

Short Note

Floral Visits and Floral Damages by Avian Nectar Robbers on an Exotic Shrub, *Tecoma stans* (L.) Kunth, in the Western Ghats, India

RADHAMANI DHANYA^{1,3*}, PARAPPURATH ABDUL AZEEZ¹ AND KARUMAMPOYIL SAKTHIDAS ANOOP DAS^{2,3}

¹Division of Environmental Impact Assessment, Sálím Ali Centre for Ornithology and Natural History, Anaikatty, Coimbatore, Tamil Nadu - 641 108, INDIA

²Centre for Conservation Ecology, Department of Zoology, M.E.S Mampad College, Malappuram - 676 542, Kerala, INDIA

³Wildlife Research and Conservation Trust, Anupallavi, Chungathara P.O., Malappuram- 679 334, Kerala, INDIA

* Corresponding author. E-mails: dhanyasacon@gmail.com

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Nectar robbers are flower visitors that remove nectar from flowers through a hole made in the corolla¹ and so they deplete the nectar supplies and potential attraction to pollinators, and may also damage floral parts², whilst by-passing the floral openings used by legitimate pollinators³. Nectar robbers are accordingly described as cheaters in the plant-pollinator mutualism, as it is thought that they gain a reward (nectar) without rendering any service (pollination)⁴. In addition, nectar robbers may significantly affect the rewards available to legitimate pollinators⁵. *Tecoma stans* (L.) Juss ex. Kunth (Lamiales: Bignoniaceae), a widely distributed ornamental shrub in India, is native to south Florida to West Indies and south America⁶. The plant is seen flowering and fruiting throughout the year, but with a high proportion flowering during October to May⁷. Its flowers are borne in terminal panicles⁶, with a yellow corolla of 4 to 4.5 cm long and the nectaries are at the base of the ovary⁸. In the current study we monitored visits by avian nectar robbers, floral damage and the fruit setting of *T. stans*.

The study was conducted in the campus of the Sálím Ali Centre for Ornithology and Natural History (76°39'-76°47' E, 11°05'-11°3' N), Coimbatore, which is located in the foot hills of the Western Ghats, India. The field study was performed during April 2009, when the shrub was in the peak of its bloom. Since, the breeding season of the sunbirds (March to May) also fell in the same period⁹, we could observe the likely maximum rate of illegitimate pollination in the shrub as the food requirements of the robbers are high. Fruit counts, as a measure of successful pollination, was performed during May 2009. The study area had 14 mature shrubs of *T. stans* with an age of 15 years.

Field observations were made between 06:30-08:00 hrs each day, as it is open daily during 05:00-08:00 hrs⁷. The frequencies of flower visits were monitored by adopting the focal animal sampling method¹⁰ and were restricted to three randomly selected shrub individuals. The damage to the flowers caused by the nectar robbers was quantified by close examination of 11 randomly selected inflorescences from each of 10 individual shrubs, except that inflorescences were selected from those that

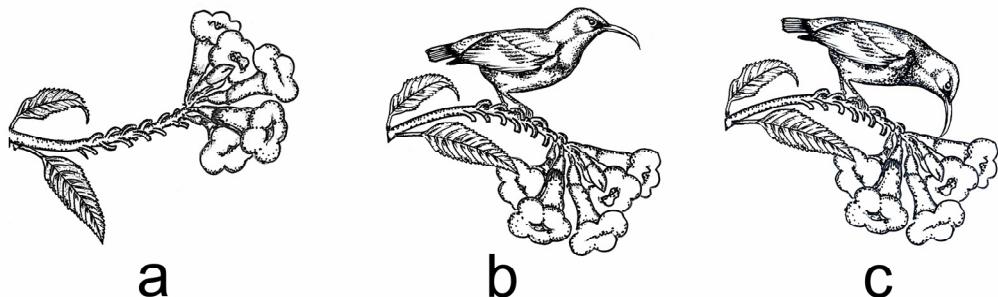


FIGURE 1. Schematic diagram showing typical nectar feeding behaviour of a sunbird on *T. stans*

had 4–10 mature flowers to reduce the bias of detectability of the flowers by birds in each inflorescence. Individual flowers were checked for damage in the buds and in the floral parts of the corolla, gynoecium (style, stigma and ovaries) and androecium (anthers and pollen). In total, 110 inflorescences with 553 flowers and 392 flower buds were observed. Fruit settings were monitored by five randomly selected inflorescences from ten trees. We observed two types of nectar extraction in the *T. stans*, one legitimate and the other illegitimate that primarily results in nectar depletion and damage of the flower. The first type of nectar extraction was caused by insects, especially bees such as *Apis dorsata*, *A. cerana*, *A. florea*, *Xylocopa latipes* and *X. pubescens*. The later was primarily caused by avian nectar robbers, such as the Purple Sunbird, *Cinnyris asiaticus* Latham 1790 (Passeriformes: Nectariniidae) and Loten's Sunbird, *Cinnyris lotenius* L. 1766 (Passeriformes: Nectariniidae). The nectar robbers usually sat on the pinnacle so that it hanged down to an inverted position such that the mouth of the corolla faced downwards. In this posture it was easy for the bird to extract the nectar by making a slit at the lower part of the

