

Notes and Comments

## ***Polistes satan* (Hymenoptera: Vespidae) predating *Dione juno juno* (Lepidoptera: Nymphalidae)**

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Insect pests, including *Dione juno juno* Cramer, 1779 (Lepidoptera: Nymphalidae), feed on leaves and branches, reducing the production of the yellow passion fruit *Passiflora edulis* Sims (Boiça Júnior et al., 2008). This pest is mainly controlled with chemical insecticides that can contaminate food, water, and soil, besides reducing populations of natural enemies and facilitating the emergence of resistant insects (Amatuzzi et al., 2018; Costa et al., 2020). Biological control agents of *D. juno juno* (e.g., Eulophidae, Formicidae, Pentatomidae, Tachinidae and Vespidae) naturally regulate populations of this defoliating lepidopteran in *P. edulis* crops (Moreira et al., 1998; Gil-Santana and Tavares, 2006; Murgas et al., 2020). Social wasps forage water, plant fibbers, and protein. These insects approach, touch with the antennae, capture, kill and cut their prey into pieces, consuming or transporting them to their colonies (Silva-Filho et al., 2020).

Predatory social wasps feed preferentially on immature Lepidoptera and generally return to continue searching for resources in successful locations, reducing populations of lepidopteran pests (Southon et al., 2019; Murgas et al., 2020). *Polistes* is one of the most efficient wasp genera controlling agricultural pests (Prezoto and Gobbi, 2005).

*Polistes satan* Bequaert, 1940 (Hymenoptera: Vespidae) occurs in the Neotropical region and has been reported in the states of Goiás, Minas Gerais, and São Paulo, Brazil, in the Atlantic Forest and Cerrado biomes (Souza et al., 2020a, b). This eusocial insect lives in large satellite-type colonies, attacking a wide variety of prey that makes up its diet, such as insects of the orders Coleoptera, Diptera, Hymenoptera and Lepidoptera (Southon et al., 2019).

The objective was to report *P. satan* preying on *D. juno juno* pupae in a *P. edulis* plantation.

Daily monitoring, during a period of 20 days, of *P. edulis* plants in the horticultural sector of the “Federal University of the Jequitinhonha and Mucuri Valleys (UFVJM)”, Campus JK in Diamantina, Minas Gerais state, Brazil (18° 12' S, W 43°34' W; 1,387 m a.s.l.) from September to

October 2020 allowed the observation of wasps preying on Lepidoptera pupae.

The wasps were collected, placed in 500 mL plastic pots, and transported to the UFVJM Cytology and Histology laboratory. They were photographed using a Canon EOS Rebel T7I camera and LED Segurimax® lights.

A taxonomist confirmed the identification of the lepidopteran as *D. juno juno*. Voucher specimens were sent and deposited in the entomological collection of the Department of Zoology at the Federal University of Paraná. Wasp specimens, collected with an entomological net, were identified as *P. satan*. Voucher species were deposited in the Coleção Biológica de Vespas Sociais (CBVS) of the IFSULDEMINAS, Campus Inconfidentes, registration number 06530-2021.

*Polistes satan* (Figure 1A) captured and fed on *D. juno juno* pupae on *P. edulis* plants. This wasp used its mandible to separate the thorax from the abdomen of the prey pupae and consumed the interior contents of its abdomen.

The average length of *P. satan* is 21.0 to 22.0 mm with black color and head and thorax with light ferruginous traces. Antennae with the first three and the last three segments ferruginous darkened. Black leg, distally narrow femurs, tibiae, ferruginous anterior tarsi, and yellow mid and posterior tarsi. Dark brown tegulae. Black wings and venation, moderate or small pronotal fovea, moderately elevated pronotal keel, elevated metanotum above the anterior scutellum, strong propodal striations, long, narrow, pointed muscle above, and Strong mesepisternal punctures are characteristic of this wasp (Figure 1) (Richards, 1978).

