



Notes on two strikingly similar Neotropical spittlebugs: *Catrimania livida* Paladini & Cryan, 2012 and *Monecphora cingulata* (Le Peletier & Serville, 1825) (Hemiptera: Cercopidae: Ischnorhininae)

Notas sobre dos especies sorprendentemente similares de cercópidos neotropicales: *Catrimania livida* Paladini & Cryan, 2012 y *Monecphora cingulata* (Le Peletier & Serville, 1825) (Hemiptera: Cercopidae: Ischnorhininae)

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Abstract.– This is a discussion of new findings on two Neotropical cercopids with a similar color pattern; *Catrimania livida* Paladini & Cryan, 2012 and *Monecphora cingulata* (Le Peletier & Serville, 1825) (Hemiptera: Cercopidae: Ischnorhininae). Variation in color pattern is documented in *C. livida*. This is the first report of *C. livida* in Panama and *M. cingulata* in Paraguay (new country records).

Key words: phenotypic convergence, intraspecific variation, new country record, distribution.

Resumen.– Se discuten dos especies de Cercopidae de los neotrópicos con un patrón de coloración similar; *Catrimania livida* Paladini & Cryan, 2012 and *Monecphora cingulata* (Le Peletier & Serville, 1825) (Hemiptera: Cercopidae: Ischnorhininae). También registramos una variación de patrón de coloración con *C. livida*. Este es el primer reporte de *C. livida* para Panamá y *M. cingulata* para Paraguay.

Palabras clave: convergencia fenotípica, variación intraespecífica, nuevo reporte, distribución.

Convergence of color pattern in distantly related species is frequently seen throughout the animal kingdom (Kratochwil, 2019). In the insect world, this similarity in color pattern is often observed and has specifically been documented in many spittlebugs (Hemiptera: Cercopidae) (Carvahlo and Webb, 2005). *Catrimania livida* Paladini & Cryan, 2012 and *Monecphora cingulata* (Le Peletier & Serville, 1825) (Hemiptera: Cercopidae: Ischnorhininae) are two Neotropical spittlebugs with a similar color pattern. Although *Catrimania* and *Monecphora* are related genera (Paladini et al. 2015), the color patterns of the species within these genera are very diverse, so this similarity between the two species is striking. Both species are primarily yellow with black foretibiae and tarsi. *Monecphora cingulata* and some *C. livida* also have a dark lateral band on the forewings. Among the stereotypic patterns seen in nature, horizontal bars have evolved in many species (Kratochwil,

2019) like the convergence seen in *C. livida* and *M. cingulata*.

Catrimania livida is one of six known species in the relatively small genus *Catrimania*. The original description of this species provided line drawings of the male and female genitalia that aid in identification (Paladini and Cryan, 2012, figs. 8-12). Carvalho and Paladini (2017) recently described a new species of *Catrimania* and provided a key to the known species of the genus, based largely on differences in color patterns between species. Intraspecific variation of color pattern and sexual dimorphism has been observed in many cercopids (Carvahlo and Webb, 2005) though it has not yet been documented in *C. livida*.

Monecphora cingulata was originally described as *Cercopis cingulata* Le Peletier & Serville, 1825. This species was reassigned to *Monecphora* by Amyot & Serville (1843) and *Monecphora soligena* Walker 1858 has been sy-



nonymized with *M. cingulata*. Two new species in the genus *Monecphora* were recently described by Carvalho et al. (2016) in which a key to the known species of the genus was provided. There is also a recent phylogeny of Neotropical Cercopidae that included line drawings of the male genitalia of *M. cingulata* (Paladini et al., 2015, figs. 5-F, 6-F, 7-F).

This paper discusses new findings on these two similar looking cercopids. We document intraspecific color variation in *C. livida* and present new country records for *C. livida* in Panama and *M. cingulata* in Paraguay.

Materials and methods

Specimen Imaging

Specimens were photographed with a Nikon Digital Sight DS-Fi2 imaging system mounted on a Nikon SMZ-18 stereomicroscope. Photograph layers were stacked using Helicon Focus 6. Photographs were edited using Adobe® Photoshop® 2020 and formatted using Adobe® Illustrator® 2020.

