Pseudosphinx tetrio (Lepidoptera: Sphingidae): Potential Pest to Ornamental Plant Plumeria Rubra in Brazil

Pseudosphinx Tetrio (Lepidoptera: Sphingidae): Potencial Praga para a Planta Ornamental Plumeria Rubra in Brasil

Douglas Silva Parreira[a]*; Francisco Andreas Rodrigues Dimaté[b]; Lorena Duarte Batista[c]; Humberto Corrêa Bonfim Ribeiro[d]; Rafael Eugênio Guanabens[a]; William Dias Martins[a]

[a]Faculdade Integradas Pitágoras.
[b]Universidade Federal de Viçosa.
[c]Centro Universitário do Leste de Minas Gerais.
[d]Fundação Educacional de Caratinga.
*E-mail: douglasparreira@ig.com.br

Abstract

Plumeria rubra L. is a rustic and small tree with 4-8 meters high with thick and smooth stems, dark green leaves and large flowers exuding a pleasant fragrance, similar to those of Jasminun sp. (Lamiales: Oleaceae). This plant is native to Central America but it was also introduced to most tropical and subtropical regions of the world in gardens, streets and used to prepare necklaces and in Medicine. The objective of this study was to identify a Lepidoptera defoliator of P. rubra at the Federal University of Viçosa in Viçosa, Minas Gerais State, Brazil. This insect was identified as Pseudosphinx tetrio (Linnaeus, 1771) (Lepidoptera: Saturniidae). Its caterpillars have black body with yellow rings, covered with bristles thoracic, and abdominal prolegs are orange . Its length can reach 6 cm and it has a black and characteristic spiniform process on the back of the eighth tergo. Adult are large and gray with black transverse stripes and wingspan from12.7 to 14.0 cm. Females are usually larger than males and lighter in color. Pseudosphinx tetrio should be included in monitoring programs of P. rubra pests.

Keywords: Apocynaceae. Herbivore. Lepidoptera. Urban Insect.

Resumo

Plumeria rubra L. é uma árvore rústica e pequena, com 4-8 metros de altura com folhas verdes grossas e suaves hastes, flores escuras e grandes que exalam uma fragrância agradável, similar aos de Jasminun sp. (Lamiales: Oleaceae). Esta planta é nativa da América Central, mas também foi introduzida na maioria das regiões tropicais e subtropicais do mundo em jardins, ruas e é usado para preparar colares e na medicina. O objetivo deste estudo foi identificar um Lepidoptera desfolhador de P. rubra na Universidade Federal de Viçosa, em Viçosa, Minas Gerais, Brasil. Este inseto foi identificado como Pseudosphinx tetrio (Linnaeus, 1771) (Lepidoptera: Saturniidae). Suas lagartas têm corpo negro com anéis amarelos, cobertos com cerdas torácicas e falsas pernas abdominais laranjas. O seu comprimento pode atingir 6 cm, possui um processo em forma de espinho preto e característica na parte de trás do oitavo tergo. Adultos são grandes e cinzas com listras transversais pretas e envergadura de 12.7 a 14,0 cm. As fêmeas, geralmente, maiores que os machos e de cor mais clara. Pseudosphinx tetrio devem ser incluídos em programas de monitoramento de pragas P. rubra.

Palavras-chave: *Apocynaceae. Herbívoro. Lepidoptera. Inseto Urbano*

1 Introduction

Genus *Plumeria* belongs to the Apocynaceae family and is native to the new world. The plants from this genus are widely cultivated in the tropical and subtropical regions throughout the world. *Plumeria* spp. are commonly grown as ornamental plants in premises, parks, gardens and graveyards because of their beautiful fragrant flowers of various colors and sizes. Ornamental plants are grown for decorative purposes in gardens and landscape design projects, as house plants, for cut flowers and exhibits. Ornamentals and flowers crops are not only grown for the exhibitionof aesthetic features, but they also have nutritive and medicinal properties. There has been renewed interest in utilizing garden environments withmedicinal value, as therapeutic entities to enhance the process of healing that occurs in healthcare environments (KUMAR *et al.,* 2005; VERMA, 2016). The essential oil and fragrant constituents from the flowers of various *Plumeria* species are used in perfumery, cosmetics and aromatherapy.