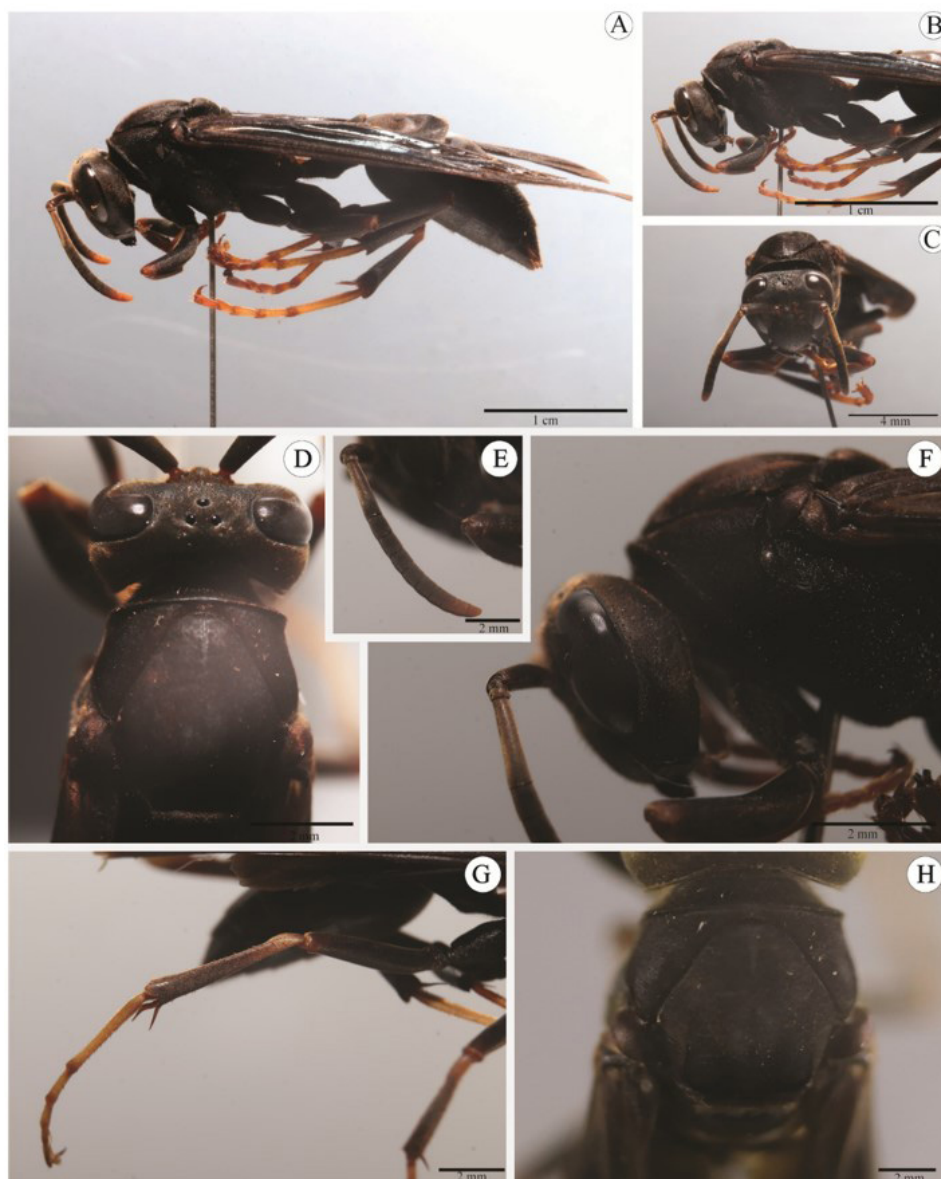
*Polistes satan* has been reported preying on *Diatraea saccharalis* Fabricius 1794 (Lepidoptera: Crambidae) and *Spodoptera frugiperda* J.E. Smith (Lepidoptera: Noctuidae) caterpillars exposed or protected inside the corn or sugarcane stalks, in the state of São Paulo, Brazil (Southon et al., 2019). This confirms the importance and the predatory habit of this wasp, such as that reported for *Mischocyttarus angulatus* Richards, 1945 (Hymenoptera: Vespidae), in the province of Coclé,

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**Figure 1.** *Polistes satan* (Hymenoptera: Vespidae), side (A and B) and frontal (C) views, head in dorsal view (D), antenna (E), view of the tegula (F), Midleg (G), pronotal with visualization of the keel (H).