Collection Codens

- FSCA: Florida State Collection of Arthropods, Gainesville, Florida, USA
 IBNP: Inventario Biológico Nacional del Paraguay [Museo Nacional de Historia Natural del Paraguay], San Lorenzo, Paraguay
 JMLC: John M. Leavengood, Jr., private collection, Brandon, Florida, USA
 NMNH: National Museum of Natural History, Washington D.C., USA
 PERC: Purdue Entomological Research Collection, West Lafayette, Indiana, USA

Catrimania livida Paladini & Cryan, 2012

In 2015, specimens were collected using a malaise trap at the Reserva Ecológica Bijagual in

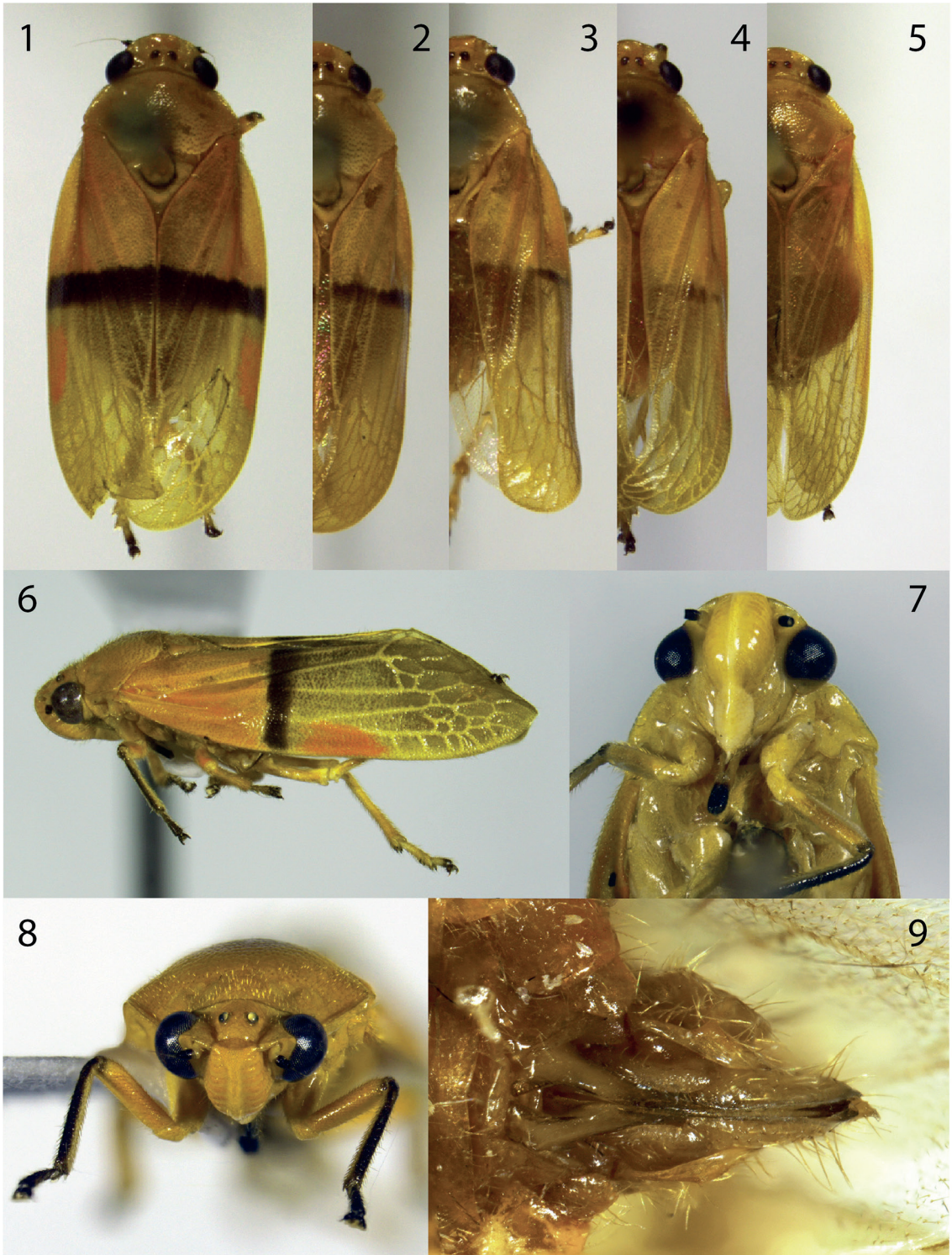
Costa Rica and preserved in 95% ethanol as part of a project managed by Ian P. Swift (California State Collection of Arthropods, Sacramento, CA) and Eugenio H. Nearn (USDA, Smithsonian Institution, Washington, DC). The trap was in the field for approximately 2-3 weeks and only the date of trap removal was recorded. The bulk samples were exhaustively sorted removing all cercopids. The specimens were discovered in the preserved bulk samples by the first author and identified with the literature. Eight trap samples from nearby regions were also sorted and produced no additional specimens. Five specimens collected from Panama were loaned from the FSCA. Males were dissected and genitalia was examined for confirmation of species identification.