Plumeria rubra L. (apocynaceae) can reach 4-8 meters with high gray, thick and smooth stems, dark green leaves, succulent branches that secrete latex when injured and reddish flowers that exude an attractive scent (GILMAN; WATSON, 2007). This is an ornamental plant in gardens and squares in several countries and used to reforest degraded areas. Its flowers are used to prepare perfumes (SHAIDA *et al.,* 2008) and necklaces in the Hawaii's tourist industry (HASS, 2005).

Leaves, flowers, bark and latex from P. rubra are used to produce medicine to diabetes, ulcers, leprosy, inflammations, rheumatism, tumors and fever treatment (ZAHID ZAHEER et al., 2010; GOPI et al., 2011; VIMLESH et al., 2012; SIRISHA et al., 2014; SHINDE; PATIL; BAIRAGI, 2014) and to synthesize products to control mosquito transmitting diseases such as Aedes aegypti (Linnaeus, 1762) and Anopheles stephensi (Liston, 1901). (Diptera: Culicidae) (CHANDRASHEKHAR et al., 2012).

The importance of P. rubra as an ornamental plant can be reduced by insects such as Paracoccus marginatus Williams & Granara Willink, 1992 (Hemiptera: Pseudococcidae) feeding on sap from leaves and fruits and causing yellowing and falling fruits as well as excreting honeydew that cover leaves, fruits and stems, inhibiting photosynthesis and gas exchange (MUNIAPPAN et al., 2006) and Microborus lautus Wood, 1961 (Coleoptera: Scolytidae) whoselarvae and adults feed on branches and the main stem, often causing tree mortality (WOOD, 1961).

The objective of this study was to identify a Lepidoptera defoliator of P. rubra at the Federal University of Viçosa in Viçosa, Minas Gerais State, Brazil.

2 Material and Methods

Seventy-two larvae of an insect were found feeding on P. rubra's leaves from December 2010 to April 2011 at the campus from the Federal University of Viçosa (UFV) in Viçosa, Minas Gerais State, Brazil (20° 45'S, 42° 52'W and 648 m asl). Leaves with larvae were detached from the plant, placed in plastic pots and taken to the laboratory of Insects Biological Control atthe Institute of Applied Biotechnology to Agriculture (BIOAGRO) of the UFV where they were kept at a temperature of 25 ± 2 °C, 70 % RH ± 5 % and photoperiod of 12 hours in wooden framed breeding cages (30 x 30 x 30 cm). Branches with leaves of P. rubra were daily placed as food for the larvae until pupae stage allowed to obtainadults. Branches with larvae were covered with organza bags and monitored daily until pupae stage, which were collected, taken to the laboratory and kept in trays with sand in cages until adult stage with the same conditions described.

After adult emergence, some specimens were selected and killed in mortifier camera, mounted on entomological pushpin and sent tothe Department of Zoology at the Federal University of Paraná (UFPR), for identification.

3 Results and Discussion

The specimens were identified as *Pseudosphinx tetrio* (Linnaeus, 1771) (Lepidoptera: Sphingidae, Figure 1), which occurs in tropical and subtropical regions of the American Continent from southern Brazil, Central America, Mexico and in the south of the USA: Florida, Mississippi, Arkansas, from Arizona to Texas (KATHRYN; DUNFORD, 2005).

Adults of P. tetrio are large moths with wingspan from 12.7 to 14.0 cm. White and gray forewings in all their extension with brown color on the dorsal margin and a white patch at the base of the costal margin. Hindwings are brown and white color along its intern and extern parts, body with coloration in white and narrow transverse bands alternating to black and more wide (Figure 1). Females usually are larger and lighter than males (KATHRYN; DUNFORD, 2005).