Panama and *Polybia fastidiosuscula* Saussure, 1854, and *Polybia scutellaris* White, 1841 (Hymenoptera: Vespidae) in the municipality of Viçosa, Minas Gerais, Brazil, also feeding on *D. juno juno* caterpillars and pupae (Murgas et al., 2020; Moura et al., 2000). *Protonectarina sylveirae* Saussure, 1854 (Hymenoptera: Vespidae) preyed on caterpillars and pupae of *D. juno juno* and of *Bedellia sommulentella* Zeller, 1847 (Lepidoptera: Bedelliidae), whereas *P. satan* preyed only on pupae of this prey (Moura et al., 2000; Cabral et al., 2022). However, prey handling by social Vespidae varies as *Synoeca cyanea* Fabricius, 1775 (Hymenoptera: Vespidae) that removed *Zaprionus indianus* Gupta, 1970 (Diptera: Drosophilidae) larvae from the fruit and macerated it into a food mass, to facilitate feeding (Prezoto and Braga,

2013) and *Agelaiia testacea* Fabricius, 1804 (Hymenoptera: Vespidae) that immobilized with its legs and pierced the abdomen of *Parascudderia* sp. (Orthoptera: Tettigoniidae) to feed (Pinedo Garcia et al., 2022).

Lepidoptera pupae predation is more common because they are immobile. In contrast, caterpillars can be aggressive, with defensive behaviors such as those of *Thyrinteina arnobia* Stoll, 1782 (Lepidoptera: Geometridae) camouflaging themselves, attacking with their jaws or hanging from silk threads to reduce predation by *Podisus fuscescens* (Dallas, 1851) (Hemiptera: Pentatomidae) (reported as *P. distinctus*) (Soares et al., 2009a). In addition, pupae of *T. arnobia* rotate, difficulting their attack by natural enemies (Soares et al., 2009b). *Mormidea noulata*

Herrich Schaeffer, 1844 and *Podisus nigrispinus* Dallas, 1851 (Hemiptera: Pentatomidae) also fed on *D. juno juno* caterpillars and pupae in the municipality of Viçosa, State of Minas Gerais, Brazil (Murgas et al., 2020; Moreira et al., 1998). *Palmistichus elaeis* Delvare & LaSalle, 1993 (Hymenoptera: Eulophidae) parasitized pupae of *D. juno juno* in the State of Rio de Janeiro, Brazil (Gil-Santana and Tavares, 2006) and *Chetogena* aff. *scutellaris* (Wulp, 1890) (Diptera: Tachinidae) parasitized pupae of *D. juno juno* with records of the first interaction of *Brachymeria koehleri* Blanchard, 1935 (Hymenoptera: Chalcididae) as a hyperparasitoid in Diamantina, State of Minas Gerais, Brazil (Pinheiro et al., 2022). The lack of defensive movements (Lindstedt et al., 2010) may facilitate the predation of *D. juno juno* pupae by *P. satan*.

This is the first report of the predation and feeding process of *P. satan* on *D. juno juno* pupae. The record of *P. satan* feeding on *D. juno juno* pupae increases the number of natural enemies of this lepidopteran and the importance of Vespidae species in managing populations of this pest in the *P. edulis* crops.