Monecphora cingulata (Le Peletier & Serville, 1825)

Specimens were collected using light traps (sheets and bucket traps; mercury vapor and black light) on a scientific expedition in 2019 led by Dr. John B. Heppner (Lepidoptera Expeditions). All specimens were collected at a single site where the GPS coordinate was recorded once during a two-day visit. The specimens were collected and identified by the second author. Forty-seven specimens were examined from the JMLC. We examined the *Monecphora* at the FSCA and noted a single series of *M. cingulata* from São Paulo, Brazil, all with the same label data. There were no specimens of *M. cingulata* in the IBNP (*pers. comm.* Bolívar Garcete-Barrett).

Results and discussion

Superficially, *C. livida* and *M. cingulata* have very similar color patterns (figs. 1, 6, 10, 14, 15) although they differ in other morphological characteristics. The two genera can be distinguished from one another, and many species have distinctive color patterns unlike the similar pattern described in *C. livida* and *M. cingulata*. *Catrimania* spp. have a wide vertex



Figures 1–9. *Catrimania livida* Paladini & Cryan, 2012 females. 1. Maculate form, dorsal habitus. 2–4. Variations of the weakly maculate forms, dorsal view. 5. Immaculate form, dorsal view. 6. Maculate form, lateral habitus. 7. Clypeus. 8. Face. 9. Female genitalia, ventral view.

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at the head, tibial spines equal in size and an aedeagus without an apical process (Paladini et al., 2015). In contrast, *Monecphora* spp. have a narrow vertex at the head, large spines on the base of the tibia relative to the apical spines, and an aedeagus with a flattened apical process. In the observed specimens of *M. cingulata*, the color pattern was invariable unlike the variation observed in *C. livida*. In *C. livida*, there is a transverse band that marks the upper third of the forewing with a prominent gap between the maculation and the apex of the scutellum (fig. 1). The transverse, dark band in *M. cingulata* is distinctly higher on the forewings intersecting the apex of the scutellum (fig. 14).

There is also a notable size difference between the two species. *M. cingulata* is a more large and robust species. Only males (n=47) were collected of *M. cingulata* and they had a body length of 9.51-10.94 mm, and a width between the humeral angles of 3.21-3.81 mm. The specimens of *C. livida* had a body length of ♂ 6.41-7.86 mm (n=284), ♀ 7.31-8.43 (n=257)

and a width between the humeral angles of ♂ 2.03-2.41 mm, ♀ 2.18-2.45 mm.

***Catrimania livida* Paladini & Cryan, 2012**
(Figs 1–13)

Specimens Examined: COSTA RICA: HEREDIA PROV.: Reserva Ecológica Bijagual de Sarapiquí, 294m elev., 95% EtOH, Malaise trap, 28-VI-2015, N 10°21.775' W 84°06.209', [Coll:] E.H. Nearn, I.P. Swift, P. Foster (JMLC, 279♂, 257♀). Some specimens from this series will be deposited in the PERC, NMNH and FSCA. PANAMA: VERAGUAS: Alto Piedra, Santa Fe, 850m el. 11-16-VIII-2012 Coll. J.B. Heppner (JMLC, 2♂; FSCA, 3♂).

Distribution: This species was previously known from only Costa Rica (Paladini and Cryan, 2012). Panama is a **new country record**.

Diagnosis: As originally described, *C. livida* is pale yellow with black eyes, ocelli, foretibiae, and tarsi (Paladini and Cryan, 2012). Both males and females can have different color forms with a transverse, dark band on the forewings (figs.



