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A report on occurrence of aphidophagous predators of *Aphis odinae* (van der Goot) (Hemiptera: Aphididae) in cashew ecosystem from Goa, India

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Abstract: The aphid, *Aphis odinae* (Van der Goot) (Hemiptera: Aphididae) is a polyphagous, occasional insect pest of cashew. A field survey was conducted from 2014 to 2015 in cashew plantations to record the incidence of aphid and its predators. Periodical sampling revealed, the occurrence of six species of aphidophagous predators comprising three species of coccinellids, viz., *Scymnus castaneus* Sicard, *Cheilomenes sexmaculata* (Fabricius) and *Pseudaspidimerus flaviceps* (Walker) and three species of syrphids, viz., *Paragus serratus* (Fabricius), *Dideopsis aegrota* (Fabricius) and *Ischidon scutellaris* (Fabricius) were found predating on *A. odinae*. All the immature stages of predators were found predating on first, second, third and fourth instars of the aphid. Among the coccinellids, the dominant species were *S. castaneus* (4.26 grubs/nut) followed by *C. sexmaculata* (0.42 grubs/leaf) and *P. flaviceps* (0.14 grubs/nut). Of the syrphids, *P. serratus* 2.39 larvae/nut was the major predator. The species *D. aegrota* (1.2 larvae/leaf) and *I. scutellaris* (0.5 larvae/nut) were recorded as minor predators. Seasonal abundance of predators was synchronized with the aphid with a maximum occurrence during February 2015. The aphid population gradually reduced from April onwards due to the voracious feeding activity of the predators. The study concluded that the aphidophagous predators, viz., coccinellids and syrphids play a major role in managing the aphid *A. odinae* in cashew and could be encouraged for augmentation and conservation of these predators in a cashew based ecosystem.

Keywords: Aphid, cashew, coccinellids, predation, predators, syrphids.

The aphid, *Aphis odinae* (*Toxoptera odinae*) (Van der Goot) (Hemiptera: Aphididae) is a polyphagous, occasional sucking insect pest of cashew (*Anacarium occidentale*. L). It feeds on trees and shrubs of many plants belonging to the families of Anacardiaceae, Araliaceae, Caprifoliaceae, Ericaceae, Malvaceae, Pittosporaceae, Rubiaceae, Rutaceae, Verbenaceae and Zapotaceae (Raychaudhuri et al. 1981; Lokeshwari et al. 2014; Vidya & Rajanna 2014). It is widely distributed in eastern and southeastern Asia and Africa (Barbagallo & Santos 1989; Martin 1989). Adults are greyish-brown to reddish-brown in colour and reproduce parthenogenetically throughout the year. It has been, however, reported to have a sexual phase on various hosts in Japan (Blackman et al. 2011). Nymphs and adults feed on tender leaves, shoots, inflorescences, apples and nuts and suck the cell sap. They excrete honeydew on which sooty mould develops, impairing photosynthetic activity of cashew and the aphid colonies are ant-attended. The damage is heavier on young plantations and heavy infestation leads to shedding and drying of inflorescences or distorted and malformed nuts and apples. In other economically important crop

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plants the aphids mainly cause reduced fruit yield and timber quality. In India, peanut green mosaic potyvirus and peanut stripe potyvirus were transmitted in a non-persistent manner by *A. odinae* (www.plantwise.org). It has been reported as sporadic and minor insect pest in cashew (Vidya & Rajanna 2014). In recent times, a minor pest, the mealybug *Phenococcus solenopsis* has attained a major status due to change in climate, and is causing severe yield losses (Maruthadurai & Singh 2015). Extensive use of synthetic pesticides for aphid management led to the development of resistance, resurgence of aphids and effects on non-targets, residue, and ecological disturbances (Dhingra 1992). Therefore, the present study was undertaken to record the natural enemy complex of *A. odinae* in cashew ecosystem and their role in management of aphid so as to formulate a suitable management strategy.

Material and Methods

Field studies were carried out to document the natural enemy complex of *A. odinae* in cashew plantations of ICAR-Central Coastal Agricultural Research Institute, Ela, Old Goa, Goa, India ($15^0$29'N & $73^0$55'E), from November 2014 to June 2015. The plantation is seven years old and has different released varieties and hybrids of cashew. Aphid Infested plants were marked and weekly observations were made on leaves, shoots, inflorescences and apple and nuts on all four sides (quadrants) of marked trees. The population of aphids and its predators were counted on 20 randomly selected aphid infested plants. Field collected grubs and larvae of different predators were brought to the laboratory along with the aphids and identified with available keys (Poorani 2002). Grubs and larvae of different predators were also reared on *A. odinae* under laboratory conditions to obtain the adults for correct identification. Relative density of predators was calculated as

$$\text{Relative density (RD)} = \frac{\text{Number of individual of one species}}{\text{Total number of individual of all species}} \times 100$$

