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Journal of Threatened Taxa



10.11609/jott.2022.14.5.20951-21126
www.threatenedtaxa.org

26 May 2022 (Online & Print)
14(5): 20951-21126
ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

Open Access





ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher
Wildlife Information Liaison Development Society
www.wild.zooreach.org

Host
Zoo Outreach Organization
www.zooreach.org

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Cover: Dorsal view of Mantis Shrimp *Cloridina ichneumon* (Fabricius, 1798) & *Gonodactylus demanii* (Henderson, 1893). © Fisheries Research Station, Junagadh Agricultural University, Sikka.



Nectar robbing by sunbirds on the flowers of *Morinda pubescens* J.E. Smith (Rubiaceae)

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The genus *Morinda* is represented by only eight species, namely, *M. angustifolia* Roxb., *M. persicaefolia* Ham., *M. villosa* Hook.f., *M. umbellata* L., *M. trimera* Hillebr., *M. elliptica* (Hook.f.) Ridl., *M. citrifolia* L., and *M. pubescens* J.E. Smith, in India (Arya et al. 2014). Recently, *M. tinctoria* Roxb. and *M. tomentosa* Heyene ex Roth. are treated as synonyms to *M. pubescens* and accordingly this is followed in this work and the published work reported on these species is cited as related to *M. pubescens*. *M. tomentosa* which is now known as *M. pubescens* is widely distributed in India, Sri Lanka, China, central Myanmar, southern Thailand, Vietnam, and Indonesia (Kesonbuaa & Chantaranonthai 2013). It is a small evergreen tree adapted to grow successfully in arid/semi-arid to mesophytic conditions (Bermer & Manen 2000).

Morinda pubescens distributed naturally with a few individuals in Kadiri Reserve Forest with arid ecosystem (14.0667°N, 78.1967°E and altitude 761 m) in Anantapur District, Andhra Pradesh, India, was used for the study during February–June 2019. This tree grows here in cracks and crevices of stony rocks and in partially weathered rocks accumulated with soil. Leaves are petiolate, simple,

opposite, decussate and broadly elliptic with acute apex. Flowers are borne in leaf-opposed solitary, terminal, globose heads. They are sessile, greenish-white, fragrant and hermaphroditic with distyly. Calyx tube is connate at base with denticulate lobes. Corolla is greenish-white and salver-shaped with slender tube extended into five abruptly spreading flat lobes exposing the sex organs. The stamens here are five attached to the corolla throat and linearly extended beyond the rim of the corolla tube. The ovary is bi-locular, 4-ovuled with linear style which is extended into a bi-lobed stigma. The fruit is a green globose syncarp with four oblong pyrenes.

In Kadiri Reserve Forest, *M. pubescens* blooms in foliate state during dry season from March to May (Image 1a). Mature buds open during early morning and expose the sex organs out of the corolla tube (Image 1b–e). The flowers are nectariferous. However, the nectar is concealed at the base of the corolla tube which is accessible only to legitimate foragers probing the flower-opening side. Thrips use the floral buds for breeding and open flowers for pollen and nectar. They move out during flower-opening. Sunbirds, *Nectarinia asiatica* and *N. zeylonica* were seen

Editor: Analinda C. Manila-Fajardo, University of the Philippines Los Banos, Laguna, Philippines.

Date of publication: 26 May 2022 (online & print)

Citation: Raju, A.J.S., S.S. Kumar, G. Nagaraju, C.V. Reddy, T.P. Raliengoane, L.K. Grace, K. Punny, K. Prathyusha & P. Srikanth (2022). Nectar robbing by sunbirds on the flowers of *Morinda pubescens* J.E. Smith (Rubiaceae). *Journal of Threatened Taxa* 14(5): 21125–21126. <https://doi.org/10.11609/jott.7915.14.5.21125-21126>

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Funding: Self-funded.

Competing interests: The authors declare no competing interests.

Acknowledgements: We thank the Andhra University, Visakhapatnam, for providing physical facilities to carry out this work.





Image 1. *Morinda pubescens*: a—Flowering tree | b–e—Different stages of bud and flower | f—*Nectarinia asiatica* feeding on thrips | g—*Nectarinia zeylonica* feeding on thrips | h & i—*Nectarinia zeylonica* puncturing corolla base to rob nectar. © A.J. Solomon Raju.

at the flowers of *M. pubescens* foraging on thrips and nectar. These birds pick up thrips (Image 1f,g) from the flowers by probing the flowers legitimately during which they occasionally effect pollination and collect nectar illegitimately by making a puncture/slit in the corolla tube from outside (Image 1h,i).

The flowers with tubular corolla are vulnerable to nectar robbing. Maloof & Inouye (2000) and Irwin et al. (2010) reported that nectar robbing is very frequent in plant species producing flowers with long corollas and abundant nectar production. Irwin & Maloof (2002) reported that nectar robbing involves primary and secondary robbing with the first one as the most common. In primary robbing, the flower forager makes a slit or hole or tear in petal tissue to rob nectar bypassing the floral opening used by legitimate pollinators. In secondary robbing, the flower forager acquires nectar via slit/hole/tear made by primary robbers again bypassing the floral opening used by legitimate pollinators. Specialization in floral architecture is vulnerable to exploitation by flower visitors which remove or steal nectar without effecting pollination (Navarro 2001). Nectar robbing by sunbirds on the flowers of *M. pubescens* is an indication of primary robbing which does not effect pollination but this robbing phenomenon reduces nectar reward and increases variability in nectar standing crop. Such a situation is

expected to promote pollination rate in general and cross-pollination in particular when legitimate pollinators visit *M. pubescens* flowers for nectar. Therefore, *M. pubescens* is an important source of thrips as insect food and nectar as instant drink for sunbirds during dry season in the arid ecosystem.

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ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

May 2022 | Vol. 14 | No. 5 | Pages: 20951–21126

Date of Publication: 26 May 2022 (Online & Print)

DOI: 10.11609/jott.2022.14.5.20951-21126

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