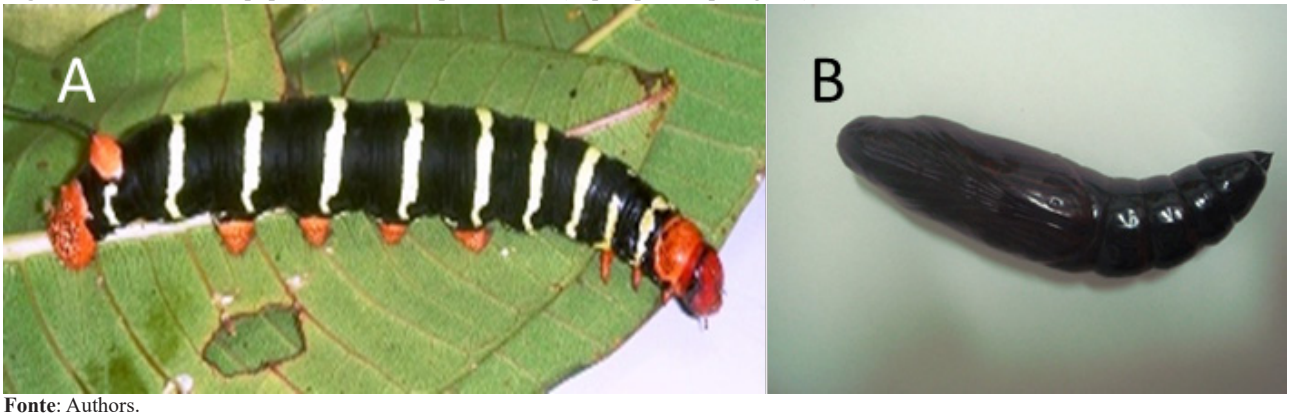
Figure 1: *Pseudosphinx tetrio*, female (Lepidoptera: Sphingidae)

Fonte: Authors.

Larvae of P. tetrio have a black color with yellow rings, covered with bristles, thoracic legs, abdominal and prolegs orange with black points.Figure 2A). This species can reach six centimeters long with spiniform or filiform characteristic process and a thorn black spin on the back-third of the eighth tergum over an orange color elevation with black marks (VEIGA, 2009).

Pupae of P. tetrio have a smooth texture, without bristles, reddish brown with dark and light mosaic (Figure 2B) yellow when new, turning brown and darken near adult emergence (VEIGA 2009).

Figure 2: Larva (A) and pupa (B) of *Pseudosphinx tetrio* (Lepidoptera: Sphingidae).



Fonte: Authors.

The number of larvae of *P. tetrio* on tree canopiesof *P. rubra* was very large and completely defoliated the plant (Figure 3). These caterpillars have high defoliation capacity and each one can consume three large leaves of this plant daily. Feeding typically starts from the leaf tip to the base but this insect can eat young branches in periods of low leaf availability (SLOAN *et al*., 2006).

Figure 3: Tree of *Plumeria rubra* after defoliation by *Pseudosphinx tetrio* (Lepidoptera: Sphingidae) larvae at the campus at the "Universidade Federal de Viçosa" in Viçosa, Minas Gerais State, Brazil.

Fonte: Authors.

Adverse effects by P. tetrio larvae on P. rubra were not studied, but this insect completely defoliated this plant what can reduce its growth rate. Caterpillars of P. tetrio can detoxify and sequester toxic substances in their tissues from latex of P. rubra for defense (KATHRYN; DUNFORD, 2005). Apostematic color of P. tetrio imitates a coral snake from Costa Rica (JORON, 2003) and the habit these caterpillars turn back to bite when disturbed, is a protective behavior that can reduce impact of its natural enemies (JANZEN, 1980).

4 Conclusion

P. tetrio usually feeds on plants from the family Apocynaceae (Lima 1949), mainly of the genus *Plumeria*. Its damage can reduce research material, cause damage in aesthetics gardens and parks and drug development. Thus, it should be included in plant pests' monitoring programs..

