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Nota

First record of *Macrosoma tipulata* Hübner, 1818 (Lepidoptera: Hedylidae) for Colombia as a species of agricultural importance in copoazu (cupuaçu) *Theobroma grandiflorum* (Willd. ex Spreng.) K. Schum (Malvaceae)

Primer registro de *Macrosoma tipulata* Hübner, 1818 (Lepidoptera: Hedylidae) para Colombia como especie de interés agrícola en copoazu (cupuaçu) *Theobroma grandiflorum* (Willd. ex Spreng.) K. Schum (Malvaceae)

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Abstract

We present the first record of *Macrosoma tipulata Hübner*, 1818 in Colombia as a species of agricultural importance in copoazu. Two individuals in immature state and one adult were collected in the department of Caquetá, Florencia municipality, associated with the crops of copoazu *Theobroma grandiflorum* (Willd. ex Spreng.) K. Schum (Malvaceae). Additionally, we provide diagnostic images for this species of wing patterns, genital structures, and observations on the damage caused by last instar caterpillars on the copoazu leaves.

Additional keywords: Amazon, moth butterflies, phytophagous, Papilionoidea.

Resumen

Se presenta el primer registro de *Macrosoma tipulata* Hübner, 1818 en Colombia como una especie de interés agrícola en copoazu. Dos individuos en estado inmaduro y un adulto fueron recolectados en el departamento de Caquetá municipio Florencia, asociados al cultivo de copoazú *Theobroma grandiflorum* (Willd. ex Spreng.) K. Schum (Malvaceae). Adicionalmente se aportan imágenes diagnósticas para esta especie de patrones alares, estructuras genitales y el daño causado por orugas de último instar sobre las hojas de copoazú.

Palabras clave: amazonía, mariposas polilla, fitofagos, Papilionoidea.

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Introduction

The family Hedylidae are a group of Lepidoptera commonly known as "moth butterflies" (Scoble 1986, Scoble 1992). These are only found in the Neotropical region from central Mexico to the lowlands of southern Peru, central Bolivia, southern Brazil (Scoble, 1990a, 1990b, 1992, Scoble and Aiello1990, Yack *et al.* 2007) and northern Argentina (Bustos 2017). Generally, adults have nocturnal flight habits and so are attracted to light traps (Scoble 1990). It is, however, possible to collect them during the day (Scoble and Aiello 1990). For a long time the Hedylidae were considered moths of the family Geometridae (Prout 1916, 1932, Scoble 1986, Weller and Pashley 1995, Lamas and Grados 1995, Lourido *et al.* 2008, McCullagh *et al.* 2020) and even as an independent superfamily Hedyloidea (Scoble 1986). Until the recent proposal of Lourido (2011) *Macrosoma* was considered the only genus of the Hedylidae (Scoble 1986) with 36 known species (Van Nieukerken *et al.* 2011) and an estimated 40 (Yack et *al.* 2007). Recently, however, phylogenetic analyses using a combination of molecular and morphological data corroborated the fact that the hedylids are butterflies of nocturnal habits that belong to the superfamily Papilionoidea as the sister group to Hesperiidae (Heikkilä *et al.* 2012, Kawahara and Breinholt 2014, Espeland *et al.* 2018, Kawahara *et al.* 2018a, 2018b, Kawahara *et al.* 2019, McCullagh *et al.* 2020). Until the recent proposal of Lourido (2011) *Macrosoma* was considered the only genus of the Hedylidae (Scoble 1986) with 36 known species (Lourido 2011, Van Nieukerken *et al.* 2011) and an estimated 40 (Yack et *al.* 2007). However, Lourido (2011) reviewed *Macrosoma* based on cladistic analysis and revalidated the genera *Hedyle* Guenée, 1857 and *Phellinodes* Guenée, 1857 and described seven new species. Therefore, according to Lourido (2011), the Hedylidae family is composed of three genera and 46 species. More recently for Colombia, Garwood *et al.* (2021) have compiled the presence of 25 species of Hedylidae distributed in three genera within the checklist of the Papilionoidea of Colombia.

