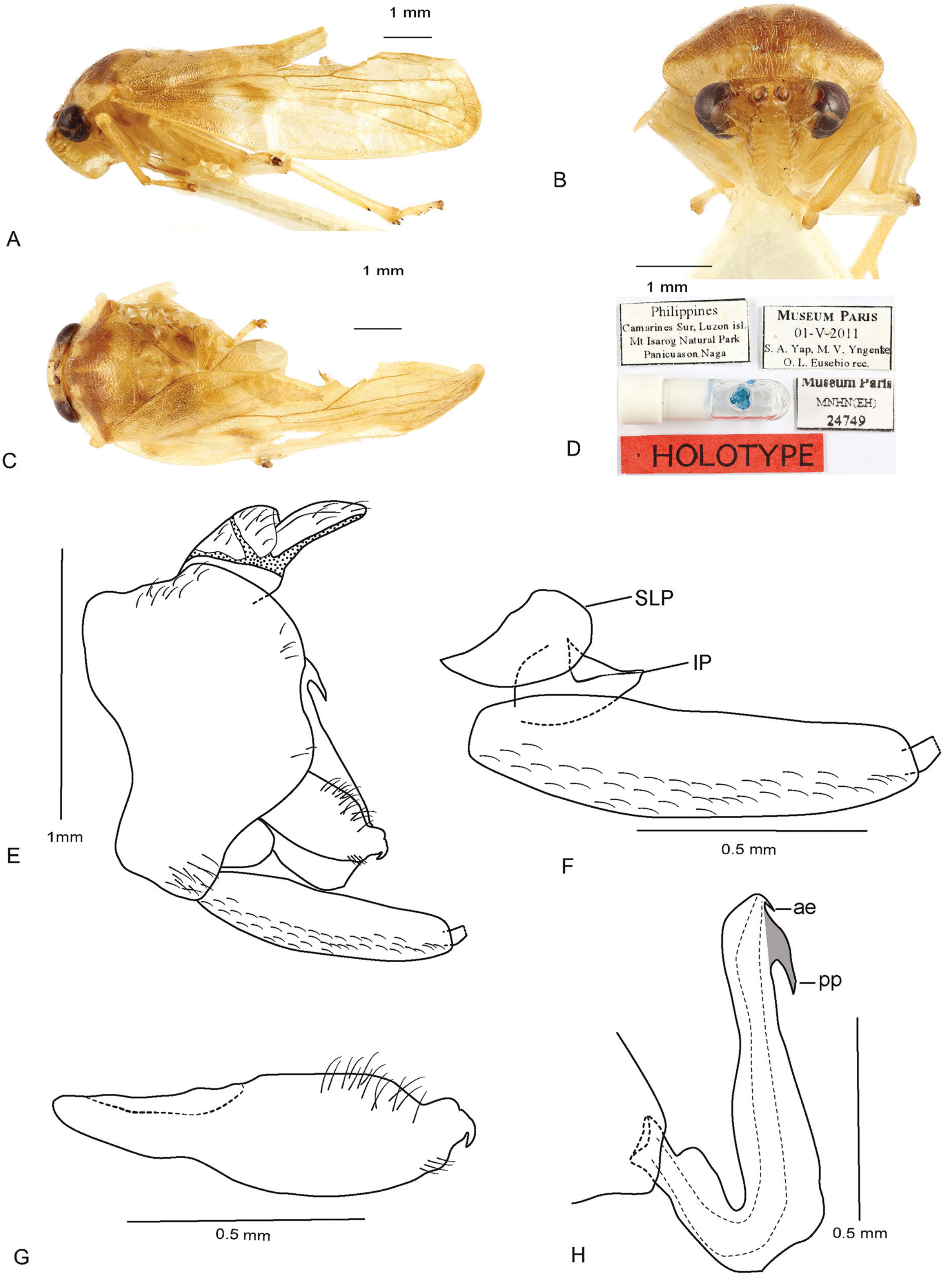

Fig. 11. *Mioscarta translucida* Crispolon & Yap sp. nov. holotype, habitus and ♂ terminalia in lateral view. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels. **E**. Terminalia. **F**. Sterno-lateral, intermediate and subgenital plates. **G**. Paramere. **H**. Aedeagus.

Remarks

The exact length of subgenital plate relative to height of pygofer is not provided because part of the appendage is damaged.

Trigonoschema Crispolon & Soulier-Perkins gen. nov.
urn:lsid:zoobank.org:act:C8299091-60D3-49B4-852F-2145956D7FE9
Figs 12–16

Type species

Trigonoschema manoborum sp. nov. here designated.

Diagnosis

In dorsal view, teardrop shaped and apex of tegmen not visible due to folding. In lateral view, very steeply declivous pronotum and crown of the head, nearly form a right angle with the rest of the dorsum in profile.

Etymology

When observed in dorsal view, the general shape of the habitus fits in a triangle even if a closer observation would lead to describe it as teardrop shaped. The name is built using two greek words "trigonos" for triangular and "schema" for shape. It is neutral.

Description

Body. Length 9.5–12.5 mm (tegmen included), width 4–5 mm.

General shape. Not dorso-ventrally flattened, in lateral view total length around 3 times height (Figs 2B, 12–16A). Ocelli small, distance between eyes 9–10.5 times ocellus diameter (Figs 1, 12–16B). Distance between ocellus and compound eye less than 4 times ocellus diameter ((Figs 1, 12–16B). Distance between ocelli 1.5 ocellus diameter (Figs 1, 12–16B). Postclypeus with longitudinal furrow, swollen laterally and slightly ovoid shape in frontal view, widest part close to frons, not receding and prior to anteclypeus where it bends rounded in lateral view, with wide longitudinal furrow (Figs 1, 12–16B). Pronotum curving around 45º angle (Figs 2B, 12–16A). Tegmen translucid without concave apical cells. Apical curve of tegmen rarely visible in dorsal view, tegmen folded in such a way that widest part of habitus is before midlength of tegmen (Figs 12–16C).

Male terminalia. Subgenital plates without fine appendage (Fig. 12F), if present shorter than main plate, not forming an acute angle shape with the main plate (Figs 14, 16F). Paramere globose, lateral margin of paramere with protrusion, on the ventral margin on the sub apex with angular protrusion ornamented with set of setae (Figs 12, 14, 16G). Pp of aedeagus thick and beak-like shape (Figs 12, 14, 16H).

Distribution

Philippines.

Key to the species of Philippine *Trigonoschema* gen. nov.

1. Most of vertex and frons bright yellow and postclypeus orange (Figs 12–13) ....
   .... ***T. manoborum*** Crispolon & Soulier-Perkins sp. nov.
– Vertex, frons and postclypeus of the same color that can be brown, orange or red (Figs 14–16) 2
2. Red band running across base of tegmen and scutellum (Fig. 16) ....
   .... ***T. rubercella*** Crispolon & Guilbert sp. nov.

– No red band visible in dorsal view (Figs 12–13).. 3
3. Scutellum yellow (Fig. 14) ....***T. negrosensis*** Crispolon & Yap sp. nov.
– Scutellum brown (Fig. 15)...***T. pallida*** **(**Lallemand, 1927) comb. nov.

Trigonoschema manoborum Crispolon & Soulier-Perkins gen. et sp. nov.
urn:lsid:zoobank.org:act:EDF12AD9-920E-46AA-937F-D66CE3ACD6B1
Figs 12–13

Diagnosis

Tegmen, white in basal $\frac{1}{4}$ with orange marking on the basal half of the margin of the clavus. Scutellum orange with yellowish white coloration in middle. Most of vertex and frons bright yellow and postclypeus dull orange for male and bright orange for female.

Etymology

Manoborum, genitive plural made from Manobos. The Manobo tribe is found in Bongolanon, Magpet, North Cotabato.

Material examined

Holotype

PHILIPPINES • ♂; "Philippines, Mt. Apo, Bongolanon, Magpet N. Cotabato"; "5 May 2018; Daniela Alcalde"; "holotype", "séquençage par Elorde Crispolon C-00148", "Muséum Paris, MNHN (EH) 24871"; MNHN.

Paratype

PHILIPPINES • ♀; "PH. MT. APO, Bongolanon, Magpet, Cot, Mindanao, 17 Dec. 2015, ES Crispolon" "séquençage par Elorde Crispolon C-00078" "UPLBMNH HEM-05054"; UPLBMNH.

Description

Body length. 10.5 mm (tegmina included), width 4 mm.

