







Notes & Comments

***Protonectarina sylveirae* (Hymenoptera: Vespidae): first report preying *Bedellia somnulentella* (Lepidoptera: Bedelliidae) in Brazil**

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The cultivation of sweet potato, *Ipomoea batatas* Lam (Solanales: Convolvulaceae), is important for food security (FAOSTAT BRAZIL, 2021). Roots and vines of sweet potato are food for humans and animals and industrial raw materials (Schoenherr et al., 2019). Sweet potato plants produce phytoalexins, latex and terpenoids with antibiosis effect, but insect pests can damage this plant (Santos et al., 2018a). The leaf-mining microlepidoptera *Bedellia somnulentella* (Zeller, 1847) (Lepidoptera: Bedelliidae) is native to Eurasia and one of the main insect pests of the aerial part of sweet potato plants (Steyn et al., 2020; Santos et al., 2021).

Bedellia somnulentella feeds on the leaf mesophyll reducing photosynthesis and, consequently, the development of tuberous roots of sweet potato plants (Santos et al., 2018b). In addition, lesions caused by *B. somnulentella* facilitate pathogenic fungi and bacteria entering leaf tissues, reducing sweet potato yield (Cabrera Asencio et al., 2008). This invasive pest was reported on the African, American, Asian, European and Oceania continents (Parrella and Kok, 1977; Fatah et al., 2014). In South America, it was registered in Peru and Brazil (Nhm, 1914; Santos et al., 2018b, 2021). Alternatives for pest management in sweet potato crops are being sought, increasing the importance of identifying native natural enemies of *B. somnulentella*.

Vespidae are predatory and entomophagous insects that are important in biological control preying on Diptera, Hemiptera, other Hymenoptera and mainly Lepidoptera species (Brigatte et al., 2011). The paper wasp *Protonectarina sylveirae* (Saussure) (Hymenoptera: Vespidae), the only species of the genus *Protonectarina* Ducke, is aggressive, forming colonies with large populations (Jacques et al., 2018) and has been reported in Argentina, Brazil and Paraguay (Silva et al., 2018). In Brazil, *P. sylveirae* has been reported in Bahia, Ceará, Espírito Santo, Goiás, Mato Grosso do Sul, Minas Gerais, Paraná, Piauí, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina, and São Paulo states (Henrique-Simões et al., 2016;

Silva et al., 2018). *Protonectarina sylveirae* occurs in the Atlantic Rainforest, Cerrado (Savanna) and Caatinga, a type of desertic vegetation found exclusively in the northeast Brazil (Silva et al., 2018).

Protonectarina sylveirae builds elaborate and polygenic nests by swarming and its social characteristics are complex (Picanço et al., 2011; Pereira et al., 2013). Social wasps (Hymenoptera: Vespidae: Polistinae) actively participate in the trophic balance in natural ecosystems and in the biological control of agricultural pests (Ferreira et al., 2020). Due to their social behavior, these wasps are abundant and participate in food chains (Picanço et al., 2010). Furthermore, social wasps preferentially feed on immature lepidopterans (Prezoto et al., 2019). Damage caused by Lepidoptera caterpillars is one of the main phytosanitary problems in Brazilian plantations with significant economic losses (Bueno et al., 2017). Wasp predation is a significant mortality factor (Soares et al., 2019) and should be included in pest management programs (Bacci et al., 2019). The objective was to record the predation of *B. somnulentella* caterpillars and pupae by *P. sylveirae* on sweet potato plants.

Wasp specimens were observed preying on *B. somnulentella* caterpillars and pupae on sweet potato in the field at different times in the horticulture sector of the Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM) in Diamantina, Minas Gerais, Brazil (altitude 1387 m, 18° 10'S and 43° 30'W). A nest and individuals of this wasp were collected, photographed and sent to the taxonomist Prof. Marcos Magalhães de Souza, from the Federal Institute of Education, Science and Technology of Southern Minas Gerais, Brazil, for identification.