M. tipulata, is morphologically distinct from the remaining species in the family (Kawahara *et al.* 2018b) and is known in South America from the Amazon region (Lourido 2011), in Peru (Pasco, Loreto and Madre de Dios), Brazil (Amapá, Amazonas, Pará and Rondônia) and French Guyana (Lamas and Grados 1995, Lourido 2011, Silva *et al.* 2016). However, due to its similarity with another species of *Macrosoma* considered to be new in the work of Lourido (2011), *M. tipulata* was previously considered widely distributed, from northwestern Costa Rica (Chacón and Montero 2007) to southeastern Brazil in Rio de Janeiro (Scoble 1990b, Lourido *et al.* 2007, Silva *et al.* 2016). Although research on the biology and ecology of the Hedylidae family is scarce and recent (Lourido 2007), there is some research on *M. tipulata* (Lourido *et al.* 2007) where aspects of its biology associated with copoazu plants are described in the Amazon region from Brazil. The Amazon region is the largest reservoir of plant genetic resources in the world where several species of cocoa of the genus *Theobroma* (Malvaceae) (Escobar *et al.* 2009). In Colombia, copoazu *Theobroma grandiflorum* (Willd. ex Spreng.) K. Schum is grown in small plots as part of family gardens. Particularly in the department of Caquetá, this crop is grown in scattered plots, which together add up to an equivalent of 30-50 hectares for the department (Escobar *et al.* 2009). In this research we report the first record of *M. tipulata* (Lepidoptera: Hedylidae) in Colombia as a species of agricultural interest, as well as some aspects of its morphology and biology.

Materials and Methods

During the development of the project "Phytophagous insects associated with agroforestry crops of *Theobroma cacao* and *T. grandiflorum*, in the department of Caquetá, Colombia" , a study by the SIA group of the Entomological Museum of the National University of Colombia, Bogotá campus (UNAB), The zone of the collections was characterized as an agricultural landscape of tropical rainforest located in the Macagual Amazonian Research Center of the University of Amazonia in the Caquetá department, municipality of Florencia, at an altitude of 251 m.a.s.l (01° 29' 59" N, 75° 39' 47" W) (Figure 1). Two larvae of last instar were manually collected from copoazu leaves where the same pattern of leaf damage was evident from each of the larvae. One caterpillar was raised under laboratory

conditions and fed with their host plant in the facilities of the Entomological Museum of the UNAB. Other specimen was preserved in the collection following the protocol: immersion in hot water until slaughter and 96% alcohol preservation (Stehr 1991). For labeling the vial, protocols were followed according to UNAB standards (Martínez and Serna 2015) and the specimen was deposited in the Collection of Immature Forms (IFC) of UNAB for taxonomic determination. An adult (male) was collected through the use of Malaise trap installed inside one of the plantations. These were subjected to the assembly, labeling, cataloging and entry processes to the Central Taxonomic Collection (CTC) of UNAB (Martínez and Serna 2015). For the taxonomic determination of adults and larvae, the diagnoses and keys of Aiello (1992), Scoble (1986, 1992), Chacón and Montero (2007), and Lourido (2011) were used.

