Scientific Note

Nest camouflage records on five social wasp species (Vespidae, Polistinae) from southeastern Brazil

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Abstract: Social insects adopt different strategies to defend their colonies, including camouflage. Aiming to increase the knowledge about this strategy on social wasps, in this study we present records of nest camouflage for Parachartergus smithii (de Saussure), Parachartergus wagneri du Buysson, Chartergellus communis Richards, Metapolybia cingulata (Fabricius) and Mischocyttarus anthracinus Richards. We recorded the nests in five conservation units in Minas Gerais state, southeastern Brazil: in the Atlantic forest areas such as Environmental Protection Area of Machado River (21º47'21.49"S; 46º07'26.13"W) in November 2018, Serra do Papagaio State Park (22º02'55.30"S; 44º38'36.67"W) in January 2017, and Rio Doce State Park (19º39'59.66"S; 42º32'57.09"W) January 2011 and in the Cerrado areas such as Pandeiros River Wildlife Refuge (15º30'19.90"S; 44º45'25.71"W) in October 2014, and Sempre Vivas National Park (43º46'37.12"S; 17º48'22.17"W) between October 2018 and March 2019.

Active searches for colonies were carried out between 9 am and 4 pm. Once the colony was found, a photographic record was made, alongside notes regarding the different characteristics of the number of colonies, substrate, ground height (m), camouflage, behavior and locality (Table 01). Additionally, we caused disturbances to the colony, by touching it and registering the behavior of the individuals for the next 25 to 30 minutes using the ad libitum method (DEL-CLARO 2010), considering it docile behavior when individuals remain inside the nest and / or dispersed in flight, and aggressive, when they fly around the source of disturbance and try to sting (STRASSMANN et al. 1990). Then, we collected around three to five individuals for species identification and prepared them for dry preservation. Finally, we integrated the specimens into the IFSULDEMINAS Campus Inconfidentes and Emilio Goeldi Paraense Museum social wasps biological collections within the SPECIESLINK NETWORK (2020). The specimens were identified by Dr. Orlando Tobias da Silva, from Emilio Goeldi Museum.

Concerning P. smithii (Figure 1A and 1B), at the time of...
registration, there were no individuals on the outside of the colony. However, the disturbance of the observed structure confirmed that it was a colony, as it prompted the exit of the individuals, which demonstrated docile behavior, remaining over the nest wrapper. The shape and gray color of the nest allows it to disappear into the substrate, which demonstrates homochromy or homotype camouflage (Table 1). Mateus et al. (1997), for instance, reported a case of a P. smithii nest with a light gray colored envelope, striated with brown and dark gray, which produced a camouflage for the nest.

Parachartergus wagneri (Figure 1C and 1D) did not present individuals on the colony surface, at the time of registration. However, disturbances in the nest prompted the exit of individuals through the opening in the posterior portion of the nest, also cryptic due to its adherence to the tree trunk. Outside the nest, the individuals remained immobile, not attacking, then flying around due to the disturbance persistence. Such docile behavior seen in P. wagneri suggests the adoption of alternative strategies of colony defense. Also, the gray color similarity between the nest and the vegetal substrate reinforces the hypothesis of camouflage (Table 1).

Metapolybia cingulata nests presented a gray color similar to the trunk or the wood used in nesting, which suggests homochromatic camouflage. However, when the nest is similar to the shape of the trunk bark, a camouflage of the homotype kind is suggested (Figure 1E), as reported by Somvila et al. (2012). Therefore, camouflage in this species is based on two simultaneous strategies, homotype and homochromia. In addition, the nests of this genus are of the astelocyttarus type (Richards & Richards 1951), where the single honeycomb is firmly adhered to the substrate, making its distinction difficult. Differently from the species of Parachartergus and Chartergellus, the individuals of M. cingulata presented aggressiveness when the intentional disturbances, by dispersing and investing in attempts to sting. This suggests camouflage and aggressiveness as joint defense mechanisms (Table 1) (Chavarría-Pizarro & West-Eberhard 2010). In the case of C. communis (Figure 1F) the shape of the nests combined with their coloring made them difficult to distinguish in the environment (Table 1). Their behavior was similar to that shown by P. smithii (Mateus et al. 1997), P. colobopeterus (Strassmann et al. 1990), Chartergellus punctation Richards, and Chartergellus golftensis West-Eberhard (Chavarría-Pizarro & West-Eberhard 2010).

Similar reports were made for Metapolybia and for Synoea species, which, although building camouflage nests, show aggressive behavior when there are disturbances external to the colony (Chavarría-Pizarro & West-Eberhard 2010). In this sense, it must be mentioned that the alternation between aggressiveness and docile behavior is directly associated with the stage of the colony, being docile in nests with low productivity and aggressive when increasing the production of eggs and pupae, as described for Metapolybia aztecoïdes Richards (Forsyth 1978).

Regarding color and shape of M. anthracinus colonies, there is considerable similarity with the capitulum type inflorescence of the Asteraceae (Figure 1G). This makes the identification of the nest hard within the environment. Therefore, we infer, once again, nest camouflage based on shape and color. When there was an approach to the colony, the individuals flew away or remained in it, moving to the opposite side of the nest, without any aggressiveness. Due to the susceptibility of some species of the Mischocyttarus genus to predators in colonies with few individuals and lacking a protective wrapper due to factors such as stunted stingers (Janné 1975; Raposo-Filho & Rodrigues 1984), direct and indirect defense strategies can be observed. In this regard, camouflage is a relevant strategy for the genus, as demonstrated by recent studies (e.g. Barbosa et al. 2016, Milan et al. 2020).

We conclude that camouflage is the main defense strategy in colonies of P. smithii, P. wagneri, C. communis and M. anthracinus, while for M. cingulata it is adopted in combination with aggressive behavior.

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Figure 1. Camouflaged nests of social wasp species, Minas Gerais state, southeastern Brazil. A and B - *Parachartergus smithii* recorded at Pandeiros River Wildlife Refuge (RVS); C and D - *Parachartergus wagneri* recorded in the Environmental Protection Area of the Machado River; E - *Metapolybia cingulata* also from RVS; F - *Chartergellus communis* in RVS; G - *Mischocyttarus anthracinus* in Serra do Papagaio State Park.
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