



Occurrence of *Aphis odinae* van der Goot and its natural enemies in cashew

K. VANITHA, T. N. RAVIPRASAD, H. RAJASHEKARA and BABLI MOG

ICAR-Directorate of Cashew Research, Puttur- 574 202, Karnataka, India

E-mail: vanitha.k@icar.gov.in

ABSTRACT: *Aphis odinae*, a polyphagous aphid, was found infesting cashew trees in Puttur, Karnataka. The damage symptoms caused by these aphids, their seasonality and their natural enemies were recorded in this study. The incidence of aphids was observed from August and April every year. The aphids infest emerging flushes, inflorescences and developing nuts. Severe damage to inflorescence resulted in the drying of flowers and the premature fall of tiny nuts. However, medium-sized cashew nuts usually mature or tolerate the aphid infestation without any damage. The size and germination percentage of aphid infested matured nuts, and healthy nuts indicated not much variation. Under field conditions, four species of coccinellids and three species of syrphids were found preying on different stages of aphids and brought their population under control within a short period. The species of ants associated with aphids were also documented. Considering the incidence and severity of the damage, it is a minor pest of cashew in the study area.

Keywords: Cashew, aphids, coccinellids, syrphids, damage symptoms

INTRODUCTION

Cashew (*Anacardium occidentale* L.) is an important edible tree nut crop grown in parts of tropical and subtropical regions, including India. Cashew kernels are rich in nutrients and used in several confectioneries; cashew apples are also nutritious. Cashew trees are infested by several insect pests, among which tea mosquito bugs and stem and root borers are important. Besides, several minor insect pests damage cashew sporadically; a few are secondary pests of regional importance. *Aphis (Toxoptera) odinae* van der Goot (Aphididae), also known as mango aphid, is considered a minor pest of cashew, which occurs on new flushes, flowers as well as developing nuts. It is a polyphagous pest, infesting at least 45 plant families (Blackman and Eastop, 2000). The common plants include citrus, tea, coffee, mango, *Aralia* sp., *Rhododendron* sp. etc. (Lokeshwari *et al.*, 2014; Vidya and Rajanna, 2014; Singh and Singh, 2017).

The *A. odinae* is widely distributed in eastern and southeastern Asia and Africa (Barbagallo and Santos, 1989; Martin, 1989, Dwomoh *et al.*, 2008), almost all the cashew growing regions of India (Pillai *et al.*, 1976). It has been associated with the transmission of at least two plant viruses: peanut green mosaic virus and peanut stripe virus (Plantwise, 2022). Generally, aphids are reported as minor pests in cashew and natural enemies play a major role in regulating the pest population. The information on the seasonality of pests, their natural enemies and the associated insects like ants is to be documented in the changing climatic scenario. Hence, the present study was taken to understand the pest status of aphids and the influence of their natural enemies.

MATERIALS AND METHODS

Random surveys were conducted in 60 ha of cashew plantations of ICAR-Directorate of Cashew Research, Puttur, Karnataka, during 2019-2021 for the occurrence of aphids and their natural enemies. The population of aphids and its predators were recorded monthly on randomly selected trees. The larvae of different predators were collected, brought to the laboratory and reared on *A. odinae* for the emergence of adults. The nature of the damage on shoots, flowers and developing apples and nuts upon aphid infestation was also recorded. To assess the damage status of aphids, net caged trees of cashew variety, VRI-3 having aphid infestation were observed periodically for the pest population buildup and subsequent damage on cashew flowers, apples and nuts. The severely infested nuts were harvested upon maturity and compared with un-infested nuts for the variations in size, weight and germination percentage.

RESULTS AND DISCUSSION

Surveys in the cashew plantations during 2020-22 indicated that the incidence of aphids was noticed in cashew from August till April in Puttur, Karnataka, in a sporadic manner. Infestation occurred initially on new shoots and was subsequently observed on flowers and nuts. In Ghana, its incidence is reported during February-March on mature trees (Dowmoh *et al.*, 2008). The number of aphids, including adults and nymphs, varied between 10 and 303 per flush or nut during the study period. At Goa, the population varied from 84.44 to 203.07 nymphs and adults per leaf (Maruthadurai and Singh, 2018). Ants played a major role in disseminating aphids to the new plant parts. This pest infests the young cashew shoots, inflorescences and developing nuts.