Head (Figs 1, 12–13B). In dorsal view, ocelli small, distance between eyes 10.5 times ocellus diameter (Figs 1, 12–13B). Distance between ocellus and compound eye less than 3.5 times ocellus diameter ((Figs 1, 12–13B). Distance between ocelli 1.5 ocellus diameter (Figs 1, 12–13B). Eyes not prominent, length 1.15 times than wide. Vertex with longitudinal short median carina, slightly longer than wide. Frons without any carina. Postclypeus with dimple below margin of frons and a longitudinal furrow clearly marked in male, swollen laterally and slightly ovoid shape in frontal view, widest part close to frons, not receding and prior to anteclypeus where it bends rounded in lateral view (Figs 1B, 12–13A). Rostrum long, reaching but not surpassing mesocoxae. Thorax (Figs 2B, 12–13A–C). In dorsal view, pronotum with anterior deep concavities on each side, much clearly marked in female, longitudinal median carina absent. Anterior margin of pronotum as wide as posterior margin of head including eyes, anterolateral margins curved, posterior margin grooved, postero-lateral margins slightly concave, slightly longer than anterolateral margins, humeral angle rounded. In lateral view, pronotum angle around 45º (Figs 2B, 12–13A), scutellum as long as wide with large median dimple (Figs 12–13C). Tegmen (Figs 12–13A–C). R bifurcates on apical half, M bifurcate on basal third, apical reticulation not well developed without concave apical cells. Posterior wing (Fig. 13E). $\frac{2}{3}$ of M length alone then fuses with Rp before reaching ambient vein, 6 longitudinal veins on posterior wing reaching apex, four apical cells between SC+Ra and Cup, angular projection near base of costal margin present. Legs. Metafemur with apical spine in inner margin, metatibiae bearing 1 lateral spine.

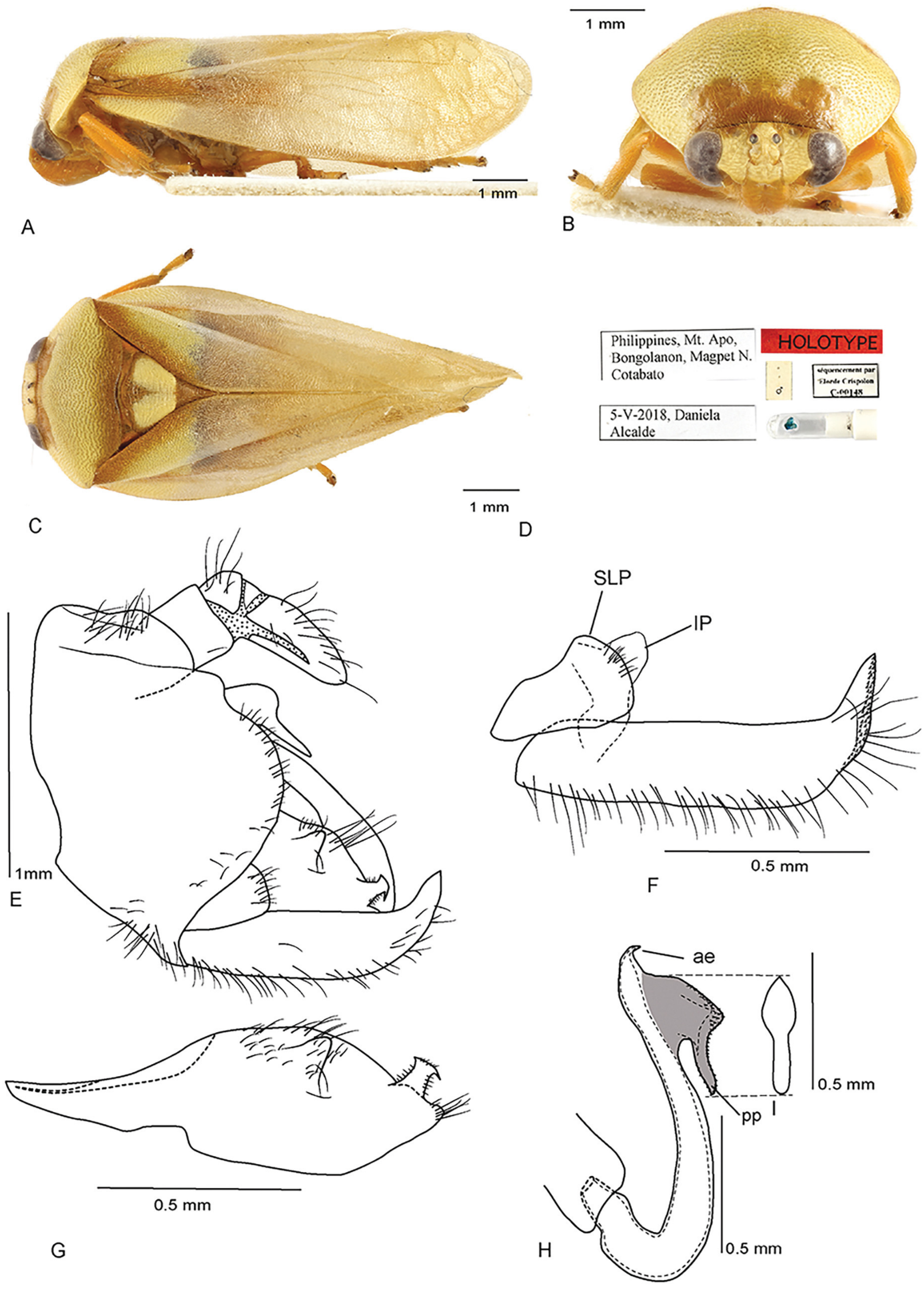

Fig. 12. *Trigonoschema manoborum* Crispolon & Soulier-Perkins sp. nov. holotype, habitus and ♂ terminalia in lateral view. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels. **E**. Terminalia. **F**. Sterno-lateral, intermediate and subgenital plates. **G**. Paramere. **H**. Aedeagus. **I**. Shape of pp in posterior view.

Male terminalia. In lateral view, posterior margin of pygofer (Fig. 12E) largely convex in middle getting concave in last third and presenting a bump in first third. Subgenital plates (Fig. 12F) with equal length relative to height of pygofer without any appendage, regularly tapering towards apex, dorsal margin straight then curving up towards apex, ventral margin straight half its length then regularly curving dorsally, minute denticuli covering last quarter toward apex. Sterno-lateral plate present,