The wasps were identified as *Protonectarina sylveirae* (Saussure, 1854) (Hymenoptera: Vespidae). The body length of *P. sylveirae* is short (less than 1.0 cm long), with black coloration and yellow marks and stripes on the body (Figure 1A). The identification of *P. sylveirae* was based, on a lateral and frontal view of the head, on the lateral

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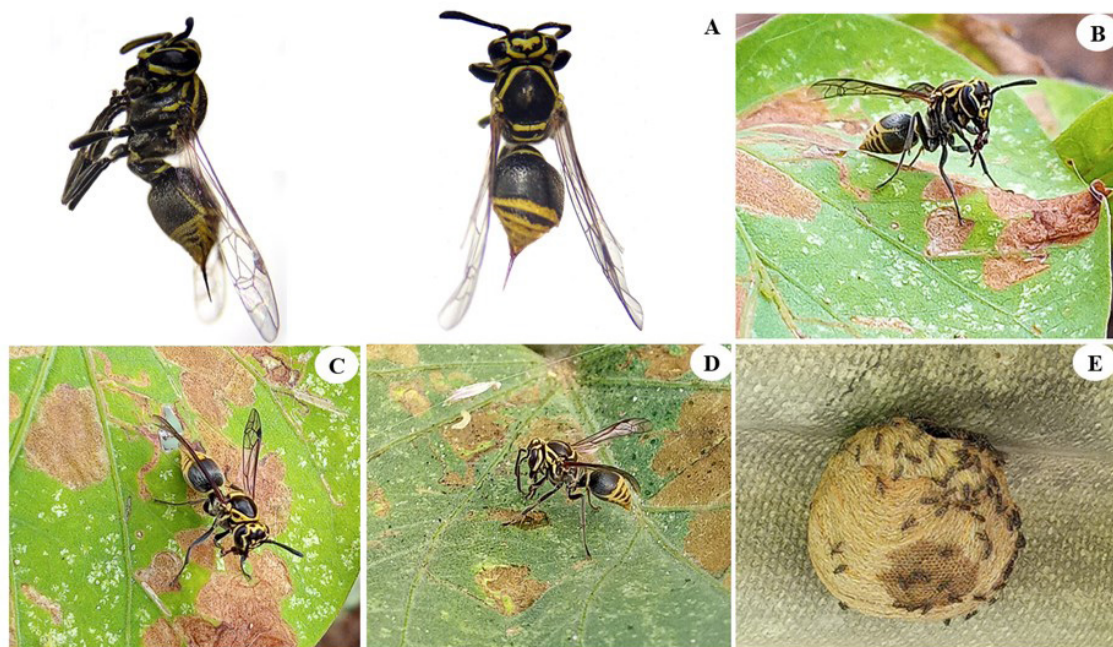


Figure 1. Adults (A), predation of *Bedellia somnulentella* (Lepidoptera: Bedelliidae) caterpillars and pupae (B, C), individual of *Protonectarina sylveirae* (Hymenoptera: Vespidae) tearing leaf mines looking for caterpillars of different instars (D) of *B. somnulentella* and nest (E), of this wasp, built in civil construction in Diamantina, Minas Gerais state, Brazil.

ocellus separated by a distance almost equal to that of an ocellus to the eye, metasomal segment I non-petiolate in a dorsal view and eyes with short bristly bristles (Richards, 1978; Carpenter and Marques 2001).

Adults of *P. sylveirae* preyed on all *B. somnulentella* caterpillars and pupae on sweet potato plants in the field by feeding and carrying many of these prey to the nest within a few hours (Figure 1 B, C). The predation of *B. somnulentella* caterpillars and pupae on sweet potato plants suggests the importance of *P. sylveirae* in the biological control of this pest. *Protonectarina sylveirae* is also important for the biological control of the leafminers *Leucoptera coffeella* (Guérin-Ménéville, 1842) (Lepidoptera: Lyonetiidae) on coffee plants and *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) in open-field tomato crops in Brazil (Bacci et al., 2019).

The generalist and voracious feeding habit of *P. sylveirae* is common in social wasps (Brigatte et al., 2011), killing many preys such as caterpillars in short periods (Ghoneim, 2014). *Protonectarina sylveirae* caused 99.08% of the mortality of *T. absoluta* caterpillars (Bacci et al., 2019). Biological control by social wasps (Vespidae: Polistinae) has been reported for *Agelaia multipicta* (Haliday, 1836), *Agelaia vicina* (Saussure, 1854), *Apoica pallens* (Fabricius, 1804), *Brachygastra lecheguana* (Latreille, 1824), *Parachartergus fraternus* (Griboldo, 1892), *Polistes ferreri* (Saussure, 1853), *Polistes versicolor* (Olivier, 1971), *Polybia bifasciata* Saussure, 1854, *Polybia chrysothorax* (Lichtenstein, 1796), *Polybia diguetana* (Buysson, 1905), *Polybia fastidiosuscula* (Saussure, 1854), *Polybia ignobilis* (Haliday, 1836), *Polybia jurinei* Saussure, 1854, *Polybia occidentalis* (Olivier, 1971),

Polybia platycephala Richards, 1978, *Polybia punctata* du Buysson, 1907, *Polybia sericea* (Olivier, 1971), and *Protonectarina sylveirae* preying on leafmining insects such as *L. coffeella*, *T. absoluta* and *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae) (Ghoneim, 2014; Tomazella et al., 2018). The social behavior of wasps, with many individuals per colony, increases the efficiency of these insects in the biological control, including *P. sylveirae* preying on *B. somnulentella*.