Results

Initially, the aphid population or damage was observed on young leaves and shoots and later migrated to apples and nuts (Image 1). Drying and curling of leaves, inflorescences and malformation of nuts and apples was noticed due to aphid damage. A minimum population (84.44 nymphs and adults/leaf) was recorded during the second fortnight of January and reached its peak (203.07 nymphs and adults/nut) during the second fortnight of February. Six species of

Image 1. Aphid population.
a - Population on young leaves; b - Population on nuts

aphidophagous predators comprising three species of coccinellids, viz., *S. castaneus*, *C. sexmaculata* and *P. flaviceps*, and three species of syrphids, viz., *P. serratus*, *D. aegrota* and *I. scutellaris*, were found predating on *A. odinae* under natural conditions (Image 2). Among the coccinellids, the dominant species were *S. castaneus* (4.26 grubs/nut) followed by *C. sexmaculata* (0.42 grubs/leaf) and *P. flaviceps* (0.14 grubs/nut). Among the syrphid predators, *P. serratus* (2.39 larvae/nut) was the major predator. The species *D. aegrota* (1.2 larvae/leaf) and *I. scutellaris* (0.5 larvae/nut) were recorded as minor predators. The predatory population followed an almost similar trend with that of the prey aphid. Predation of aphids was observed from December onwards and reached its peak during February, coinciding with the maximum population of aphids. The maximum density and diversity of the predators was also noticed in the month of February. Among the coccinellids, the maximum relative density (47.31%) was recorded in *S. castaneus* followed by *C. sexmaculata* (2.96%) and *P. flaviceps* (2.02%). Of the syrphid predators, the

Image 2. Predators of cashew aphid (a–c - coccinellids; d–f - syrphids).
a - *Scymnus castaneus* grub; b - *Pseudaspidimerus flaviceps* grub; c - *Cheilomenes sexmaculata* grub; d - *Paragus serratus* larvae; e - *Ischidon scutellaris* larvae; f - *Dideopsis aegrota* larvae.

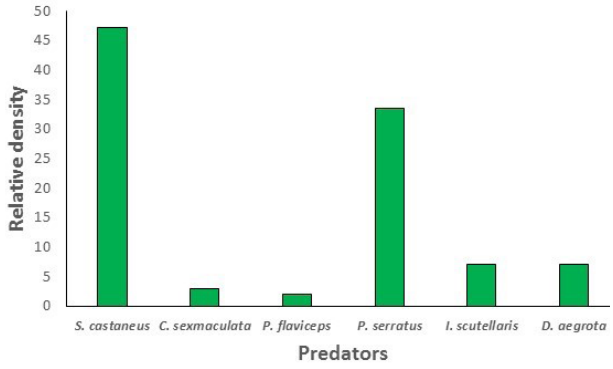

Figure 1. Relative density of aphidophagous predators of cashew aphid

maximum relative density (33.60%) was recorded in *P. serratus* followed by *D. aegrota* (7.06%) and *I. scutellaris* (7.02%) (Fig. 1). The aphid population gradually reduced from April onwards due to the voracious feeding activity of the predators.

Discussion

The field study revealed the presence of two different groups of aphidophagous predators, viz., coccinellids and syrphids in cashew plantations in Goa. Among the coccinellids, *S. castaneus* was the major one followed by *C. sexmaculata* and *P. flaviceps*. This is in accordance with Vidya & Rajanna (2014) who reported three species of coccinellids, four species of syrphids and a species each of hemerobid and chrysopid comprising the group of aphidophagous predators on *T. odinae*. They reported *P. flaviceps* was the predominant coccinellid predator from Karnataka. Baskaran et al. (2009) reported the predators *S. castaneus* and *P. flaviceps* feeding on *A. gossypii* in guava. Garcia (1974) also found *Scymnus* spp. as potential predator of *A. gossypii*. The predator *C. sexmaculata* has been recorded as a major predator of *A. gossypii* in okra, guava and cashew (Venugopal et al. 1975; Mani & Krishnamoorthy 1989; Satapathy 1993). Among the syrphid predators, *P. serratus* was the predominant predator. The species *D. aegrota* and *I. scutellaris* were recorded as minor predators. Vidya & Rajanna (2014) who reported *P. yerburiensis* was the major syrphid predator followed by *P. serratus*. The predators *P. serratus* and *I. scutellaris* have been found predating on *A. gossypii, A. craccivora* and *T. odinae* (Satapathy 1993; Joshi et al. 1999; Baskaran et al. 2009). The relative density and diversity of the predators varies with the prey and the crop. In the present study, the maximum relative density was recorded in *S. castaneus* and *P. serratus* during the month of February. Devi et al. (2010) recorded a maximum density and diversity of *P. serratus* and *C. septempuncta* in tea against *T. aurantii*

during the month of September.

To conclude, the coccinellids and syrphids predators were quite effective in managing *A. odinae* in cashew plantations. The present study suggests that there is no need of any insecticidal spray to manage aphids and augmentation and conservation of these predators could be encouraged.

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