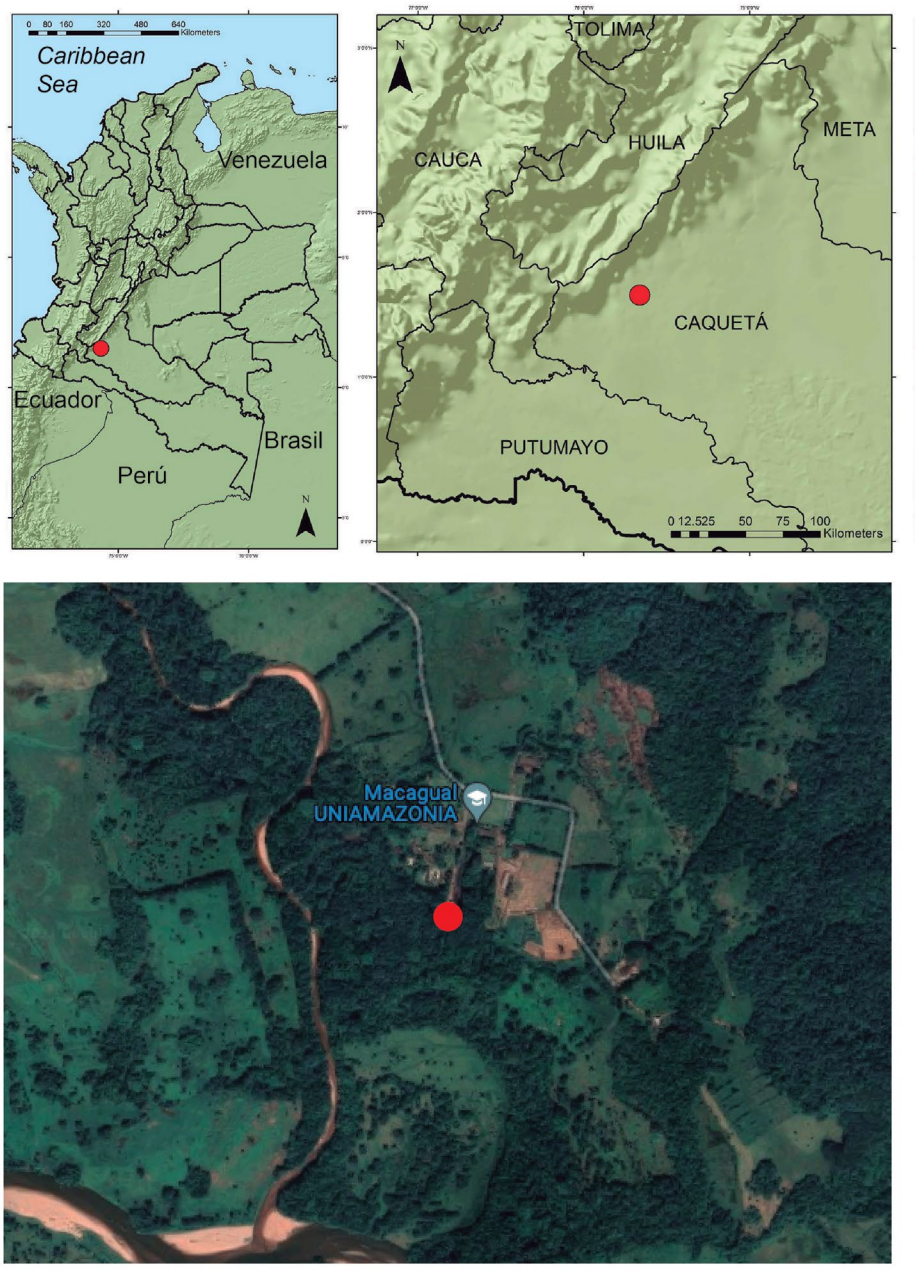

Figure 1. Location of *M. tipulata* in the Macagual Amazon Research Center, University of the Amazon, Florencia, Caquetá, Colombia.

Material examined

Adults: Colombia, Caquetá, Florencia, Vereda La Viciosa, site of the Macagual Amazon One Research Center, lat 1° 29' 59» N, long 75° 39' 47» W, 257 m.a.s.l, 15/IV/2014. C. Garcia. Raising the larva, Det. (diagnosis of taxon) C. Flautero. These data also correspond to the female collected by M. Bermúdez, 25/X/2014, Det. (diagnosis of taxon) C. Flautero. **Two larvae of last instar:** Colombia, Caquetá, Florencia, Vereda La Viciosa, site Amazonian Research Center Macagual (1° 29' 59" N, 75° 39' 47" W), 257 m.a.s.l, 11/IX/2013, C. Flautero, Det. (diagnosis of taxón) C. Flautero. UNAB No. Catal. 1239. The larvaes are preserved in alcohol 90%.

Results and Discussion

These are the first records of *M. tipulata* in Colombia, and two larvae were collected in September 2013 and Abril 2014, infesting leaves of copoazu as a species of agricultural importance. After four days the caterpillar entered pupal stage, and after 10 days an adult female emerged. One specimen male was collected in October 2014. Male and female are similar to *Macrosoma* considered a new species by Lourido (2011).