Individuals of *P. sylveirae* prey on caterpillars of different instars and *B. somnulentella* pupae inside or outside leaf mines (Figure 1D). This predation behavior is similar to that reported for this wasp preying on caterpillars and pupae of *T. absoluta* (Picanço et al., 2011; Bacci et al., 2019). Mines, in the leaves, protect *T. absoluta* caterpillars against *P. sylveirae*, but this wasp located these prey inside them, removed and preyed on them (Bacci et al., 2019).

Migrating caterpillars and prepupa of *B. somnulentella* are exposed on the leaves and are the first predated. In addition, *P. sylveirae* located leaves mined with *B. somnulentella* caterpillars, tore the leaf epidermis with its chewing mouthparts and withdrew them from the mines. The initial predation on exposed caterpillars is due to the easiness of attacking them, as feeding on the leaf mesophyll provides some protection, through the upper and lower epidermis of the leaf, against *P. sylveirae*.

The behavior of locating and removing caterpillars in mines is typical in species of the Vespidae family such as *B. lecheguana*, *Mischocyttarus drewseni* (Saussure, 1857), *Mischocyttarus labiatus* (Fabricius, 1804), *Mischocyttarus latior* (Fox, 1898), *Polistes ferreri* (Saussure, 1853), *Polistes*

simillimus (Zikán, 1951), *Polistes versicolor*, *Polistes satan* (Bequaert, 1940), *Polybia fastidiosuscula*, *Polybia ignobilis*, *Polybia jurinei*, *Polybia occidentalis*, *Polybia paulista* (R. Von. Ihering, 1896), *Polybia sericea* and *Protopolybia sedula* (Saussure, 1854) (Ghoneim, 2014; Jacques et al., 2018).

The nest shape of *P. sylveirae*, found 200 meters away from the sweet potato plantation, attached to civil construction, is oval cylindrical with thousands of individuals with a small upper opening (Figure 1E). The cylindrical oval *P. sylveirae* nest morphology is not a standard (Jacques et al., 2015), as this wasp builds nests in varying shapes and sizes, from small with simple to large and complex structures (Henrique-Simões et al., 2016). The finding of the *P. sylveirae* nest attached to civil construction confirms the diversity of nesting sites for this wasp, including large, perennial tree species, usually suspended from a branch (Soares et al., 2019), near civil constructions (Somavilla et al., 2017). The materials used by *P. sylveirae* to build nests are mainly vegetable fibers mixed with water and salivary secretion from the mandibular glands, resulting in a product similar to paper, which gave rise to its common name (Somavilla et al., 2012). The nest of *P. sylveirae* is of the fragmocyctic type with an initial comb fixed to the substrate and covered by an envelope or by a combination of new cells in the lower part of the first envelope, surrounded by a second one (Henrique-Simões et al., 2016). Then, new combs are built in an identical process, with each envelope having an entrance to the respective combs (Henrique-Simões et al., 2016).

The high population size of *P. sylveirae* is due to its swarm and polygyny strategy (more than one queen per nest), reducing the risk of losses and increasing the life span of the colony, whose females are philopatric (Biondi et al., 2013; Locher et al., 2014). The number of *P. sylveirae* individuals per nest can be thousands, including workers, males and queens (Arab et al., 2010), as reported for approximately 43,000 individuals, including 500 queens and large numbers of eggs, larvae and pupae in a nest of this wasp in São José do Rio Preto, São Paulo, Brazil (Tanaka Junior et al., 2010). The presence of males in *P. sylveirae* colonies indicates the beginning of the flocking period for the foundation of new nests (Tanaka Junior et al., 2010).

Identifying *P. sylveirae* preying on *B. somnulentella* caterpillars and pupae on sweet potato plants in Brazil is important for the integrated management of this pest. This is the first time this association has been registered and increases the need to preserve wasp colonies near cultivated areas to reduce *B. somnulentella* populations in conservative biological control.

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