Acknowledgements

To "Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) " and "Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG) " for financial support.

References

CHANDRASHEKHAR, D.P. *et al.* Larvicidal activity of silver nanoparticles synthesized using Plumeria rubra plant latex against Aedes aegypti and Anopheles stephensi. *Parasitol. Res*., v.110, n.5, p.815-1822, 2012.

DUNFORD, J.C.; KATHRYN, A.B. *Tetrio Sphinx, Giant Gray Sphinx, Frangipani Hornworm, Pseudosphinx tetrio (Linnaeus) (Insecta: Lepidoptera: Sphingidae).* Florida: University of Florida IFAS Extension, 2005.

GOPI, J. et al. Phytochemical and pharmacological potential of Plumeria rubra Linn. (Apocyanaceae): a review. *Int. J. Ph. Sci*., v.3, p.1162-1168, 2011.

HASS - Hawaii Agricultural Statistics Service. *Hawaii flowers & nursery products Annual summary.* Honolulu: USDA/HASS, 2005.

JANZEN, D.H. Two potential coral snake mimics in a tropical deciduous fores*t. Biotropica,* v.12, n.1, p.77-78, 1980.

JORON, M. Aposematic coloration. *In*: CARDÉ, R.T.; RESH, R.T. *Encyclopedia of insects*. New York: Academic Press, 2003. p.39-45.

KUMAR, R.S. *et al. Antioxidant and antimicrobial activities of Bauhinia racemosa L.* stem bark. *Braz. J. Med. Biol. Res.,* v.38, n.7, p.1015-1024, 2005.

LIMA, A.C. *Insetos do Brasil:* Lepidópteros. Rio de Janeiro: Escola Nacional de Agronomia, 1949.

MUNIAPPAN, R. *et al.* Classical biological control of the papaya mealybug, Paracoccus marginatus (Hemiptera: Pseudococcidae) in the republic of Palau. Fla. *Entomol*., v.89, n.2, p.212-217, 2006.

SHAIDA, F.S. *et al.* Chemical components of the essential oils from three species of Malaysian Plumeria and their effects on the growth of selected microorganisms. *J. Biosc.,* v.19, n.2, p.1-7, 2008.

SHINDE, P.R., PATIL, P.S., BAIRAGI V.A. *Phytopharmacological* review of plumeria species. *Sch. Acad. J. Pharm*., v.3, n.2, p.217-227, 2014.

SIRISHA, K. *et al.* Comparative Phytochemical and PharmacologicalvEvaluation of flowers of Plumeria rubra L. f. rubra and Plumeria rubra f. lutea. *Bras. Med. Bull*., v.2, n.1, p.49-57, 2014.

SLOAN, S.A.; ZIMMERMAN, J.K.; SABAT, A.M. Phenology of Plumeria alba and its herbivores in a tropical dry forest. *Biotropica*, v.39, n.2, p.195-201, 2006.

VEIGA, A.F.L.; MELO, J.P.R.; MOREIRA, M.D. Aspectos morfológicos da forma imatura de Pseudosphinx tetrio (Linnaeus, 1771) (Lepidoptera: Sphingidae). *In:* JORNADA DE ENSINO, PESQUISA E EXTENSÃO – JEPEX, 9. Recife, 2009. Anais… Recife, 2009.

VERMA, S. Multipurpose Ornamental Plant Plumeria rubra Linn (Apocynaceae*). IJSRSET*., v.2, n.4, p.646-649. 2016.

VIMLESH, M. *et al.* Antipyretic activity of the Plumeria rubra leaves extract. *Int. J. Pharm*., v.2, n.2, p.330-332, 2012.

WOOD, S.L. New species of bark beetles. *Great Basin National.,* v.21, p.100-103, 1961.

ZAHID, Z. *et al.* Comparative phytochemical screening of flowers of Plumeria alba and Plumeria rubra. *Asian J. Pharm. Clin. Res*., v.13, n.4, p.88-89, 2010.