Figures 10–13. *Catrimania livida* Paladini & Cryan, 2012 males from Costa Rica. 10. Weakly maculate form, dorsal habitus. 11. Immaculate form, dorsal view. 12. Aedeagus, lateral view. 13. Paramere, lateral view.

Table 1. Distribution of color patterns in examined specimens of *Catrimania livida* (n=541).

Sex	Color Pattern	n
Males	Weakly maculate	49
	Immaculate	235
Females	Maculate	103
	Weakly maculate	30
	Immaculate	124

1-4, 6, 10) as seen in our collected specimens. The postclypeus is inflated and convex with a median carina (fig. 7), and the pronotum lacks a median carina. The aedeagus is curved, weakly bifurcated apically (when viewed dorsally) with apical serrations on the margins (fig. 12). The parameres are pale yellow and weakly sinuated with a subapical spine directed anteriorly that darkens apically (fig. 13).

Remarks: A large number of specimens (n=536) were collected from the Heredia Providence which is where the type series was collected (Paladini and Cryan, 2012). Until now, *C. livida* was only known to be entirely pale yellow except for the black foretibia and tarsi. Here, we present variation in color pattern seen in this species where males and females have a single transverse, dark band on the forewings (Table 1). Besides the variation in the lateral band, there were no other differences observed between the different color forms.

Two forms were observed in the males; weakly maculate (fig. 10) and immaculate (fig. 11). Of the specimens from Panama, all five were weakly maculate males. The genitalia of immaculate males, and weakly maculate males from both localities were consistent with the line drawings presented in the original description of the species (Paladini and Cryan, 2012; figs. 8-9, 11-12). A greater diversity was seen in the females with several forms ranging from maculate to immaculate (figs. 1-5 respectively). Weakly maculate (figs. 2-4, 10) is described as having a very thin band that is lighter in color than the

maculate form and may or may not be entire. On immaculate individuals (fig. 5), the wings are more hyaline beginning where a band would be present, which is also seen in the maculate and weakly maculate forms.

***Monecphora cingulata* (Le Peletier & Serville, 1825)**
(Figs. 14–19)

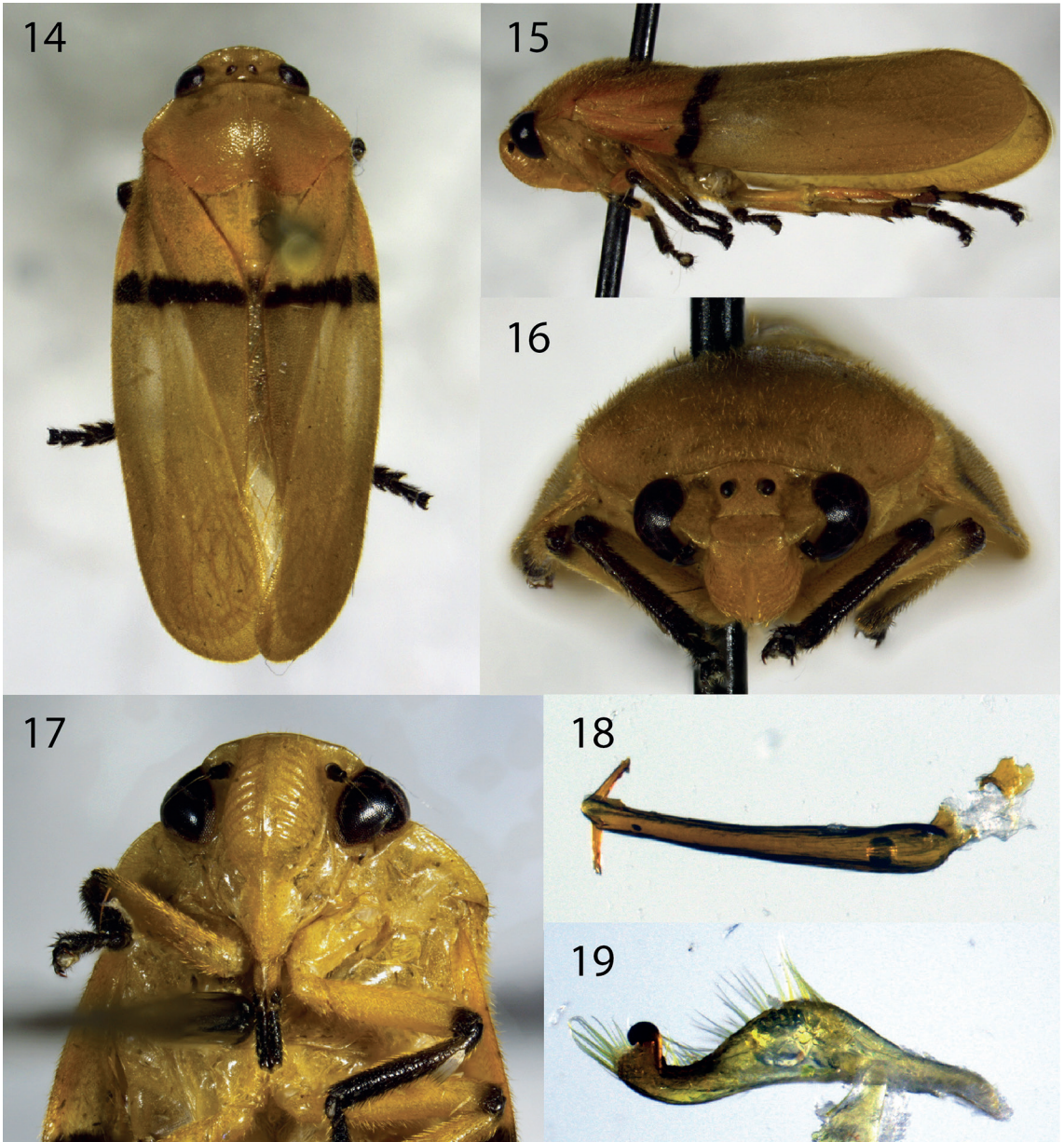
Specimens Examined: PARAGUAY: ITAPÚA DEPT.: vic. Pro Cosara Nature Reserve, S 26°38.271' W 055°39.850', Elev. 933 ft., 9-10-XII-2019, Coll: JE Eger, W Tyson, JB Heppner & JM Leavengood, Jr. (JMLC, 47 ♂). Some specimens from this series will be deposited in the IBNP, NMNH and FSCA.