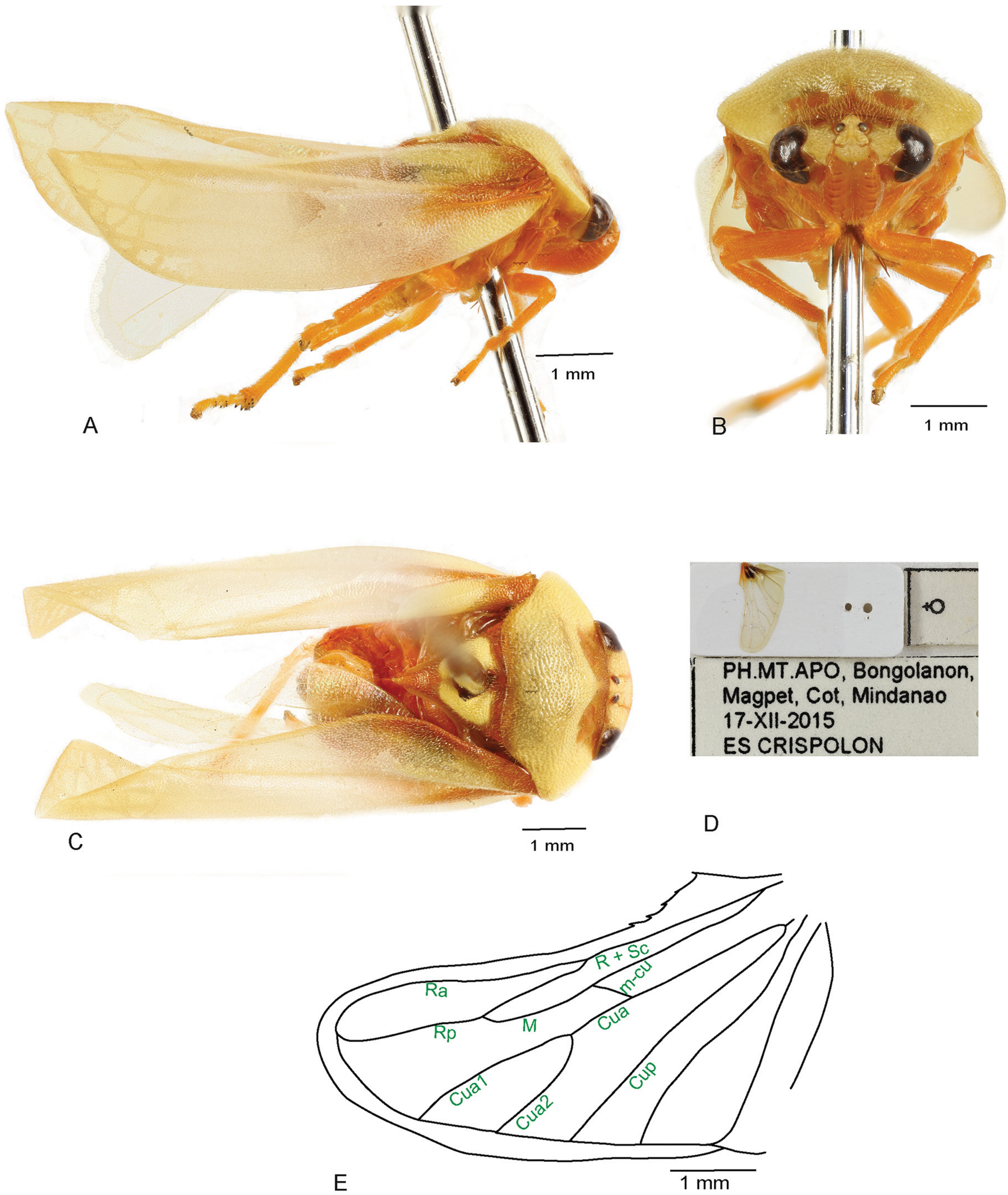

Fig. 13. *Trigonoschema manoborum* Crispolon & Soulier-Perkins sp. nov., ♀ paratype (UPLBMNH HEM-05054). Habitus and posterior wing. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels. **E**. Posterior wing.

slightly elongated. Intermediate plates present, elongated and linked with internal sides of lateral plate and subgenital plate. Paramere (Fig. 12G) globose, dorsal margin convex then curving regularly and finishing with a sharp spine pointed antero dorsally, lateral margin with process in middle part pointing postero-dorsally, ventral margin regularly rounded with subapical part largely protruding posteriorly then finishing with a sharp spine pointing ventrally. Aedeagus (Fig. 12H) with dorsal margin slightly humped at base then concave most its length, curving regularly half its length vertically and finishing ¼ its length convex in a C-shaped, apical extension pointing posteriorly, posterior protrusion thick, duck head shaped with minute denticuli along posterior margin, in posterior view basal half lobular (Fig. 12I), postero-dorsal protrusion absent.

Color. Head, and pronotum white-yellowish with orange markings, postclypeus, rostrum, abdomen and legs orange, pedicel of antennae yellowish brown, scutellum orange with yellowish white markings medially. Tegmen, translucid yellowish white, white in basal ¼ with orange marking in between white and on the basal half of the margin of the clavus, last $^{3}/_{4}$ yellowish getting yellowish brown in apical fourth.

Type Locality

Philippines, Mt. Apo, Bongolanon, Magpet North Cotabato.

Distribution

Philippines: Mindanao Island.

Trigonoschema negrosensis Crispolon & Yap gen. et sp. nov.

urn:lsid:zoobank.org:act:BFF10DEF-C172-4861-A9AE-81AA8B88657B

Fig. 14

Diagnosis

In general shape, *T. negrosensis* is similar to *T. rubercella* but their coloration is distinctly different. *T. negrosensis* in dorsal view presents a dirty yellow pronotum followed by a light orange scutellum framed by yellow irregular patches on clavus of tegmen while *T. rubercella* presents a bright yellow pronotum followed by a red band running on basal parts of tegmen and across scutellum.

Etymology

The species is named after the island where it was found: Negros.

Material examined

Holotype

PHILIPPINES • ♂; "Philippines, Negros volcan Canlaon, champ de coqs; 10º25'29" N, 123º05.23" E"; "Muséum Paris, Piège lumineux, 932 m; 28 Oct. 2010; A. Soulier-Perkins rec.", "UPLBMNH HEM-05055"; UPLBMNH.

Paratypes

PHILIPPINES • 4 ♂♂; "Philippines, Negros volcan Canlaon, champ de coqs; 10º25'29" N, 123º05'36" E" ; "Muséum Paris, 1050 m; 28 Oct. 2010; D. Ouvrard Rec.", "Muséum Paris, MNHN (EH) 23639, 24825 to 24827"; MNHN • 5 ♂♂; "Philippines, Negros volcan Canlaon, champ de coqs, 10º25'29" N, 123º05.23" E"; "Muséum Paris, Piège lumineux 932 m; 28 Oct. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN (EH) 24828", "Muséum Paris, MNHN (EH) 24829 to 24830", "séquençage par Elorde Crispolon, C-00076, C-00077", "Muséum Paris, MNHN (EH) 24831"; MNHN. "UPLBMNH HEM-05056"; UPLBMNH • ♀; "Philippines, Negros volcan Canlaon, forêt, 10º25'31" N, 123º05'40" E";

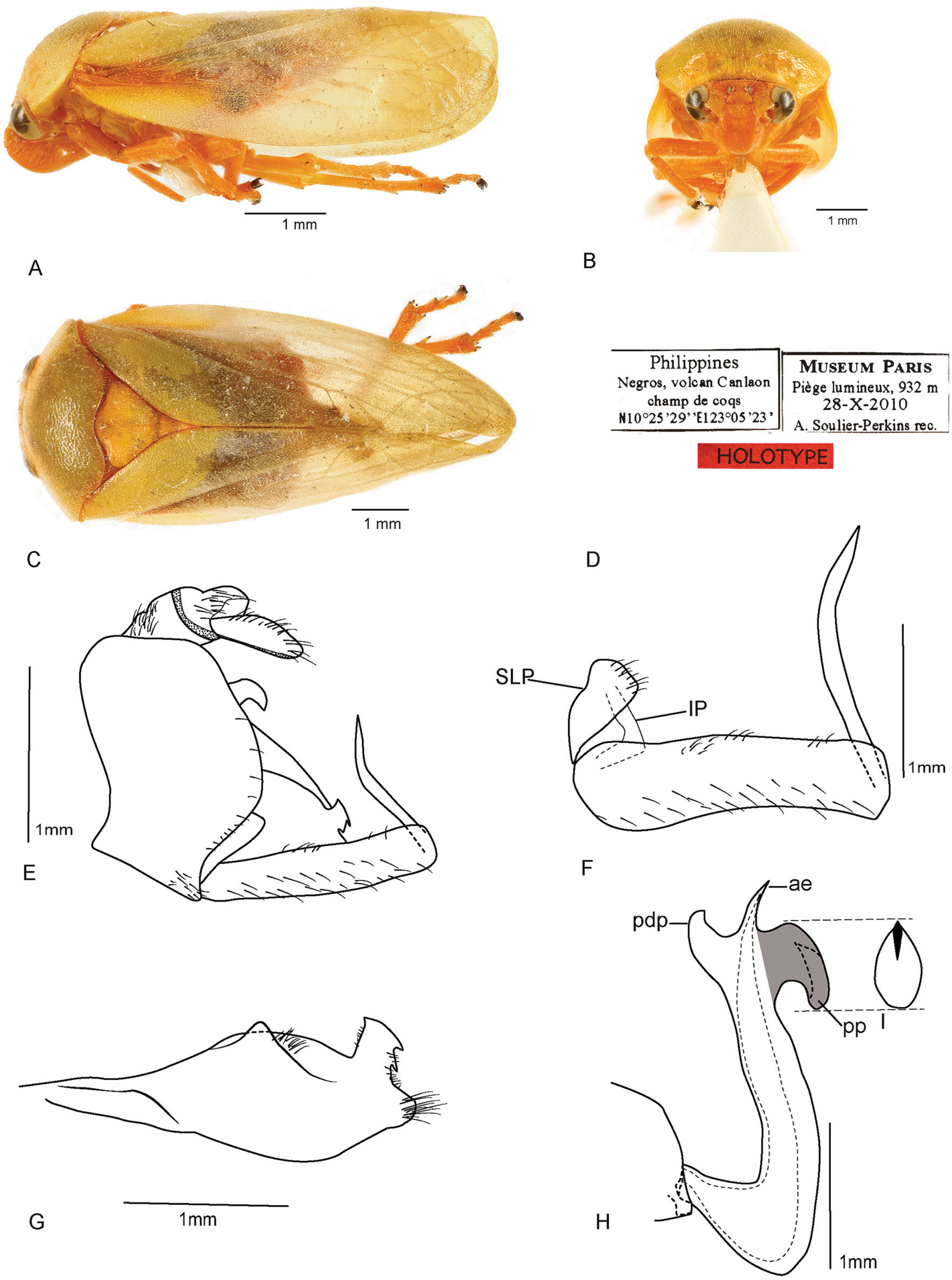

Fig. 14. *Trigonoschema negrosensis* Crispolon & Yap sp. nov., holotype, habitus and ♂ terminalia in lateral view. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels. **E**. Terminalia. **F**. Sterno-lateral, intermediate and subgenital plates. **G**. Paramere. **H**. Aedeagus. **I**. Shape of pp in posterior view.

