Uncovering the diversity of a rich insect family in Colombia, the case of the genus Notiospathius

To understand a phenomenon, we usually start by looking at the number and type of parts that compose that subject; we like to know the anatomy of a system in order to move into its functionality. The simple question of how many species live in our planet is challenging to answer. The lack of knowledge on the size of biodiversity is uneven both taxonomically and geographically. There are regions of the planet where the number of known species has been quite stable along decades, while for other places this number is fairly unknown. Thus, we may be far from understanding key traits of the web of relationships that hold biodiversity. Furthermore, the disproportionally small number of scientists working on insects struggle to understand the biodiversity of the group. For example, for the family Braconidae, the number of known species is about 40,000 and several estimations easily doubled this value.

Fig. 1. Habitus of species of *Notispathius* from Colombia.

Colombia is a country with a mixture of unique ecosystems, a complex geography, and a strategic location in the tropics; cornered by two oceans, bordered on the south by the amazons, and connected to Central America by Panama. Nevertheless, Colombia is one of these regions with a precarious knowledge of its biodiversity. Thus, the efforts to discover the real meaning of its biodiversity should be a priority for mankind there.

For instance, *Notiospathius* is the second most diverse genus of the doryctine, a subfamily of the Braconidae wasps in the Neotropical region. However, only two species had been reported there and no studies on the diversity of the genus had been conducted. With some exceptions doryctine wasps are almost entirely represented by parasitoid wasps. Parasitoids are organisms that live in or on other organisms, feed upon them, and finally kill them. Such a life strategy renders these insects a key group in pest control.

Morphology has been the background upon which most of the diversity has been described, and given our natural perceptive bias, visual structures are more than welcome to recognize species limits with the use of explicit and rigorous methods for morphological data analysis. Most of morphological characters for the identification of the species of the genus *Notiospathius* include shape, size, color of their body, and specific veins on the wings (Fig. 1). Hence, qualitative and quantitative characters of specimens from entomological collections from Colombia and international repositories of *Notiospathius* specimens were analyzed.

Therefore, to investigate which is the diversity of *Notiospathius,* we used standardized ways to document structural variation joined by an array of powerful statistical tools of multivariate analysis that allow us to take taxonomic decisions based on more explicit and testable information. Our study revealed that *Notiospathius* inhabits between 2 m and 3,660 m, and the analysis of morphologic characters provides strong evidence to report eight species to Colombia originally described from Costa Rica, Panama and Venezuela. In addition, the description for 14 new species to science was provided, a comprehensive taxonomic key was supplied with illustrations. Based on our results, now 23 species is a closer number to the richness of the genus in Colombia. These results support the value of morphology to uncover diversity and the cited need to deeply study the diversity of arthropods in biodiversity hotspots.

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Publication

Taxonomic synopsis of Notiospathius Matthews & Marsh, 1973 (Hymenoptera: Braconidae) from Colombia.
Rodriguez-Jimenez A, Sarmiento CE
Zootaxa. 2016 Jun 29