Adult diagnostic morphology

Diagnosis: Filiform antennae, white vertex and frontoclypeus (Lourido 2011). Forewing with white reniform spot, and a black border extending from the middle of the apex of the discal cell; subcostal band with light black dots towards the apex, black subapical spot encompassing the area of R1 and R2, apical spot extending from the area of R to M1, black dot located in the middle part of M1 visible dorsally and ventrally. Hindwing with light brown spots throughout the wing except for the costal area (Figure 2).

The genital structures were corroborated as per Lourido (2011). Genital structures of male: Uncus simplex ending in a point, valvae oval, ampulla projecting towards the apex of the valva and slightly overlapping it, margin equipped with spines on the internal segment (Figure 3 a-b). Genital structures of the female: Corpus bursae with serrate signum, thrice as long as wide and located medially on the dorsum (Figure 3c) (Lourido 2011).

Eating habits of caterpillars

In our observations, we obtained two last instar caterpillars that actively fed during the day under laboratory conditions and pupated 7 days after constantly feeding on fresh leaves of *T. grandiflorum*. An female emerged from the only surviving caterpillar after 10 days.

According to the observations made by Lourido *et al.* (2007) on the immature stages of *M. tipulata*, the caterpillars feed preferably on young leaves of *Theobroma grandiflorum* (Malvaceae). The damage caused by *M. tipulata* in copoazu is easily recognizable because of the irregular holes of varying sizes present in the interveins (Venturieri 1993, Lourido *et al.* 2007, Silva et al. 2016) (Figure 4). In its first larval instar, the consumption of the leaf is insignificant, since it is limited to scraping the leaf without making a hole. From the second larval instar there is a process of increasing consumption of the leaf that increasingly causes changes (Lourido *et al.* 2007). This consumption generates a relatively uniform vertical distribution of damage on the leaf with a tendency to greater consumption resulting in holes of the central rib (Figure 4). Infestation occurs at the beginning of the rainy season (December) when there is an intense flush of new leaves (Lourido *et al.* 2007). Our observations on last instar caterpillars are consistent with that reported by Lourido *et al.* (2007) where irregular shaped holes of various sizes were found within the leaf area of *T. grandiflorum*. Our observations on last instar caterpillars coincide with that reported by Lourido *et al.* (2007) where irregular shaped holes of various sizes were found within the leaf area of *T. grandiflorum*.

Conclusion

The Hedylidae is a very interesting group of Lepidoptera, but poorly studied in Colombia. For this reason, the observations on *M. tipulata* as a species of agricultural interest provide interesting data for the study of its ecology, taxonomy and distribution in Colombia. However, more precise observations are necessary on the behavior and development of the immature stages of *M. tipulata* in Colombia, its phenology, possible natural enemies in the search for an integrated control such as insects of agricultural interest in crops of *T. grandiflorum*.

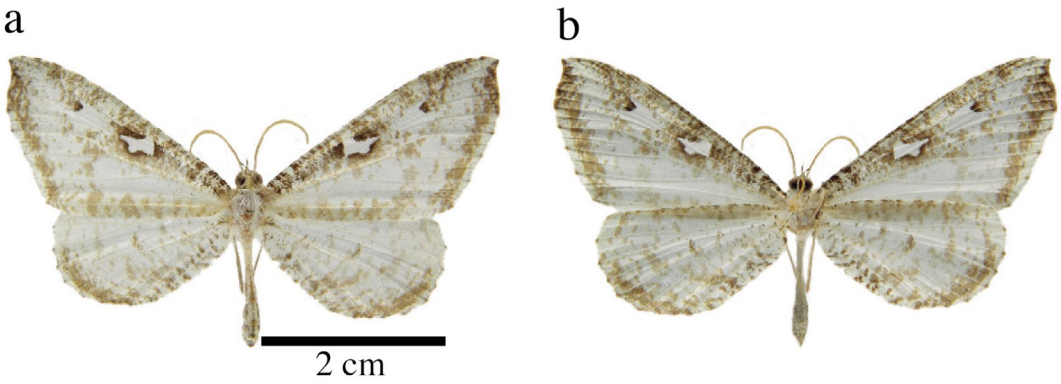

Figure 2. Adult female of *M. tipulata* obtained after 10 days emerging from the pupa. **a**. dorsal view. **b**. ventral view.

