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Article

Three new registers of stem-borer insects in Terminalia ivorensis A.Chev.

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Abstract:

In the rural area of the municipality of Cúcuta, in northeastern Colombia, near the Venezuelan border, plantations of *Terminalia ivorensis* (amarillón), showed symptoms of stem borers insects. Although trees generally survive, damage affects directly the quality of the wood and demerits its value. In order to adequately diagnose this problem and identify the insects involved, logs were transfered to the phytosanitary diagnostic laboratory of the Colombian Agricultural Institute, *sede* Cúcuta, where they were placed in breeding chambers, from which emerged adults from three species. The recovered specimens were mounted, identified and determinations were confirmed for taxonomist. The butterfly *Cossula arpi* and the beetles *Cotyclytus scenicus* and *Scolytopsis puncticollis* are recorded as stem borers for the first time in forest plantations of *Terminalia ivorensis*. The latter is also a new report for Colombia. Comments are made about the distribution, morphology and ecology of

these species. It is hoped that this new information will contribute to direct monitoring actions in other regions where there are currently plantations of *T. ivorensis* and to complement the information of the temporal and spatial distribution of these insects.

Key words: Cerambycidae, Cossidae, *Cossula arpi, Cotyclytus scenicus,* Scolytidae, *Scolytopsis puncticollis.*

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Introduction

The Ivory Coast almond, *idigbo* or *amarillón* (*Terminalia ivorensis* A.Chev.) is a forest species native to Africa that is currently used in forest plantations in Central and South America (Arguedas, 2007). The entomofauna registers associated to this plant in the Neotropic are scarcely representative and correspond to information relative to other countries like *Costa Rica*, as well as to very specific detailed researches with little geographic distribution across *Colombia* (Madrigal, 2003).

In recent years, *T. ivorensis* plantations have been located in northern *Santander*, where a stem-borer larva identified as *Cossula* sp. (Lepidoptera: Cossidae) has produced deformation and loss of quality of the wood and weakening of the stem. Although this is a common, limiting problem in its entire distribution area in Central and South America (Madrigal, 2003; Arguedas, 2007), the causative agent remains unidentified so far. In the same locations, two beetle species unregistered in the literature have been observed to bore the bark of *T. ivorensis*.

Since every management strategy must originate from, and be consistent with the taxonomic and biological information regarding the causative agent, the

objectives of this research were to determine the taxonomic identity of, and collect biological information about various stem-borer species in *T. ivorensis*.

Materials and Methods

At present there are no taxonomic keys for its identification at species level in is larval state. Therefore, the capture of adult specimens is necessary. In order to collect adult specimens, pieces of the stem with an evidence of the presence of stem-boring larvae were cut; these evidences included the opening of the gallery and the presence of tree exudate and larval excrements; the material was taken to the phytosanitary diagnostic laboratory of the Colombian Agricultural Institute (*ICA)* in the Northern *Santander* District, where the samples were placed in 30 × 30 × 80 cm breeding chambers lined with cloth, and the emergence of adults was waited for.

Once the adults emerged, they were sacrificed and mounted on entomological pins as proposed by Triplehorn and Johnson (2005). For the preparation of the genitalia of both females and males, the abdomen of the examined specimen was removed and submerged during 10 minutes in alcohol at 70 %; it was subsequently put in KOH (potassium hydroxide) at 10 % p/v and was left in a double boiler (indirect heating) for 15 minutes in order to accelerate the process to 60 °C. The first to sixth abdominal segments were then removed so as to leave only the genitalia, which were stored in a phial with glycerine next to the specimen to which they belonged. Photographs were taken with a Nikon SMZ 1000 camera and a Nikon ni camera.

The identification at family level was carried out using the Lepidoptera and Choleoptera order keys of Da Costa Lima (1945) and Triplehorn and Johnson (2005); the keys of the Cossulinae subfamily were used for the genus *Lepidoptera* (Davis *et al.,* 2008), while Wood's keys (2007) of the *Scolytidae* family were utilized for the specimens of the genus *Choleoptera*. The identification was subsequently corroborated by Thomas Atkinson, the group's

taxonomist. In the case of *Cerambycidae*, the taxonomic keys and tools (Turnbow and Thomas, 2002; Bezark, 2012) made it possible to carry out a preliminary identification, which was corroborated by specialist María Helena Galileo. The specimens were deposited in the "Luis María Murillo" National Taxonomic Insect Collection (*CTNI*), under the 750 to 752 codes.

Results and Discussion

Examined material

Cossula arpi (Schaus, 1901)

1H. *Colombia*: Northern *Santander*: *Cúcuta*. Township of *Palmarito*. 7°51'06" N, 72°30´12" W. 381 m. March 11, 2010. Vásquez, J. A. (CTNI). 3M. *Colombia*: Northern *Santander. Sardinata*. 7°51'06" N, 72°30´12" W. 381 m. March 11, 2010. (CTNI).