"Muséum Paris, Piège lumineux 1098 m; 29 Oct. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN (EH) 24832"; MNHN • ♀; "Philippines, Negros volcan Canlaon, forêt, 10º25'31" N, 123º05'43" E" "Muséum Paris, 1098 m, 30 Oct. 2010, D. Ouvrard Rec.", "Muséum Paris, MNHN (EH) 24833"; MNHN • ♂; "Philippines, Negros volcan Canlaon, forêt; 10º25'31" N, 123º05'43" E"; "Muséum Paris, Piège lumineux 1098 m; 30 Oct. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN (EH) 24834"; MNHN • 2 ♀♀, 2 ♂♂; "Philippines, Negros volcan Canlaon, forêt, 10º25'36" N, 123º05'37" E"; "Muséum Paris, Piège lumineux 1057 m, 31 Oct. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN (EH) 24835 to 24837" "séquençage par Elorde Crispolon C-00167", "Muséum Paris, MNHN (EH) 24838"; MNHN • ♀; "Philippines, Negros volcan Canlaon, forêt, 10º25'23" N, 123º04'46" E; "Muséum Paris, Piège lumineux 745 m; 3 Nov. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN (EH) 24839"; MNHN. • 2 ♂♂; "Philippines, Luzon, mount Isarog, Light trap", "Muséum Paris; 31 May 2011; S. Yap Rec." "Muséum Paris, MNHN (EH) 24840 to 24841"; MNHN.

Description

Body. Length 11–12.5 mm (tegmina included), width 4–5 mm.

Head (Figs 1, 14B). In dorsal view, ocelli small, distance between eyes 9.5 times ocellus diameter (Figs 1, 14B). Distance between ocellus and compound eye less than 3 times ocellus diameter (Figs 1, 14B). Distance between ocelli 1.5 ocellus diameter (Figs 1, 14B). Eyes not prominent, length 1.33 times than wide. Vertex with longitudinal median carina, as long as wide. Frons without median carina. Postclypeus with dimple below margin of frons and a longitudinal furrow clearly marked in males, swollen laterally and slightly ovoid shape in frontal view, widest part close to frons, not receding and prior to anteclypeus where it bends rounded in lateral view (Figs 1B, 14A). Rostrum long, reaching but not surpassing mesocoxae. Thorax (Figs 2B, 14A–C). In dorsal view, pronotum with anterior deep concavities on each side, much clearly marked in female, longitudinal median carina absent. Anterior margin of pronotum as wide as posterior margin of head including eyes, anterolateral margins curved, posterior margin grooved, postero-lateral margins slightly concave, slightly longer than anterolateral margins, humeral angle rounded. In lateral view, pronotum angle around 45º (Figs 2B, 14A). Scutellum as long as wide with large median dimple (Fig. 14C). Tegmen (Fig. 14A, C). R bifurcates on apical half, M bifurcate on basal third, apical reticulation not well developed without concave apical cells. Posterior wing (Fig. 3A). Rp separating from SC+Ra nearly at midlength, M reaches ambient vein, Cua and Cup fused at base and m-cu links M to Cua before Cua bifurcation, 7 longitudinal veins and 5 apical cells between SC+Ra and Cup, angular protrusion of costal margin near its base. Metafemur with apical spine in inner margin, metatibiae bearing 1 lateral spine.

Male terminalia. In lateral view, posterior margin of pygofer (Fig. 14E) convex in middle and clearly concave on last third. Subgenital plates (Fig. 14F) slightly longer relative to height of pygofer with fine appendage shorter forming acute angle with main plate, dorsal and ventral margin of main plate roughly straight. Sterno-lateral plate present and slightly elongated. Intermediate plates present, boomerang-shaped, linking internal sides of lateral plate and subgenital plate. Paramere (Fig. 14G) globose, dorsal margin convex then curving regularly and finishing with a sharp spine pointed antero dorsally, lateral margin with process in middle part pointing dorsally, ventral margin regularly rounded with subapical part largely protruding posteriorly then finishing with two sharp spines pointing postero-ventrally. Aedeagus (Fig. 14H) with basal fourth almost straight then bending vertically and slightly wave-shape up to postero-dorsal protrusion, apical extension pointing dorsally, posterior protrusion thick, beak-shaped, in posterior view, very slim at the top and petal shaped and foliaceous toward the base (Fig. 14I), postero-dorsal protrusion present.

Color. Head including postclypeus and rostrum, legs and abdomen orange, pronotum orange white anterior half, greenish on apical part, scutellum greenish white with orange coloration, antennal scape and pedicel orange, flagellum with brown coloration. Tegmen translucid yellow, basal third with white coloration in costal margin and clavus and with orange coloration in between white coloration, last ⅔ yellowish brown.

Type Locality

Philippines: Visayas, Negros Occidental, Mount Kanlaon.

Distribution

Philippines, Visayas, Negros Island; Luzon Island.

Trigonoschema pallida (Lallemand, 1927) comb. nov.
Fig. 15

Mioscarta pallida Lallemand, 1927: 113.
Mioscarta pallida – Lallemand 1949: 84–85.

Distribution

Philippines: Philippine Islands.

Remarks

Lallemand in 1927 described this species based on the pattern of coloration and placed it in *Mioscarta*. He mentioned only a single male specimen (holotype), however, in the collection it is labelled as female (Fig. 15D). This species does not conform to Breddin's definition of *Mioscarta* but possesses characters of *Trigonoschema* gen. nov. For this reason we transfer it to this new genus. We could not borrow the holotype, however some photographs of the habitus and labels were kindly provided by Mick Webb (NHM). They are integrated here (Fig. 15) and are sufficient to see the most obvious characters of *Trigonoschema* gen. nov.

Trigonoschema rubercella Crispolon & Guilbert gen. et sp. nov.
urn:lsid:zoobank.org:act:02DFAF48-FC8F-45CE-BE52-FB1DD05626DF
Fig. 16

Diagnosis

In general shape, *T. rubercella* is similar to *T. negrosensis* but is distinctly different in color. *T. rubercella* presents a bright yellow pronotum followed by red band running on the basal parts of the tegmen and scutellum when *T. negrosensis* in dorsal view presents a dirty yellow pronotum followed by a light orange scutelum framed by yellow patches sprawling on the clavus of the tegmen.

Etymology

This species has a distinct red coloration in the network of cells at the apex of tegmen. The species name is a combination of two latin words "ruber" and "cella" respectively meaning red and cell. The name is placed in apposition.

Material examined

Holotype

PHILIPPINES • ♂; "Philippines, Negros volcan Canlaon, forêt, 10º25'29" N, 123º05.36" E"; "Muséum Paris, 1050 m; 28 Oct. 2010; D. Ouvrard Rec", "Muséum Paris, MNHN (EH) 23638", "séquençage par Elorde Crispolon C-00074"; MNHN.

