Chapter 7

Interaction of *Aulacophora foveicollis* Lucas, 1849 (Red Pumpkin Beetles) with *Trapa natans* L., and other cucurbits

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ABSTRACT

For the proper functioning of any ecosystem, there should be balance in every relationship available in nature. The present study is carried out in the Cuttack-Bhubaneswar cities of Odisha and Jamtara, Jharkhand states. The interaction between the plant, *Trapa natans,* and red pumpkin beetles, which is a newly discovered relationship is discussed here. Red pumpkin beetles are known as the pests of many plants belonging to the family Cucurbitaceae. It was found from the present study that these beetles keep in check the overgrowth of *T. natans,* which is considered a weed. Due to the presence of many ecological and medicinal properties in *T. natans,* the plant should be conserved by managing the pest activity of the red pumpkin beetles. For this, there should be discussion on such little-overlooked interactions that are covered in this chapter.

Keywords: Animal-plant interaction, conservation, pest management, wetland flora

Introduction

Animal-plant interactions are a crucial part of the environment but are often overlooked by researchers (Guchhait *et al.,* 2023). They play a major role in the ecosystem through interactions (Sharma *et al.,* 2023). Many interactions are already known to the people like pollination, seed dispersal, nectar rewards, nesting, etc. which are mostly positive interactions between plants and animals (Devi *et al.,* 2024). Some negative interactions in nature include pest activity like termites, spittlebugs, caterpillars, etc. attacks (Kumar and Rathor, 2020). One of the most infamous insect pests is the red pumpkin

beetle. The Red Pumpkin Beetle, *Aulacophora foveicollis* is a beetle species belonging to Chrysomelidae family. It is mainly considered a serious pest of members of the Cucurbitaceae family like pumpkin, watermelon, muskmelon, cucumber, and different gourds, etc. It is widely distributed across southern Europe, Asia, Australia, and Africa (Chandi et al., 2022). They feed on the young seedlings, tender leaves, and flowers of the plants, ultimately causing the mortality of the plants. The female beetles lay eggs on terrestrial plants' stems and aquatic plants' leaves. The newly hatched grubs are yellowish-white in colour and start consuming the roots of the plants causing serious damage to the plant (Dash *et al.,* 2021).

During the floral diversity study near the waterbodies of Cuttack and Bhubaneswar cities of Odisha and Jamtara, Jharkhand, there was sighting of red pumpkin beetles on a new host plant, *Trapa natans* by the authors. The pest is also observed in many cucurbits. The beetles were seen feeding on the flowers and leaves, mating, and laying eggs on the leaves of the plant. *Trapa natans* is commonly known as water chestnut and locally known as “pani singhara” in Odisha, and the kernel of the fruit is eaten raw or after boiling with water (Toma *et al.,* 2021). The wading birds like to eat insects that are found in the plants. The plants have been used in many Ayurvedic preparations to treat eye disorders, sore throat, bronchitis, inflammation, etc (Bhatiwal *et al.,* 2012). *T. natans* is also a weed that has to be controlled through the use of its natural insect enemies but the overconsumption of the beetles on *T. natans* will critically reduce the plant population. Therefore, there is a need to conserve the plant population by controlling the pest activity of red pumpkin beetles using pest management strategies like neem seed extract spray (Rashid *et al.,* 2016).

Morphology of *Trapa natans*

Trapa natans is a free-floating aquatic herb belonging to the family Trapaceae. Floating leaves rhomboid, 2-6 cm diameter, broader than long, denticulate, dentate, serrate or incised with entire base, apex acute, red and densely pubescent or villous beneath; petiole 10-16 cm long, the inflated portion ca. 2.5 cm long, hairy or woolly. Flowers white, ca. 1.6 cm across, not much raised above the water's surface. Fruit obovoid, angular, 2-4 cm long and broad with a short conical, often spinous beak in the centre through which the radicle is protruded; with two spines at two angles, the second pair of spines usually wanting. The flowering season is in August and the fruiting

season is from November to December (Saxena and Brahmam, 1995; Figure 1).