Cotyclytus scenicus (Pascoe, 1866)

1H. *Colombia*: Northern *Santander*: *Cúcuta*. Township of *Palmarito*. *Finca Villanueva*. 8°18'49" N, 72°29´09" W. 63 m. February 28, 2013. Tricia Nayibe (CTNI).

Scolytopsis puncticollis Blandford, 1896

1H. Colombia: Northern *Santander*: *Cúcuta*. Township of *Palmarito*. *Finca Villanueva*. 8°18'49" N, 72°29´09" W. 63 m. February 28, 2013. Tricia Nayibe Murillo (CTNI).

This is the first register of the host of *Cossula arpi*. *Cossula* sp. larvae have been observed as stem borers in other species of the genus *Terminalia*, such as *T. amazonia* (J.F.Gmel.) Exell, and *T. oblonga* (Ruiz & Pav.) Steud. However, there is no confirmation that this stem borer is indeed *Cossula arpi* (Arguedas, 2007). According to comments by producers in plantations of Northern *Santander*, the damages caused by larvae of the genus *Cossula*

are much milder in *Terminalia amazonia*, a native species, than in *T. ivorensis*, an introduced taxon native of Africa. This may be due to differences in the amount of exudate produced by the *Terminalia* taxa when bored by the Lepidopterous' larvae, since *T. amazonia* exhibits more exudate than *T. ivorensis* when the larva bores the main stem.

The *C. arpi* moth has a neotropical distribution across the following countries: Guatemala, Colombia, Costa Rica, Panama, Venezuela, Ecuador and southern Brazil. *C. arpi* adults have been collected within a range of 20 to 2 200 masl (Davis *et al.,* 2008). There are *T. ivorensis* plantations exhibiting damage below 500 masl. As for the temporal distribution of the species, adult specimens have been captured through most of the year (Davis *et al.,* 2008).

The larva has a length of up to 5.5 cm and a diameter of 0.9 cm; it is robust, with a hump in the prothorax that has a round, stiff plate with curved bristles, a typical characteristic of the genus *Cossula* (Machín, 1991) (Figure 1d and 1e).

The first larval states are located in the bark and have a reddish hue. They take shelter in these galleries and constantly expel their excrements to the exterior (Figure 1c). Subsequently, the larvae bore through the xylem and build vertical ascending galleries that range between 25 and 40 cm in length; similar damages are cited for *Terminalia ivorensis* plantations in *Costa Rica* (Ford, 1986).

Soon before they enter the pupa state, the larvae have a whitish hue; this happens close to the orifice of their gallery, from which adult specimens eventually emerge. The damage and the larvae have been observed in trees with a diameter as small as 8 cm until the harvesting of the wood. In certain occasions, the damages caused by the larva occur in adult individuals almost 10 m tall.

The color pattern of the wings and the genitalia of the male are diagnostic for the species (Davis *et al.,* 2008) (Figure 1a and b). The description proposed by Davis *et al.* (2008) agrees with the specimens collected during this research, with the exception of slight differences in the male's genitalia, in which the distance between the apex of the *uncus* and the *gnathos* corresponds to 40 %, not 30 %, of the genital capsule (Figure 1g).