Flower drying due to aphid damage



Tending of aphids by red ants

Fig 1. *Aphis odinae* infestation on cashew inflorescences**Nature of damage**

Large numbers of aphids occur on young shoots and leaves. But no apparent damage on the shoots was observed due to feeding by aphids, except slightly discoloured streaks on the severely infested shoots without any shoot drying. This could be due to the influence of natural enemies, especially syrphids and coccinellids, which occurred on the aphid infested shoots within 10 to 15 days of aphid infestation and brought down its population subsequently. *Aphis odinae* also sucks the sap on the buds and the cashew flowers, and the nut set was observed generally in most infested inflorescences. However, during heavy infestation by aphids and natural enemy free conditions (caged inflorescences), total drying of flowers was noticed because of intensive feeding damage under the high population pressure of aphids. According to Barzman *et al.* (1996), although pseudococcids, coccids and aphids are sap-sucking feeders, they have never been identified as significant pests of cashew.

Later, aphids also occurred on developing cashew nuts but not on cashew apples. Nuts of very early stages dried prematurely and fell off. However, medium-sized cashew nuts matured usually without any significant damage. But the severely infested nuts expressed black discolouration. There was no significant reduction in the size of aphid infested nuts compared to un-infested nuts. However, drying and curling of leaves, inflorescences and malformation of nuts and apples were reported at Goa due to aphid infestation (Marudhadurai and Singh, 2018), which might be due to higher population pressure

of aphids under reduced population of natural enemies or variation in varietal reaction to aphid infestation. The mean length, breadth and width of un-infested nuts of VRI-3 cashew variety ones are 3.10, 2.36 and 1.62 cm, respectively (N=100 Nos), while the values of severely infested nuts were 3.01, 2.40 and 1.60 cm, respectively (N=30 Nos). The mean nut weight of un-infested and infested nuts was 5.68 and 5.56 g, respectively. Further, good germination was also observed in those aphid infested nuts (92 %), similar to un-infested nuts (94 %). Studies on biochemical changes in mango plants upon *T. odinae* infestation indicated a significant reduction in the amount of total soluble sugars and free amino acid content in infested shoots in mango (Lokeshwari *et al.*, 2014) and other crops (Singh and Sinha, 2011).

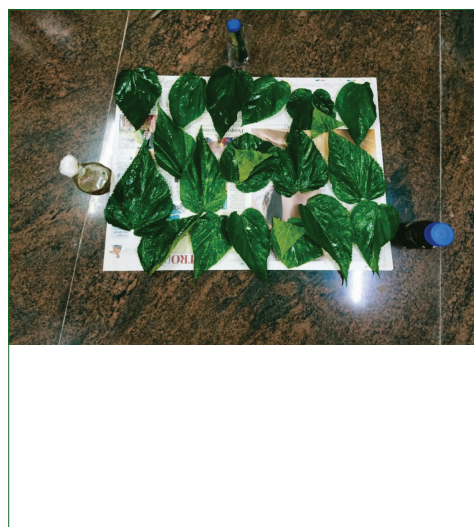
**Fig 2. *A. odinae* with exuviae on developing nuts**

Table 1. Occurrence and damage symptoms of *A. odinae* in cashew plant parts

Plant part infested	Season of occurrence	Aphid population (No.)	Damage symptom
Leaves and young flushes	August-December	10-99 / flush	No clear symptoms. Mild brown streaks develop at heavy infestation (but natural enemies (NE) reduces the aphid population subsequently).
Inflorescences	November-March	15-106 / inflorescence	Flower drying without nut set under NE free condition.
Cashew nuts	March-April	86-303 / developing nut	Early-stage nuts - drying and premature drop. Medium sized developing nuts- black discolorations, small dots on nut surface in severely infested nuts.

Table 2. Influence of *A. odinae* on cashew nut parameters

Parameters	Severely infested nuts (Mean±SD)	Healthy nuts (Mean±SD)
Nut Length (cm)	3.02±0.14	3.11±0.08
Breadth (cm)	2.40±0.13	2.36±0.21
Width (cm)	1.61±0.08	1.69±0.16
Weight (g)	5.57±0.07	5.68±0.12
Germination of nuts (%)	92	94

Natural enemies

Under field conditions, the aphid population is controlled by several predatory insects, mainly coccinellids and syrphids. During our field collections, though few mummified bloated dark aphids were encountered, the emergence of parasitoids was not found in them under laboratory conditions. Hence parasitoids could not be documented. However, intensive surveys may yield information on parasitoids of *A. odinae* in cashew plantations. Among coccinellids, the common species observed in cashew that predate the aphids are *Scymnus castaneus* Sicard, *Pseudaspidimerus flaviceps* (W.), *Cheilomenes sexmaculata* (F.) and *Coccinella transversalis* F. The other coccinellid species recorded in the cashew plantations of Puttur include *Anegleis cardoni* (Weise), *Illeis cincta* (F.), *Brumoides suturalis* (F.) etc. Still, their predation on *A. odinae* could not be noticed during the surveys.