Morphological characteristics of Red Pumpkin Beetle

The adults of red pumpkin beetles (*Aulacophora foveicollis*) are light brownish with a very soft body. After emerging from the pupa, the elytra in both sexes cover the entire abdomen. Still, a considerable portion of the last abdominal segments remains uncovered with the elytra after some time. In the case of the males, the uncovered portion remains a bit smaller. The elytra appear black, gradually the color deepens and the body gets hardened to its usual color and texture. The head, antennae, and legs are yellow in appearance, the thorax brownish yellow, the elytra reddish orange, and the ventral side of the abdomen black with shining small hairs. The head was hypognathous and strongly sclerotized. The fully developed beetle is red-orange with a metallic tint. The adult male measured 5.5 mm to 7 mm in length and the breadth measured 2.5 mm to 3 mm. The adult female was slightly larger than the male and measured 6.75 mm to 9 mm in length. The breadth of the adult female ranged from 2.75 mm to 3.5 mm (Ali et al., 2015).

Methodology

During the survey of floral diversity near water bodies in the Cuttack and Bhubaneswar cities of Odisha from January to May 2024 and in Jamtara, Jharkhand from May 2023-August 2023, red pumpkin beetles were sighted on the leaves of *T. natans*. The beetles infected and damaged the plant which is a source for supplying food to many waterbirds. Knowing the importance of *T. natans*, literature studies were undertaken to list the preferred host plants of red pumpkin beetles. The observed plant, *T. natans* and insect species were identified by the authors.

Table 1: Common host plants of Red Pumpkin Beetles

Scientific name	Common name	Family	Source
Benincasa hispida	Ash gourd	Cucurbitaceae	Khan *et al.,* (2011)
Citrullus lanatus	Watermelon	Cucurbitaceae	Hassan *et al.,* (2012)
Cucumis melo	Melon	Cucurbitaceae	Hassan *et al.,* (2012)
Cucurbita maxima	Pumpkin	Cucurbitaceae	Bhowmik *et al.,* (2022)
Cucurbita pepo	Squash	Cucurbitaceae	Khan *et al.,* (2015)

Cucurbita sativus	Cucumber	Cucurbitaceae	Khan *et al.,* (2015)
Lagenaria siceraria	Bottle gourd	Cucurbitaceae	Khan *et al.,* (2015)
Luffa acutangula	Ridge gourd	Cucurbitaceae	Raman and Annadurai, (1985)
Luffa aegyptiaca	Sponge gourd	Cucurbitaceae	Khan *et al.,* (2015)
Momordica charantia	Bitter gourd	Cucurbitaceae	Raman and Annadurai, (1985)
Trichosanthes cucumerina	Snake gourd	Cucurbitaceae	Raman and Annadurai, (1985)
Trichosanthes dioica	Pointed gourd	Cucurbitaceae	Ali *et al.,* (2015)



Figure 1: Habitat of *Trapa natans* in wild (Naturally growing in pond)



Figure 2: Red Pumpkin Beetles feeding and laying eggs on the leaves of *Trapa natans*



Figure 3: Red Pumpkin Beetles consuming the flower of *Trapa natans*

Observations

In the present study, it was observed that waterbirds preferred to feed on insects found on the leaves and other parts of *T. natans*. There was also a sighting of a good population of red pumpkin beetles on the leaves of *T. natans* feeding and laying eggs on the leaves (Figure 2). While consuming the leaves and flowers, they puncture the leaves causing browning and death of the leaves (Figure 3). The beetles might pollinate the flowers of *T. natans*, but mainly they harm the plant by making the flowers sterile, defoliating them, and reducing the rate and quality of fruit formation considering them a destructive pest. From the literature study, the authors found that the red pumpkin beetles preferred 12 plants belonging to the Cucurbitaceae family as their host plants (Table 1). They mostly like to feed on pumpkins and the least preferable host plant is *Momordica charantia* due to its bitter taste.