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## References

- AMATUZZI, R.F., CARDOSO, N., POLTRONIERI, A.S., POITEVIN, C.G., DALZOTO, P., ZAWADENEAK, M.A. and PIMENTEL, I.C., 2018. Potential of endophytic fungi as biocontrol agents of *Duponchelia fovealis* (Zeller) (Lepidoptera: crambidae). *Brazilian Journal of Biology = Revista Brasileira de Biologia*, vol. 78, no. 3, pp. 429-435. <http://dx.doi.org/10.1590/1519-6984.166681>. PMID:29160362.
- BOIÇA JÚNIOR, A.L., ANGELINI, M.R. and OLIVEIRA, J.C., 2008. Aspectos biológicos de *Dione juno juno* (Cramer) (Lepidoptera: Nymphalidae) em genótipos de maracujazeiro. *Revista Brasileira de Fruticultura*, vol. 30, no. 1, pp. 101-105. <http://dx.doi.org/10.1590/S0100-29452008000100019>.
- CABRAL, M.J.S., SILVA, I.M., PINHEIRO, R.A., SANTOS, M.M., SOARES, M.A., PLATA-RUEDA, A., CASTRO, B.M.C., SILVA, W.M., SILVA, E.S. and ZANUNCIO, J.C., 2022. *Protonectarina sylveirae* (Hymenoptera: Vespidae): first report preying *Bedellia somnulentella* (Lepidoptera: Bedelliidae) in Brazil. *Brazilian Journal of Biology = Revista Brasileira de Biologia*, vol. 84, no. 5, p. e256779. <http://dx.doi.org/10.1590/1519-6984.256779>. PMID:35239790.
- COSTA, E.S.P., SOARES, M.A., CALDEIRA, Z.V., VELOSO, R.V.S., SILVA, L.A., SILVA, D.J.H., SANTOS, I.C.L., CASTRO, B.M.C., ZANUNCIO, J.C. and LEGASPI, J.C., 2020. Selectivity of deltamethrin doses on *Palmistichus elaeis* (Hymenoptera: Eulophidae) parasitizing *Tenebrio molitor* (Coleoptera: Tenebrionidae). *Scientific Reports*, vol. 10, no. 1, pp. 12395. <http://dx.doi.org/10.1038/s41598-020-69200-x>. PMID:32709920.
- GIL-SANTANA, H.R. and TAVARES, M.T., 2006. *Palmistichus elaeis* Delvare & LaSalle (Hymenoptera, Eulophidae): a new parasitoid of *Dione juno juno* (Cramer) (Lepidoptera, Nymphalidae). *Revista Brasileira de Zoologia*, vol. 23, no. 3, pp. 891-892. <http://dx.doi.org/10.1590/S0101-81752006000300040>.
- LINDSTEDT, C., TALSMAN, J.H.R., IHALAINEN, E., LINDSTRÖM, L. and MAPPEL, J., 2010. Diet quality affects warning coloration indirectly: excretion costs in a generalist herbivore. *Evolution*, vol. 64, no. 1, pp. 68-78. <http://dx.doi.org/10.1111/j.1558-5646.2009.00796.x>. PMID:19659593.
- MOREIRA, L.A., ZANUNCIO, J.C. and MOLINA-RUGAMA, A.J., 1998. Dados biológicos de *Podisus nigrispinus* (Dallas) alimentado com a lagarta do maracujazeiro *Dione juno juno* (Cramer). *Anais da Sociedade Entomológica do Brasil*, vol. 27, no. 4, pp. 645-647. <http://dx.doi.org/10.1590/S0301-80591998000400018>.
- MOURA, M.F.D., PICANÇO, M., GONRING, A.H.R. and BRUCKNER, C.H., 2000. Seletividade de inseticidas a três Vespidae predadores de *Dione juno juno* (Lepidoptera: heliconidae). *Pesquisa Agropecuária Brasileira*, vol. 35, no. 2, pp. 251-257. <http://dx.doi.org/10.1590/S0100-204X2000000200003>.
- MURGAS, A.S., MARTÍNEZ, A. and RODRÍGUEZ, L.M., 2020. Enemigos naturales de *Dione juno* (Cramer, 1779) (Lepidoptera: Nymphalidae) en cultivo de *Passiflora edulis* Sims, J. (1818). Centro Regional Universitario de Coclé, Universidad de Panamá. *Tecnociencia*, vol. 22, no. 1, pp. 97-108. <http://dx.doi.org/10.48204/j.tecno.v22n1a7>.
- PINEDO GARCIA, R.B., ROJAS, R.R., SÁNCHEZ, C., MENDES, D.M.M. and SOMAVILLA, A., 2022. Hunting from the air: a new record of predation of *Agelaea testacea* (Fabricius, 1804) (Vespidae: Polistinae) on a katydid *Parascudderia* sp. (Orthoptera: Tettigoniidae: Phaneropterinae) in the Peruvian Amazon. *Entomological Communications*, vol. 4, no. 1, pp. ec04006. <http://dx.doi.org/10.37486/2675-1305.ec04006>.
- PINHEIRO, R.A., ZANUNCIO, J.C., TOMA, R., ISAAC JUNIOR, J.B., SOARES, M.A., SANTOS, C.A., SERRÃO, J.E., CABRAL, M.J.S. and TAVARES, M.T., 2022. *Brachymeria koehleri* (Hymenoptera: Chalcididae): first record as hyperparasitoid in *Dione juno juno* (Lepidoptera: Nymphalidae) pupae. *Brazilian Journal of Biology = Revista Brasileira de Biologia*, vol. 82, pp. e260645. <https://doi.org/10.1590/1519-6984.260645>.
- PREZOTO, F. and BRAGA, N., 2013. Predation of *Zaprinus indianus* (Diptera: Drosophilidae) by the social wasp *Synocera cyanea* (Hymenoptera: Vespidae). *The Florida Entomologist*, vol. 96, no. 2, pp. 670-672. <http://dx.doi.org/10.1653/024.096.0243>.
- PREZOTO, F. and GOBBI, N., 2005. Flight range extension in *Polistes simillimus* Zikán, 1951 (Hymenoptera, Vespidae). *Brazilian Archives of Biology and Technology*, vol. 48, no. 6, pp. 947-950. <http://dx.doi.org/10.1590/S1516-89132005000800011>.
- RICHARDS, O.W., 1978. *Social wasps of the Americas excluding the Vespinae*. London: British Museum (Natural History), 580 p.
- SILVA-FILHO, R., BRÜGGER, B.P., CORRÊA, C.A., SOUZA, L.S.A., CASSINO, P.C.R., ZANUNCIO, J.C., SILVA, P.R., SOARES, M.A. and ZANUNCIO, A.J.V., 2020. Flight distance and return capacity of *Polistes lanio lanio* (Hymenoptera: Vespidae) workers. *The Florida Entomologist*, vol. 103, no. 1, pp. 38-40. <https://doi.org/10.1653/024.103.0406>.
- SOARES, M.A., TORRES-GUTIERREZ, C., COLA-ZANUNCIO, J., PEDROSA, A.R.P. and LORENZON, A.S., 2009b. Superparasitismo de *Palmistichus elaeis* (Hymenoptera: Eulophidae) y comportamiento de defensa de dos hospederos. *Revista*