Paratypes

PHILIPPINES • ♂; "Philippines, Negros volcan Canlaon, champ de coqs, 10º25'29" N, 123º05'23" E", "Muséum Paris, Piège lumineux 932 m; 28 Oct. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN (EH) 24842"; MNHN • ♂; "Philippines, Negros volcan Canlaon, forêt, 10º25'31" N, 123º05'40" E", "Muséum Paris, Piège lumineux 1098 m; 29 Oct. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN

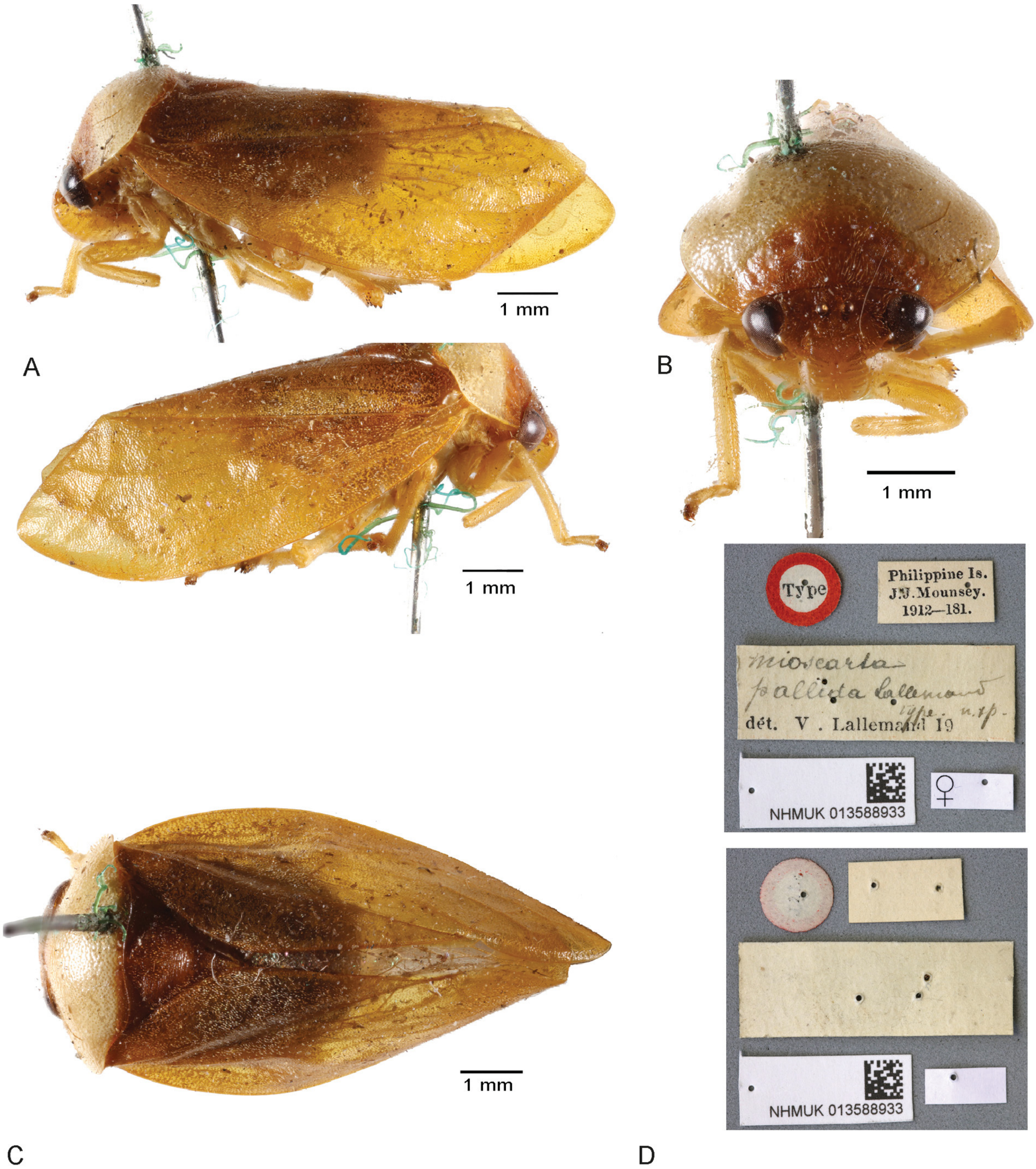

Fig. 15. *Trigonoschema pallida* (Lallemand, 1927) comb. nov., holotype (NHMUK 013588933), habitus. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels.

(EH) 24843"; MNHN • ♂; "Philippines, Negros volcan Canlaon, forêt, 10º25'31" N, 123º05'43" E", "Muséum Paris, 1098 m; 30. Oct. 2010; D. Ouvrard Rec", "Muséum Paris, MNHN (EH) 24844"; MNHN • ♂; "Philippines, Negros volcan Canlaon, forêt, 10º25'31" N, 123º05'43" E", "Muséum Paris, Piège lumineux 1098 m; 30 Oct. 2010; A. Soulier-Perkins rec.", "UPLBMNH HEM-05058"; UPLBMNH. • ♂; "Philippines, Negros volcan Canlaon, forêt, 10º25'36" N, 123º05'37" E", "Muséum Paris, Piège lumineux 1057 m; 31 Oct. 2010; D. Ouvrard Rec", "UPLBMNH HEM-05057"; UPLBMNH • 2 ♂♂; "Philippines, Negros volcan Canlaon, forêt, 10º25'36" N, 123º05'37" E", "Muséum Paris, Piège lumineux 1057 m; 31 Oct. 2010; A. Soulier-Perkins rec.", "Muséum Paris, MNHN (EH) 24845", "séquençage par Elorde Crispolon C-00075", "Muséum Paris, MNHN (EH) 24846"; MNHN • ♂; "Philippines, Negros volcan Canlaon, forêt, 10º25'35" N, 123º05'51" E"; "Muséum Paris, 1117 m; 2 Nov. 2010; D. Ouvrard rec.", "Muséum Paris, MNHN (EH) 23640"; MNHN.

Description

Body length. 9.5–10.5 mm (tegmina included), width 4.5 mm.

Head (Figs 1, 16B). In dorsal view, ocelli small, distance between eyes 9 times ocellus diameter (Figs 1, 16B). Distance between ocellus and compound eye less than 4 times ocellus diameter (Figs 1, 16B). Distance between ocelli 1.5 ocellus diameter (Figs 1, 16B). Eyes not prominent, length 1.33 times than wide. Vertex slightly longer than wide. bearing a median longitudinal carina. Frons without carina. Postclypeus with dimple below margin of frons and a longitudinal furrow, swollen laterally and slightly ovoid shape in frontal view, widest part close to frons, not receding, prior to anteclypeus where it bends forming obtuse angle in lateral view (Figs 1B, 16A). Rostrum long, reaching but not surpassing mesocoxae.

Thorax (Figs 2B, 16A–C). In dorsal view, pronotum with anterior deep concavities on each side, much clearly marked in female, longitudinal median carina absent. Anterior margin of pronotum as wide as posterior margin of head including eyes, anterolateral margins curved, posterior margin grooved, postero-lateral margins slightly concave, slightly longer than anterolateral margins, humeral angle rounded. In lateral view, pronotum angle around 45º (Figs 2B, 16A). Scutellum as long as wide with large median dimple (Fig. 16C).

Tegmen (Fig. 16A–C). R bifurcates on apical half, M bifurcate on basal third, apical reticulation not well developed without concave apical cells. Posterior wing (Fig. 3A). Rp separating from SC+Ra nearly at midlength, M reaches ambient vein, Cua and Cup fused at base and m-cu links M to Cua before Cua bifurcation, 7 longitudinal veins and 5 apical cells between SC+Ra and Cup, angular protrusion of costal margin near its base present. Metafemur with apical spine in inner margin and metatibiae bearing 1 lateral spine.

Male terminalia. In lateral view, posterior margin of pygofer (Fig. 16E) convex in middle with slight concavity toward ventral margin. Subgenital plates (Fig. 16F) with equal length relative to height of pygofer with fine appendage shorter than main plate directed posteriorly not forming acute angle with main plate, dorsal and ventral margin of main plate regularly curved. Sterno-lateral plates present, triangular shaped. Intermediate plates present, roughly boomerang-shaped linking internal sides of lateral plate and subgenital plate. Paramere (Fig. 16G) globose, dorsal margin convex then curving regularly and finishing with a sharp spine pointed dorsally, lateral margin with slightly and rounded, ventral margin roughly straight with subapical part angled largely protruding posteriorly then finishing with two sharp spines pointing postero-ventrally. Aedeagus (Fig. 16H) with dorsal margin making a right angle at its base, straight on a small portion before curving up regularly, apical part bending posteriorly and straight, apical extension pointing dorsally, posterior protrusion thick and beak-shaped, postero-dorsal protrusion absent.