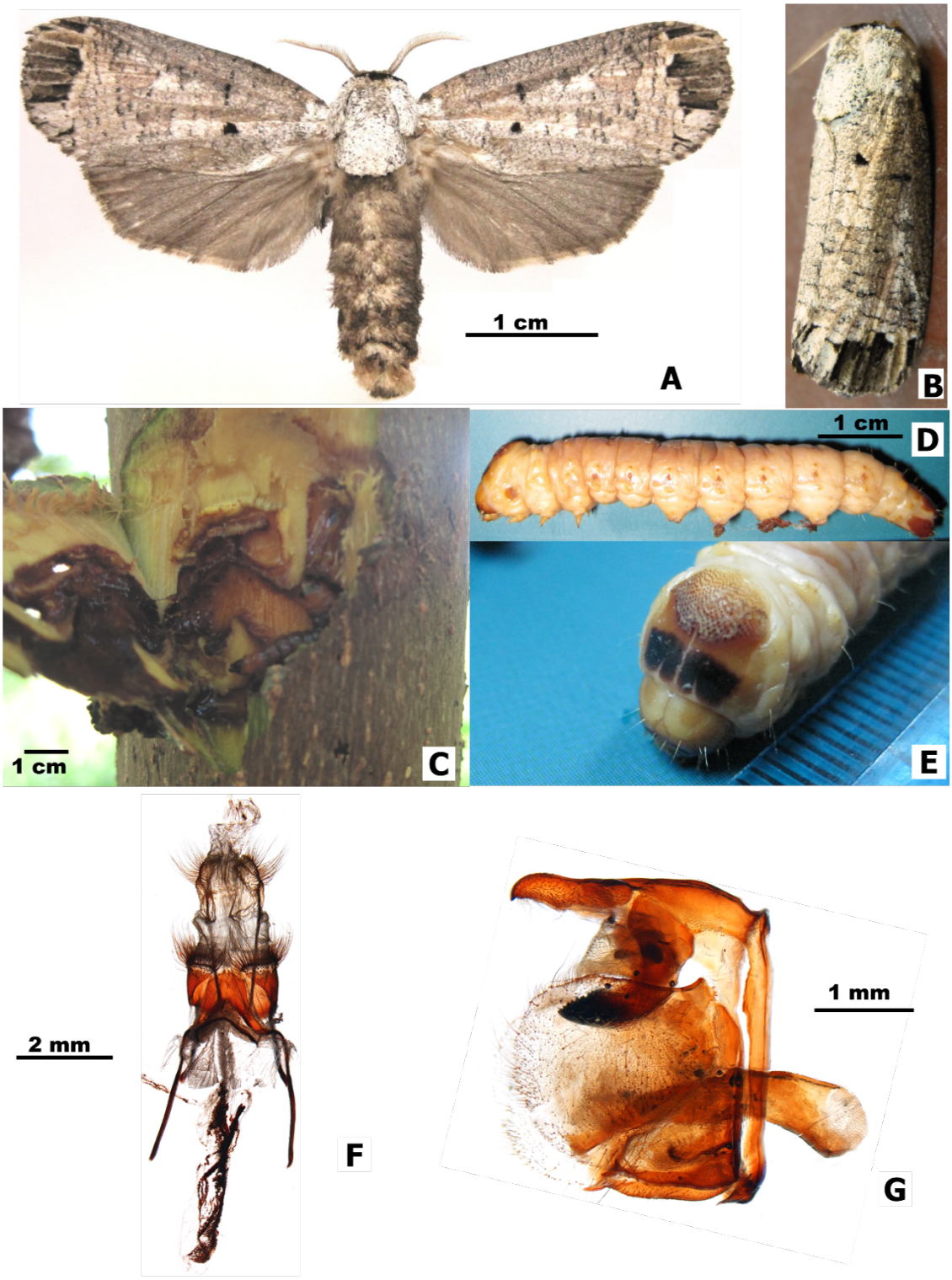

Figure 1. Stem-borer moth, *Cossula arpi* (Schaus, 1901). A. Habitus. B. Rest posture. C. Initial damage caused by the larva. D. Side view of the larva. E. View of the larva's prothorax. F. Female genitalia. G. Male genitalia.

Today, *C. arpi* is the main sanitary issue in *T. ivorensis* forest plantations of the region, which has caused certain producers to avoid planting this species. Management and control practices of this organism must be based on preventing the entry of the larva into the stem; frequent monitoring during the first stages of infestation might work to keep low the populations of insects.

Several dead larvae have been registered inside the stems; this would evidence the presence of an entomopathogenic microorganism. However, farmers have not observed any insects preying on or parasitizing the species. *Trichogramma* spp. releases have reduced the damage caused by this stem-borer; however, there are no experimental corroborations.

The bark borer beetle *Scolytopsis puncticollis* (Blandford, 1896), has a broad distribution in various Central American countries and in Brazil. Nevertheless, there are no records for *Colombia* (Wood, 2007) (Figure 2a). Its hosts include the lianas of the Malhigiaceae family, such as *Laguncularia racemosa* (L.)C.F.Gaertn. and *Bauisteria cornifolia* (Kunth) Spreng. 1825 (Wood, 1982); there are also plants of the Combretaceae family, of the genus *Conocarpus,* and *Terminalia amazonia*, (Atkinson, 2017).

The entry orifices are visible from the outside, and inside, longitudinal galleries for the offspring and transverse parental galleries can be observed (Wood, 2007) (Figure 2b). Each larva occupies a longitudinal gallery; the beetles later emerge as adults, and each beetle bores its own exit orifice.

Cotyclytus scenicus = *Neoclytus colombianus* (Pascoe, 1866) presents Santa Marta as a typical location, and *Colombia, Panamá* and *Venezuela* as its countries of distribution (Monné, 2013); neither the host plant nor any information about its biology were known before that time. Numerous adult *S. puncticollis* specimens emerged from the studied log.

C. scenicus elytra exhibit variations in the thickness of the Bellow V-shaped band in the middle of the elytron and in the back part of the basal triangular mark, which can be totally straight or projected backwards (Figure 2c and d). Pascoe's original description (1866) agrees with the characteristics observed in the specimens of Northern Santander.