Conclusion

The red pumpkin beetles are considered destructive pests on plants belonging to the family Cucurbitaceae. At the same time, the present study revealed a new host plant of the beetles, *T. natans,* whose leaves and flowers were fed upon by the beetles. They damage the leaves and flowers of the plant and delay fruit formation. The beetles were also found to lay eggs on the upper surface of the leaves. The overgrowth of the beetles on the *T. natans* happens because the waterbodies are not cleaned properly. As *T. natans* capture insects on the plant parts, providing food to bronze-winged jacana, pheasant-tailed jacana, and other water birds, there is a need to conserve the plant species through proper maintenance and pest management strategies.

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References

Ali MA, Islam MS, Sarker MNI and Bari MA. (2015). Study on biology of red pumpkin beetle in sweet gourd plants. International Journal of Applied Research. 2(1): 1-4.

Bhatiwal S, Jain A and Chaudhary J. (2012). *Trapa natans* (Water Chestnut): an overview. International Research Journal of Pharmacy. 3(6): 31-33.

Bhowmik B, Chakraborti U, Mandal A, Paul B and Bhadra K. (2022). Attraction of *Aulacophora foveicollis* Lucas (Coleoptera: Chrysomelidae) to host *plant Cucurbita maxima* Duchesne (Cucurbitaceae) volatiles. Agronomy. 12(11): 2640. https://doi.org/10.3390/agronomy12112640.

Chandi RS, Kaur A and Aggarwal N. (2022). Management of red pumpkin beetle, *Aulacophora foveicollis* (Lucas) with traditional method of dusting with dung ash in cucurbits. Indian Journal of Traditional Knowledge. 21(1): 208-214.

Dash L, Rout S, Ramalakshmi V, Padhy D, Nihal R and Nayak S. (2021). Studies on biology of red pumpkin beetle (*Aulacophora foveicollis* Lucas) under Odisha condition, India. Journal of Plant Development Sciences. 13(6): 381-384.

Devi R, Das K, Rout S and Rath SK. (2024). Animal-Plant interaction, Volume 3. APRF Publishers, India.

Guchhait KC, Saradar B, Behera B, Rout S and Kumar S. (2023). Animal-Plant interaction. APRF Publishers, India.

Hassan K, Uddin MM and Haque MA. (2012). Host suitability of red pumpkin beetle, *Aulacophora foveicollis* (Lucas) among different cucurbitaceous hosts. International Research Journal of Applied Life Sciences. 1(4): 91-100.

Khan L, Shah M and Usman A. (2015). Host preference of Red Pumpkin Beetle (*Aulacophora faveicollis*) Lucas (Chrysomelidae: Coleoptera) among different cucurbits. Journal of Entomology and Zoology Studies. 3(2): 100-104.

Khan MMH, Alam MZ and Rahman MM. (2011). Host preference of red pumpkin beetle in a choice test under net case condition. Bangladesh Journal of Zoology. 39(2): 231-234.

Kumar R and Rathor VS. (2020). Nature and types of damage by insect pests. Journal of Entomological Research. 44(4): 639-646.

Raman K and Annadurai RS. (1985). Host selection and food utilization of the red pumpkin beetle, *Raphidopalpa foveicollis* (Lucas) (Cbrysomelidae: Coleoptera). Proceedings-Indian Academy of Sciences, Animal Sciences. 94(5): 547-556.

Rashid MA, Naeem M, Tariq M, Khan MA and Shaheen FA. (2016). Population and infestation assessment of red pumpkin beetle (*Aulacophora foveicollis* Lucas) and management using botanicals. Journal of Entomology and Zoology Studies. 4(4): 1072-1075.

Saxena HO and Brahmam M. (1995). The Flora of Orissa. Regional Research Laboratory, Bhubaneswar. Orissa Forest Development Corporation Ltd., Bhubaneswar, Odisha. 2: 731-731.

Sharma BP, Das A, Jaiswal A, Rout S and Rath SK. (2023). Animal-Plant interaction, Volume 2, APRF Publishers, India.

Toma C, Kuklinski M and Dajdok Z. (2021). Changes in physico-mechanical properties of water caltrop fruit (*Trapa natans* L.) during the drying process. Naturwissenschaften. 108(6): 59. DOI: 10.1007/s00114-021-01768-4.