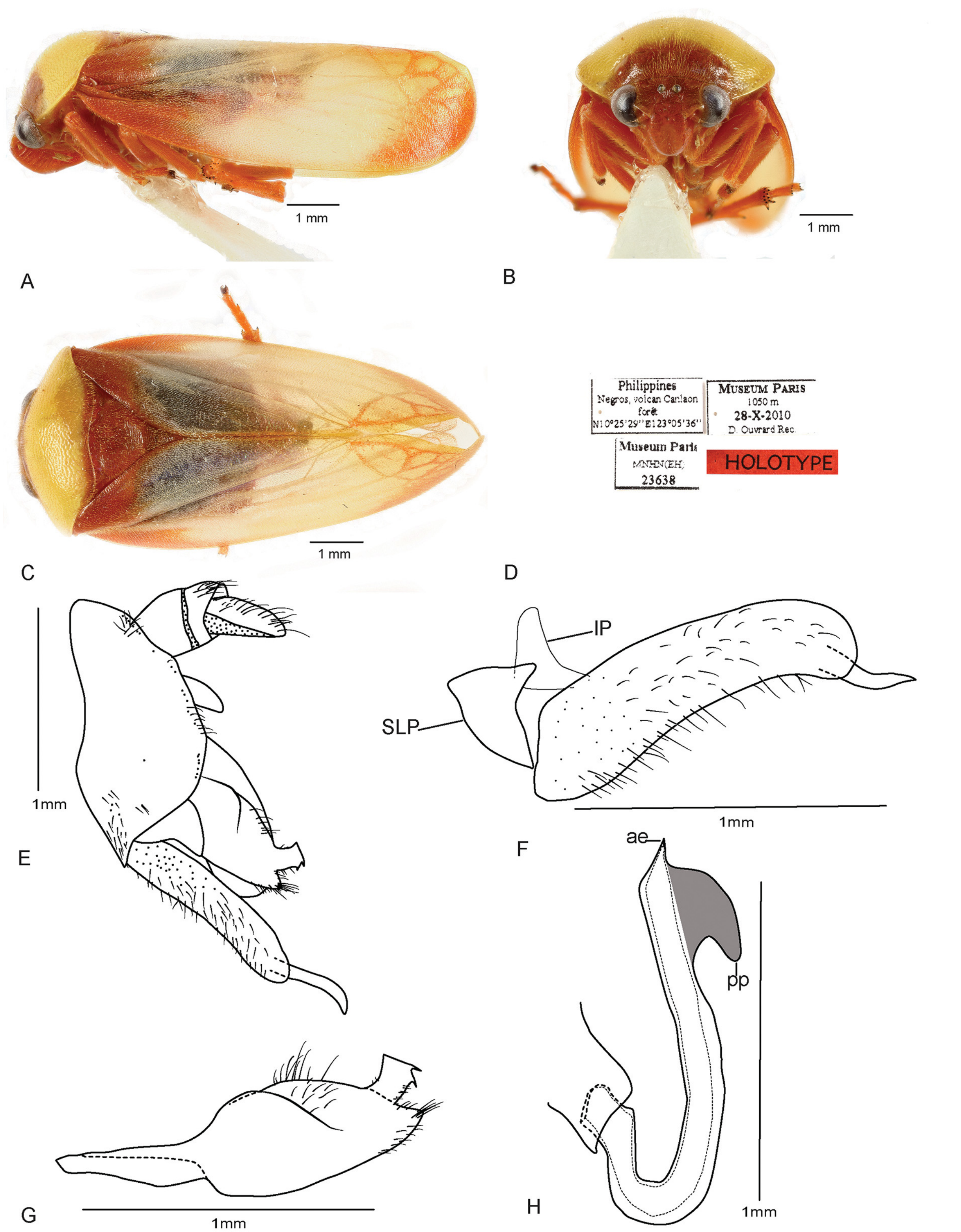

Fig. 16. *Trigonoschema rubercella* Crispolon & Guilbert gen. et sp. nov. Holotype. Habitus and ♂ terminalia in lateral view. **A**. Lateral view. **B**. Frontal view. **C**. Dorsal view. **D**. Labels. **E**. Terminalia. **F**. Sterno-lateral, intermediate and subgenital plates. **G**. Paramere. **H**. Aedeagus.

Color. Head, legs, abdomen, scutellum and anterior part of pronotum red, rest of pronotum yellow, rostrum red, antennal scape and pedicel reddish orange, flagellum yellowish. Tegmen translucid yellow, basal and apical third including network of cells red.

Type Locality

Philippines: Visayas, Negros Occidental, Mount Kanlaon.

Distribution

Philippines: Visayas, Negros Island.

Molecular Phylogeny

Results of the Bayesian 50% consensus tree and ML analyses with likelihood score of −13870.493 are shown in Figures 17 and 18 respectively. The resulting topologies are not similar with respect to the placement of *Jacobsoniella* and *Wawi*. In the Bayesian topology (Fig. 17), *Jacobsoniella* is recovered within a clade containing *Eoscarta*, *Mioscarta*, *Poeciloterpa* and *Trigonoschema* gen. nov. clades, each

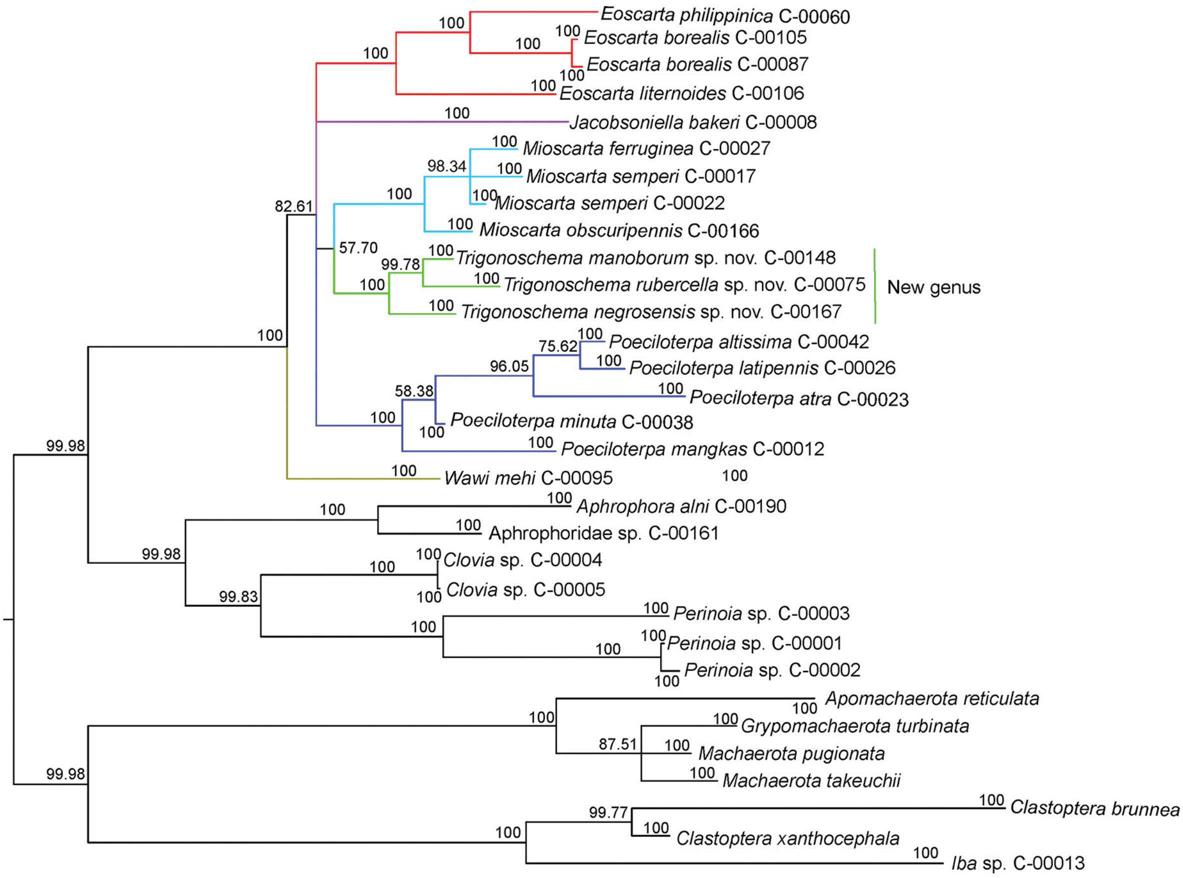

Fig. 17. Bayesian 50% consensus tree based on partitioned analysis of combined sequences Histone 3 + CO1 + 18S + 28S for *Eoscarta* Breddin, 1902, *Jacobsoniella* Melichar, 1914, *Mioscarta* Breddin, 1901, *Poeciloterpa* Stål, 1870, *Trigonoschema* Crispolon & Soulier-Perkins, gen. nov. and *Wawi* Soulier-Perkins & Le Cesne, 2016 species with Clastopteridae, Machaerotidae and Aphrophoridae as outgroup. Numbers indicated at each resolved nodes are posterior probability values presented in %. Branches are colored according to genus.

supported by a probability value (PPv) of 100%. This clade (*Eoscarta* + *Mioscarta* + *Poeciloterpa* + *Trigonoschema* + *Jacobsoniella*) is supported PPv of 82.61% and *Wawi* appears as sister group to it. However, the clade containing *Wawi* plus the five other genera is supported with a high PPv of 100%. In the ML analysis (Fig. 18), *Poeciloterpa* and *Trigonoschema* gen. nov. are sister groups with a ML bootstrap value (MLBv) of 85.2/21% (SH-aLRT support/ standard bootstrap support). Then *Mioscarta* appears as sister group of (*Eoscarta* + Wawi + (*Poeciloterpa* + *Trigonoschema*)). *Jacobsoniella* is recovered basally as sister of the other ingroup taxa and all together the ingroup clade is supported with a MLBv of 100/100% branch support.