The syrphid species associated with *A. odinae* in cashew at Puttur include *Paragus serratus* (F.), *Ischiodon scutellarins* (F.) and *Dideopsis aegrota* (F.). Vidya & Rajanna (2014) reported three species of coccinellids, four species of syrphids and a species each of hemerobid and chrysopid as aphidophagous predators on *A. odinae*. In Goa, three species of coccinellid and syrphids were reported on *A. odinae*. Among the coccinellids, *P. flaviceps* was dominant, followed by *C. sexmaculata*, which was in accordance with Vidya and Rajanna (2014). While in Goa, *S. castaneus* was the dominant species

(Maruthadurai and Singh, 2018). Among syrphids, *D. aegrota* was abundant compared to the other two species. In Goa, *P. serratus* was the dominant coccinellid, followed by *D. aegrota*. The maggots of *P. serratus* and *I. scutellaris* were found preying on *A. craccivora* and *T. odinae* (Satapathy 1993; Joshi *et al.*, 1999).

It was observed that under field conditions, these natural enemies play a significant role in rapidly bringing down the aphid population within 10-15 days, so that aphids remain a minor pest in cashew. A maximum of three grubs of predators were found on a single shoot or nut. Sometimes, two or more natural enemies co-exist in the same niche. A study at ICAR-DCR, Puttur revealed that when the cashew trees are covered with fine mesh nylon net cages during the flowering season for pollination studies, the population of aphids flared up as there were no natural enemies of the aphids. As a result, flower drying and reduced nut set were noticed in those caged trees, which proved the role of natural enemies in managing this aphid species in field conditions.

Association of ants

Cashew plants attract a lot of ant species towards their extra floral nectarines. The common ant species attended aphids in cashew plants are *Oecophylla smaragdina* (F.), *Anaplolepis gracilipes* (Smith), *Crematogaster* sp., *Camponotus scompressus* (F.), *Camponotus* sp., *Myrmecaria brunnea* Saunders, *Prenolepis naoroji* Forel *etc.* In Ghana, aphids were closely associated with *Oecophylla*

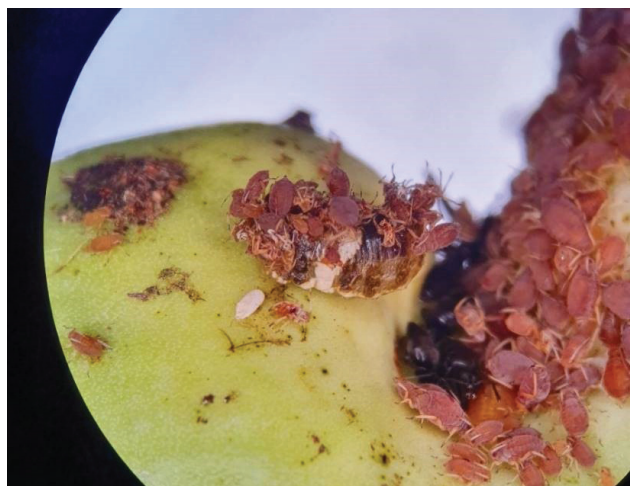


Fig 3. Predators of aphids, Left: Coccinellid grubs (*P. flaviceps* and *S. castaneus*), right: syrphid larva (*D. aegrota*)

longinoda, *Crematogaster striatula* and *Camponotus olivieri* on cashew fruits (Dowmoh *et al.*, 2008). The foraging ants, syrphids and coccinellids all were seen on the same aphid infested shoots or nuts. As aphids are minor pests in cashew and natural enemies significantly reduce their population, management measures are not required. Furthermore, Peng *et al.* (1999) found that *O. smaragdina* do not affect homopteran natural enemies during flowering and fruiting periods, resulting in very little damage to the cashew crop. *O. longinoda* might also not affect homopteran natural enemies on cashew (Sreekumar *et al.*, 2019).