- Colombiana de Entomologia*, vol. 35, no. 1, pp. 62-65. <http://dx.doi.org/10.25100/socolen.v35i1.9191>.
- SOARES, M.A., ZANUNCIO, J.C., LEITE, G.L.D., WERMELINGER, E.D. and SERRÃO, J.E., 2009a. Does *Thyriniteina arnobia* (Lepidoptera: Geometridae) use different defense behaviours against predators? *Journal of Plant Diseases and Protection*, vol. 116, no. 1, pp. 30-33. <http://dx.doi.org/10.1007/BF03356283>.
- SOUTHON, R.J., FERNANDES, O.A., NASCIMENTO, F.S. and SUMNER, S., 2019. Social wasps are effective biocontrol agents of key lepidopteran crop pests. *Proceedings of the Royal Society B: Biological Sciences*, vol. 286, no. 1914, pp. 20191676. <http://dx.doi.org/10.1098/rspb.2019.1676>.
- SOUZA, M.M., TEÓFILO-GUEDES, G.S., BUENO, E.T., MILANI, L.R. and SOUZA, A.S.B., 2020a. Social wasps (Hymenoptera, Polistinae) from the Brazilian savanna. *Sociobiology*, vol. 67, no. 2, pp. 129-138. <http://dx.doi.org/10.13102/sociobiology.v67i2.4958>.
- SOUZA, M.M., TEOFILLO-GUEDES, G.S., MILANI, L.R., SOUZA, A.S.B. and GOMES, P.P., 2020b. Social wasps (Vespidae: Polistinae) from the Brazilian Atlantic Forest. *Sociobiology*, vol. 67, no. 1, pp. 1-12. <http://dx.doi.org/10.13102/sociobiology.v67i1.4597>.