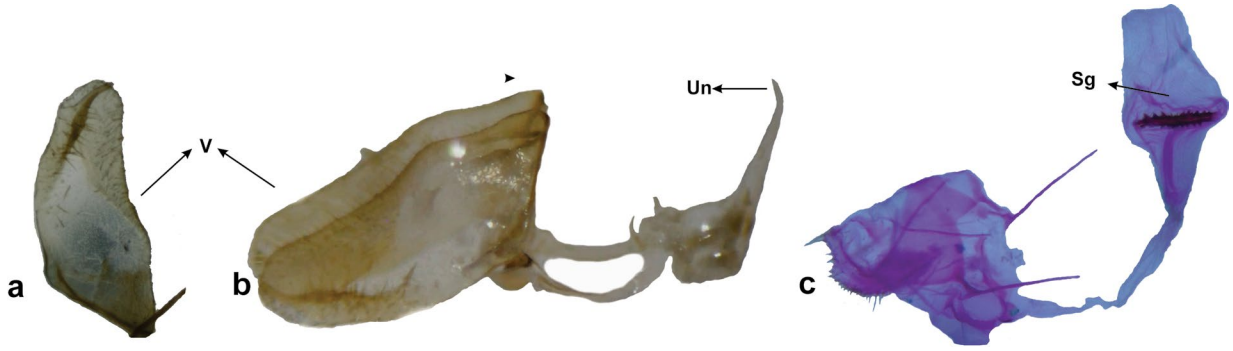

Figure 3. Male genitalia structures of *M. tipulata* **a-b**. V = valve, Un = uncus, **c**. Female genitalia structures, sg = toothed (serrated) signum.

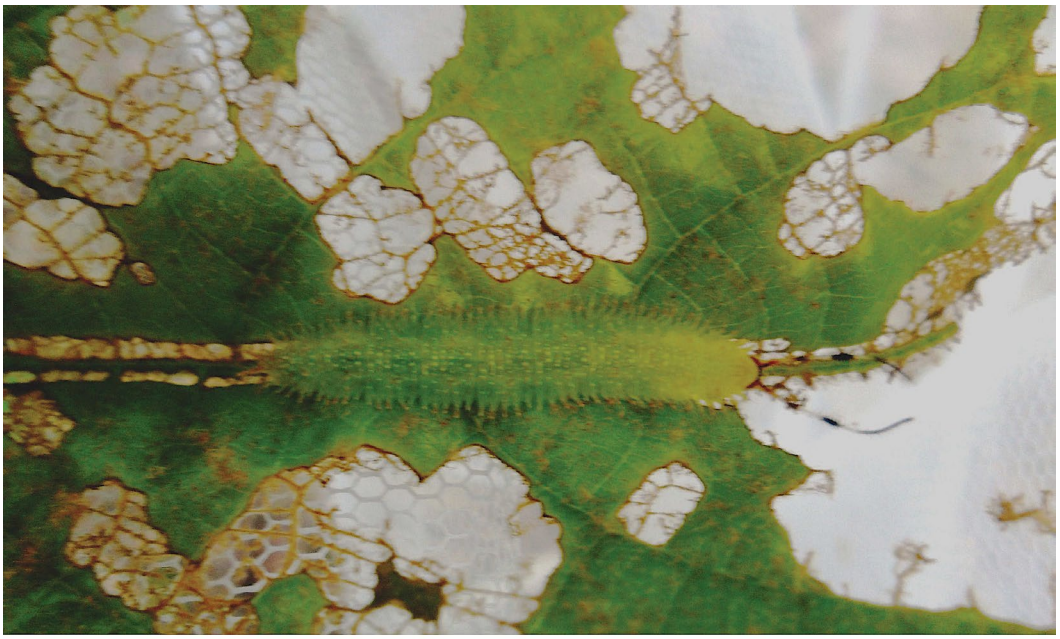

Figure 4. Damage caused by last stage caterpillars of *M. tipulata* on the leaves of *T. grandifolium* in the Macagual Amazon Research Center, University of the Amazon, Florencia, Caquetá, Colombia.

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