Several key aspects of both topologies are similar. Regardless of the relationships of *Eoscarta*, *Mioscarta, Poeciloterpa*, *Trigonoschema*, *Jacobsoniella* and *Wawi* in both topologies the monophyly of each genus is well supported with a PPv of 100% and MLBv of 98.40/91%, 97.3/96%, 99.7/99% and 98.8/77% respectively. In both trees the ingroups are well supported with a PPv of 100% and MLBv of 100/100%.

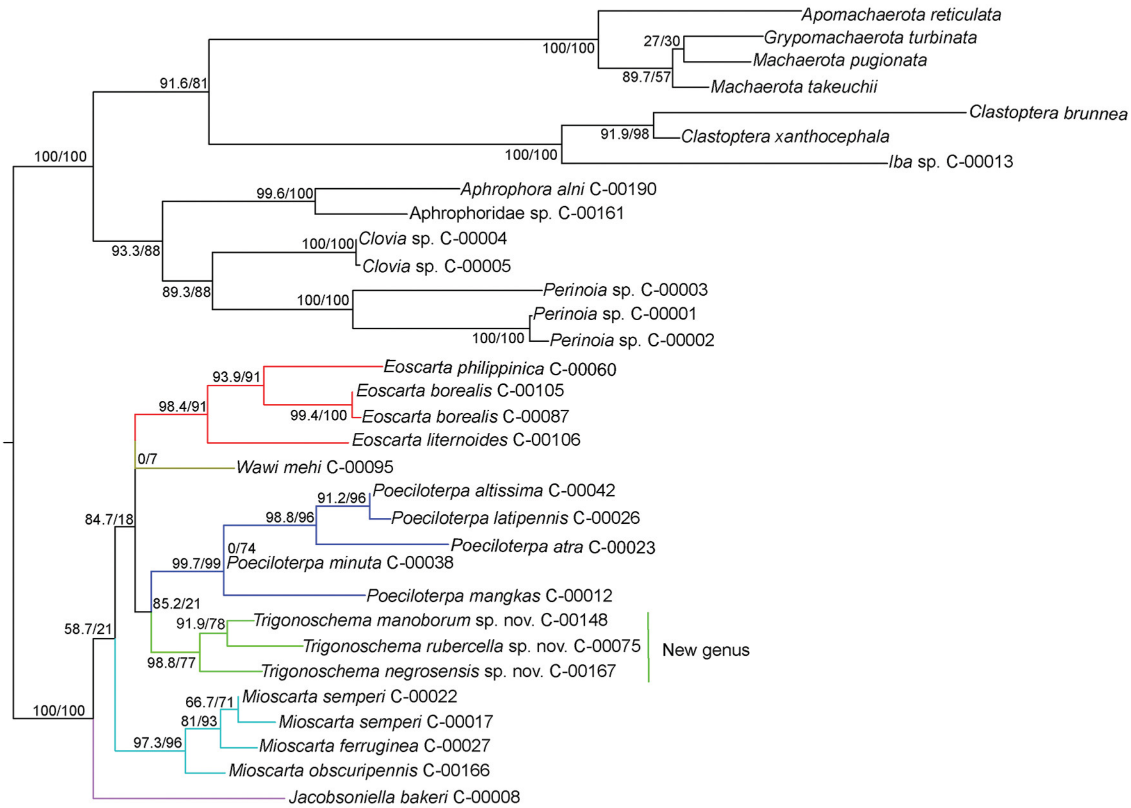

Fig. 18. Maximum likelihood topology (likelihood score of −13870.493) for *Eoscarta* Breddin, 1902, *Jacobsoniella* Melichar, 1914, *Mioscarta* Breddin, 1901, *Poeciloterpa* Stål, 1870, *Trigonoschema* Crispolon & Soulier-Perkins, gen. nov. and *Wawi* Soulier-Perkins & Le Cesne, 2016 species with Clastopteridae, Machaerotidae and Aphrophoridae as outgroup based on analyses of combined sequences (CO1, Histone 3, 18S, and 28S). Support statistics from a ML bootstrap value (SH-aLRT support % / standard bootstrap support %) are indicated at each resolved node. Branches are colored according to genus.

Discussion

Distribution, Biology and Ecology

Eight species currently belonging to the genus *Mioscarta* (Fig. 19) and four species of the new genus *Trigonoschema* (Fig. 20) are known from the Philippines. Of the four species of *Trigonoschema* gen. nov., only *T. pallida* cannot be placed precisely since the locality provided by Lallemand (1927) was "Philippine Islands".

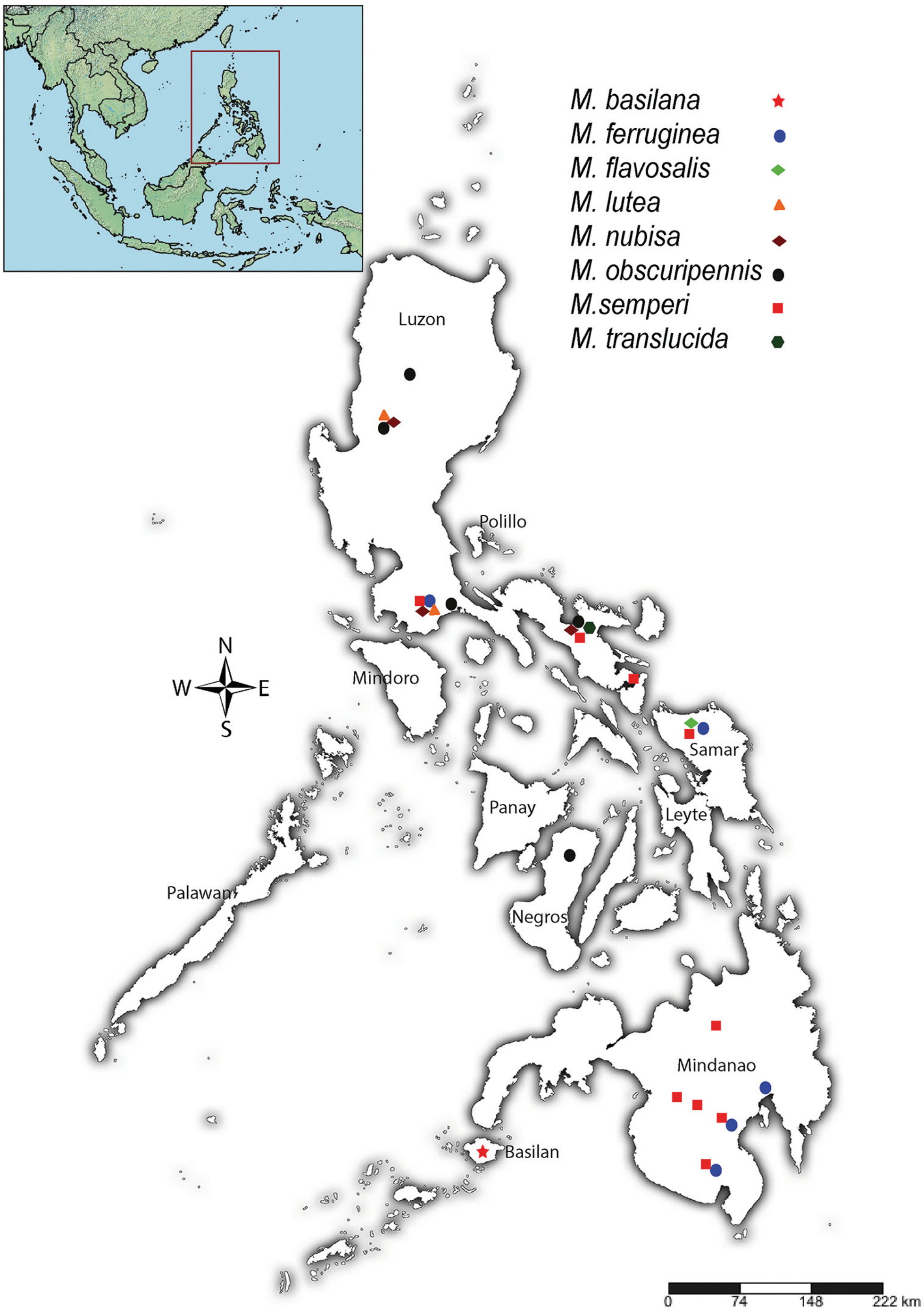

Fig. 19. Philippines *Mioscarta* Breddin, 1901 distribution map.