corolla (Fig. 1). The beak length (from the skull) of *C. asiaticus* is 2 to 2.2 cm, and that of *C. lotenius* is 3.0 to 3.2 cm⁹, compared to the 4.0 to 4.5 cm corolla length of *T. stans*. Thus, the long corolla tube of *T. stans* makes it difficult for the bird species to extract nectar from the flower legitimately, inserting their beaks through the corolla mouth. We monitored the attempt of the avian robbers to extract nectar for two hours, within which time period the birds visited the flowers 593 times. Of the two species of birds, *C. asiaticus* made the highest number of visits (374 visits; 63.1%), some 1.7-fold more visits than *C. lotenius* at 219 visits (36.9%). The total floral damage caused by the two species was 75.8% (corolla damage); where 423 of the 558 flowers examined had slits made in the corolla. Of the 395 buds examined only 5 had corolla damage (1.3%) and these five were mature buds. Damage to petals were seen in eleven cases and in three cases damage to the style (part of gynoecium) was observed, which are likely to have been caused by flower visiting insects. A total of 314 fruit settings were observed from 50 inflorescences. Overall, 558 (5.03 ± 1.74) flowers and 395 (4.67 ± 3.21) buds from 110 inflorescences and 314 (6.28 ± 2.13)

fruit settings from 50 inflorescences were observed.

There are several hypotheses that explain animal foraging on flowers and stealing nectar as an illegitimate behaviour⁴. One view is that nectar robbing occurs because it is easier for animals to reach the nectar than going through the more elaborate legitimate way. The mismatch between the morphologies of the animals' mouthparts and the floral structure in some cases may make access to the food (nectar) possible only in an illegitimate way.

The breeding seasonality of sunbirds is during March to May⁹ and this is the time they require more energy for nest construction, egg laying and rearing the chicks. Although two other nectar contributing plants, *Delonix regia* (Boj. Ex. Hook.) Raf. (Fabales: Fabaceae) and *Lagerstroemia* sp. (Magnoliopsida: Lythraceae), were available during the breeding season in the campus, *T. stans* stands out as a major nectar source and potential contributor to the sunbirds as it blooms in enormous numbers in the season. The plentiful availability of the species in bloom, combined with the scarcity of other flowers and the need for more food during the bird's breeding season may be the reason for the high level of nectar robbing from *T. stans* by the sunbirds.

It was observed that the nectar robbing occurs most often on flowers adapted for humming bird pollination¹¹. Humming bird pollinated plants may not lose much from nectar robbing if the avian robbers are of low efficiency in robbing nectar¹². Robbing can also be partially beneficial if the body parts of nectar robbers reach the nectaries of plants touching upon reproductive parts leading to pollination¹². Robbing may be even neutral in effect if the robbers destroy only the corollas without any damage to the

androecium and gynoecium, as such an action does not affect the fruit setting or seed setting in the host plant. Pollination in *T. stans* is largely performed by humming birds, bees and some other insects. The natural propagation of the species is mainly through seed dispersal¹³. The present findings on the intensity of floral damage to *T. stans* recorded only three cases (0.75%) of damage to the sex organs (style), which is negligible in terms of the likely affect upon the total seed setting and propagation of that plant is concerned. Such damages are also likely to be caused by insects, such as Carpenter bees (*Xylocopa* sp.) and Leaf-cutter bees (*Megachile* sp.), which are frequent visitors to the flowers. It is likely that these avian robbers are almost neutral in effect to *T. stans* with respect to the above issues. Apparently all the Tecoma plants in the campus are found producing seeds abundantly. However, further investigations are worthwhile to check any collateral damage to the plants, such as nectar depletion that discourages legitimate pollinators from visiting the flowers.

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Literature Cited

1. Maloof, J.E. and Inouye, D.W. 2000. Are Nectar Robbers Cheaters or Mutualists?. *Ecology*. 81: 2651-2661.
2. Askins, R.A., Ercolino K.M. and Waller, J.D. 1987. Flower Destruction and Nectar Depletion by Avian Nectar Robbers on a Tropical Tree, *Cordia sebestena*. *Journal of Ornithology*. 58: 345-349.
3. Inouye, D.W. 1980. The Terminology of Floral Larceny. *Ecology*. 61: 1251-1253.
4. Yanwen, Z., Yong, W. and Youhao, G. 2007. Effects of Nectar-robbing on Plant Reproduction and Evolution. *Frontiers of Biology* 2: 443-449.
5. Irwin, R.E. and Brody, A.K. 1998. Nectar Robbing in *Ipomopsis aggregata*: Effects on Pollinators. *Behaviour and Plant Fitness*. *Oecologia*. 116: 519-527.
6. Mathew, K.M. 1991. An Excursion Flora of Central Tamil Nadu, India. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. p 1-647 + (i-xlv).
7. Jonathan, K.H., Raju, A.J.S., Branham K.S. and Devi, D.S. 2009. Interactions between insect pollinators and the ornamental tree, *Tecoma stans* (L.). *Journal of Threatened Taxa*. 1: 126-127.
8. Rivera, G. 2000. Nuptial Nectary Structure of Bignoniacae from Argentina. *Darwiniana*. 38: 227-239.
9. Ali, S. and Ripley D. 1999. *Handbook of the Birds of India and Pakistan*, Volume 10, Flowerpeckers to Buntings. Oxford University Press, pp. 25-31.
10. Altmann, J. 1973. Observational Study of Behavior: Sampling Methods. *Behaviour*. 49: 227-267.
11. Barrows, E.M. 1980. Robbing of Exotic Plants by Introduced Carpenter and Honey Bees in Hawaii, with Comparative Notes. *Biotropica*. 12: 23-29.
12. Arizmendi, M,C, DomñÁnguez, C.A. and Dirzo, R. 1996. The role of an avian nectar robber and of hummingbird pollinators in the reproduction of two plant species. *Functional Ecology* 10:119-127.
13. ICRAF. Agro Forestry Tree Data Base. A tree species reference and selection guide. <http://www.worldagroforestrycentre.org/sea/Products/AFDbases/AF/index.asp>. Accessed on 12-12-2011.