Fig 4. Tending of *A. odinae* by *Prenolepis* sp. ants and a grub of *P. flaviceps* (brown) seen among aphids

REFERENCES

- Barbagallo, S. and L. A. Santos. 1989. *Toxopteraodinae* (V.D.G.) (Homoptera: Aphididae), infesting (*Anacardium occidentale* L.) in Mozambique. (*Toxopteraodinae* (V.D.G.) (Homopter: Aphididae), uma nova praga do cajueiro (*Anacardium occidentale* L.) em Mocambique.), *Phytophaga*, **3**: 163–171.
- Barzman, M. S., Mills, N. J. and Nguyen, T. T. C. 1996. Traditional knowledge and rational for weaver ant husbandry in the Mekong delta of Vietnam. *Agriculture and Human Values*, **13**: 2-9.
- Blackman, R. L. and Eastop, V. F. 2000. Aphids on the World's Crops-An Identification and Information Guide. The Natural History Museum. John Wiley and Sons, Ltd., New York.
- Dwomoh, A., J. B. Ackonor and J. V. K. Afun. 2008. Survey of insect species associated with cashew (*Anacardium occidentale* Linn.) and their distribution in Ghana E. *African Journal of Agricultural Research*, **3** (3): 205-214.
- Lokeshwari, D., Verghese, A., Shivashankar, S., Krishna Kumar, N. K., Manjunatha, H. and Venugopalan, R. 2018. Effect of *Aphis odinae* (Homiptera: Aphididae) infestation on sugars and amino acid content in mango. *African Entomology*, **22** (4): 823–827.
- Martin, J. H. 1989. Identification, occurrence and pest status of *Toxopteraodinae* (Van der Goot) (Homiptera: Aphididae) in Africa. *Bulletin of Entomological Research*, **79**: 611.
- Maruthadurai, R. and N. P. Singh. 2017. A report on occurrence of aphidophagous predators of *Aphis odinae* (van der Goot) (Homiptera: Aphididae) in cashew ecosystem from Goa, India. *Journal of Threatened Taxa*, **9** (2): 9858–9861. [http:// doi.org/10.11609/jott.2435.9.2.9858-9861](http://doi.org/10.11609/jott.2435.9.2.9858-9861).

- Peng, R. K., Christian, K. and Gibb, K. 1999. Utilization of green ants, *Oecophylla smaragdina*, to control cashew insect pests, Rural Industries Research and Development Corporation Canberra, Australia, p. 88.
- Pillai, G. B., Dubey, O. P. and Singh, V. 1976. Pests of cashew and their control in India. A review of current status. *Journal of Plantation Crops*, **4**: 37-50.
- Plantwise, 2022 . <https://www.plantwise.org/knowledgebank/datasheet/54272#Impact> Section. Accessed on 5th October 2022.
- Satapathy, C. R. 1993. Bio-ecology of major insect pests of cashew (*Anacardium occidentale* L.) and evaluation of certain pest management practices. PhD Thesis. University of Agricultural Sciences, Bangalore, India.
- Singh, G. and Singh, R. 2017. Food plant records of Aphidini (Aphidinae: Aphididae: Hemiptera) in India. *Journal of Entomology and Zoology Studies*, **5** (2): 1280-1302.
- Singh, P. and Sinhal, V. K. 2011. Effect of aphid infestation on the biochemical constituents of mustard (*Brassica juncea*) plant. *Journal of Phytology*, **3** (8): 28–33.
- Sreekumar, K.M., Dhanya, C. and Gavas, R., 2019. Population dynamics of red ant, *Oecophylla smaragdina* in cashew orchards and its augmentation for biological control. *Pest Management in Horticultural Ecosystems*, **25**(2): 211-215.
- Sunil, J., Ballal, C.R. and Rao, N.S. 1999. Evaluation of biotic potential of syrphid predators, *Ischiodon scutellaris* (Fabr.) and *Paragus serratus* (Fab.) (Diptera: Syrphidae). *Journal of Aphidology*, **13**: 9–16.
- Vidya, M. and Rajanna, K. M. 2014. Role of Insect Predators in the Control of *Toxoptera odinae* (Hemiptera: Aphididae) in Cashew Plantation. *Biopesticides International*, **10** (1): 112–115.

MS Received: 21 October 2022
MS Accepted : 17 December 2022