Some specimens were collected using a light trap, thus very little information on their natural history is available to date. Such positive phototaxy was also reported by Soulier-Perkins & Kunz (2012). Their host-plants remain unknown, even if, some species of both genera were observed alighting on the leaves of different plants of secondary and primary forests. This observation is not enough to conclude the insect's hostplant. Direct observations therefore remain difficult. With the development of next generation sequencing it is possible now to identify plants using their barcoding even when in small

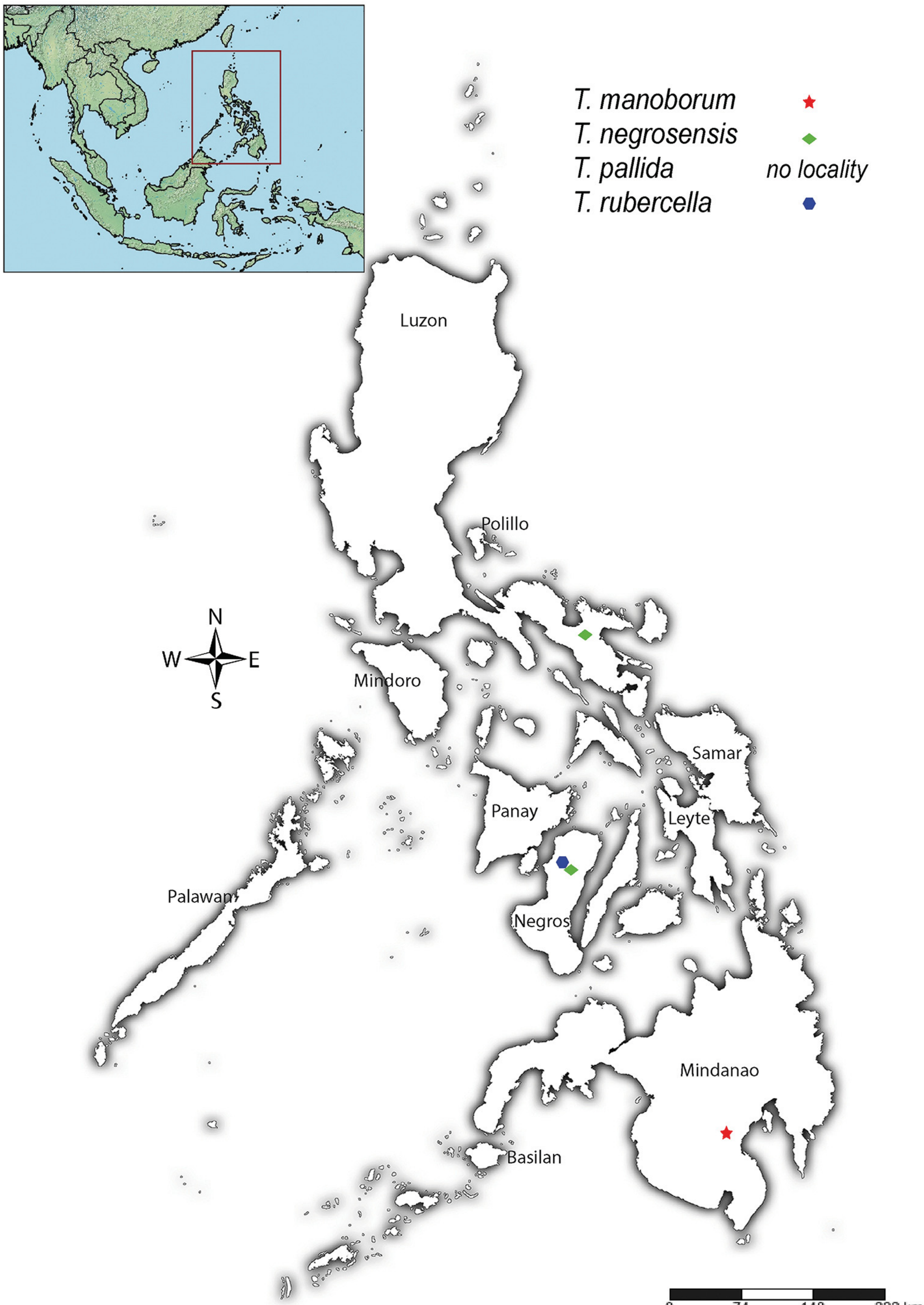

Fig. 20. *Trigonoschema* Crispolon & Soulier-Perkins gen. nov. distribution map.

quantity. It is most likely that in a near future, when analysing the content of the insect guts we should find enough genetic material belonging to the ingested host plants that would allow their identification.

Placement of *Trigonoschema* gen. nov. in the classification

According to Liang & Webb (2002) the tribe Rhinaulacini is characterized by a relatively broad head with non-globose eyes and a concave posterior margin of pronotum. It is also usually mentioned that a central longitudinal concave postclypeus and a hind tibia bearing a single strong lateral spine (Lallemand 1949, Liang & Webb 2002). However, the most obvious character that can separate Rhinaulacini from other Cercopidae is the presence of a sterno-lateral plate between the pygofer and subgenital plate (Liang & Webb 2002). This sterno-lateral plate is observed in all new described taxa belonging to *Eoscarta* (Liang & Webb 2002), *Amberana* and *Bourgoinrana* (Soulier-Perkins & Kunz, 2012), *Euryaulax* (Liang *et al.* 2012), *Wawi* (Soulier-Perkins & Le Cesne 2016), *Poeciloterpa* (Crispolon *et al.* 2019), and *Jacobsoniella* (based on a specimen we identified), and here in all new *Mioscarta* and *Trigonoschema* gen. nov. We are therefore certain in our placement of the new genus *Trigonoschema* in Rhinaulacini.

Liang & Webb (2002) formally placed the Eoscartini as a junior synonym of Rhinaulacini without placing the genera in any of the existing subtribes due to the need of further studies on their male terminalia. They emphasized the difficulties in identifying genera and species in this group, separations mainly based on small differences in male genitalia. *Trigonoschema* gen. nov. possesses characters that allow its clear identification from the other Rhinaulacini genera found in the Philippines, specifically *Mioscarta* and *Poeciloterpa*. It appears as well close to those genera, which belong to the Poeciloterpina subtribe. But we have decided for now to follow Liang and Webb's example and leave *Trigonoschema* gen. nov. as *incertae sedis* in the Rhinaulacini. The phylogeny shows that *Trigonoschema* gen. nov. is a distinct clade from *Mioscarta*. Although the sample is reduced to only six genera with a partial representation for each of them, both resulting topologies (ML and BI) show a well-supported monophyly of *Eoscarta*, *Mioscarta*, *Poeciloterpa,* and *Trigonoschema* gen. nov., revealing *Mioscarta* and *Trigonoschema* gen. nov. as two distinct genera. This justifies the description of the new genus *Trigonoschema* gen. nov. It is also clear from the differences in topologies between ML and BI, it would be unwise to make assumptions on genera relationships here. All the ingroup genera selected, except *Jacobsoniella*, belong to the Rhinaulacini and the ingroup support in both analyses is strong but no hasty conclusion should be made on placing *Jacobsoniella* in the Rhinaulacini or even believing this tribe to be monophyletic. Such hypotheses could only be tested with a larger sampling of Cercopinae genera.

Using the 50% majority rule topology highlighted the need of a wider analysis including the rest of Cercopidae to reconsider the family's relationships and to build up more robust phylogenetic hypotheses for the family. It is also congruent with the ML analysis, as the relationships between the targeted genera are not well established.

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