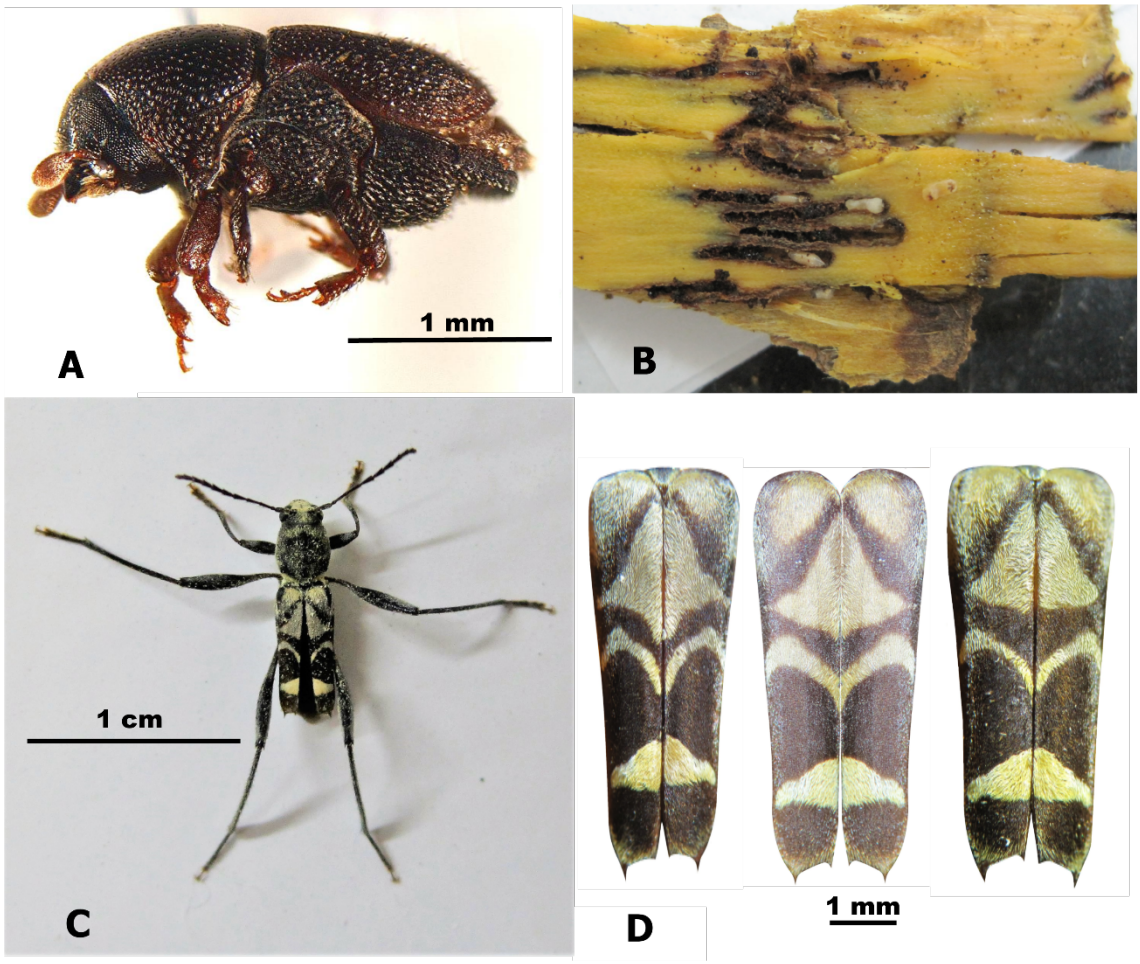

Figure 2. Stem-borer insects of *Terminalia ivorensis* A.Chev. A - B. Bark borer beetle *Scolytopsis puncticollis* Blandford, 1896. A. Side view. B. Damage. C – D. *Cotyclytus scenicus* (Pascoe, 1866) beetle with long antennae. C. Habitus. D. Elytra variation.

There is little knowledge of the entomofauna existing in *T. ivorensis* trees in the Neotropic; in the course of this research, three new registers were obtained with few samples and during a single season of the year. Further efforts must be carried out —with representative samplings in the regions where *T. ivorensis* is currently being cultivated—, and other *Terminalia* species must be included, in order to identify all the insects that may affect the quality of the wood.

Conclusions

Three species of insects affecting the wood in *T. ivorensis* plantations were registered for the first time. The *C. scenicus* beetle and the *C. arpi* lepidopterous had been cited for *Colombia*; however, their host plants were unknown. This was the first time that *Scolytopsis puncticollis* was registered in *Colombia* and in *T. ivorensis*.

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Conflict of interests

The author declares no conflict of interests.

Contribution by author

José Mauricio Montes Rodríguez: processing of the material, preliminary identification of the entomological material; drafting of the abstract, introduction, materials and methods, conclusions and acknowledgements, photographs and photographic edition.