Distribution: This species was previously known from Brazil (Carvalho and Webb, 2005), and only recently recorded from Misiones in extreme northeastern Argentina (Carvalho et al., 2016). Paraguay is a **new country record**.

Diagnosis: Both sexes of *M. cingulata* are yellow with a transverse, black band across the forewings, intersecting the tip of the scutellum (fig 14). The eyes, ocelli, apex of the scutellum, foretibiae, and tarsi are black. The postclypeus is inflated and convex with a median carina (fig. 17), and the pronotum also has a median carina. The aedeagus is rounded at the apex with a laterally flattened, bifurcated, apical process (fig. 18). The parameres are yellow, elongate, and sinuated with a subapical spine directed anteromedially that darkens apically (fig. 19).

Remarks: This distributional record was to be expected. Itapúa (Paraguay) shares its border with Misiones (Argentina) and the known records in Brazil (Rio de Janeiro, Paraná, Santa Catarina, Rio Grande do Sul) are all from the southeast. Some early sources mention a distribution in South America (Walker, 1851; Metcalf, 1961), though this continental distribution has not yet been verified by collected specimens.

All 47 specimens of *M. cingulata* collected were male, and no female specimens were collected at this site. Even if there was a sex collec-



Figures 14–19. *Monecphora cingulata* (Le Peletier & Serville, 1825) males. 14. Dorsal habitus. 15. Lateral habitus. 16. Face. 17. Clypeus. 18. Aedeagus, ventral view. 19. Paramere, lateral view.

tion bias, a collector might expect to still observe at least a few females in such a large sample size. Carvalho et al. (2016) examined 22 males with series of multiple specimens from the same localities, and six females from various sites with a maximum of 2 females from a given locality. This could simply be an artefact of the availa-

bility of *M. cingulata* specimens used in their investigation, or conversely, the lack of females could also suggest a male bias in the population during collection. A male bias for dispersal and seasonal variation in male abundance has been indicated in several *Prosapia* spp. (Hemiptera: Cercopidae) (Peck, 1999). Additionally, females

of *Prosapia* spp., especially when gravid, are known to be poor fliers (Peck 1999), so this male bias in *M. cingulata* may simply be from collection technique (light traps).

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