



Prepared by:
 Nafeesa, M., Nimisha, M., Murugan M,
 Remya, J. S., Preethi, T. T., Simi, A.



SOME RECENT VERTEBRATE AND
 INVERTEBRATE PEST REPORTS ON CARDAMOM
 [*Elettaria cardamomum* (L.) Maton]
 IN THE CARDAMOM HILL RESERVES, KERALA



ALL INDIA CO-ORDINATED RESEARCH
 PROJECT ON SPICES

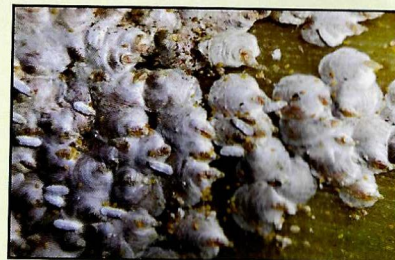
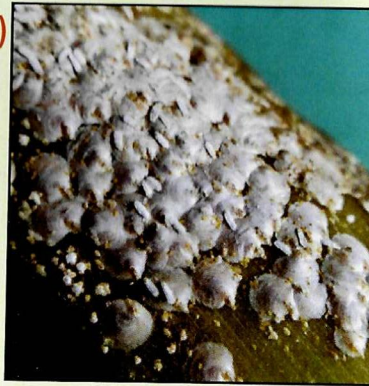
Cardamom Research Station, Kerala Agricultural University
 Pampadumpara, Idukki - 685553
 Phone: 04868 263236, E mail: crspam@kau.in

Small cardamom [*Elettaria cardamomum* (L.) Maton; Zingiberaceae] is a native of the moist evergreen forests of the Western Ghats of southern India. It is widely cultivated in the Indian Cardamom Hills for its spicy aromatic capsules, and among the Indian states, Kerala ranks top in area and production. Abiotic and biotic stresses have challenged cardamom cultivation in recent years. In India, cardamom farming faces significant threats from vertebrate and invertebrate pest species. More than seventy-five species of invertebrate and twelve species of vertebrate pests are known to cause damage to cardamom plantations. New pest infestation records (vertebrate and invertebrate) are increasing year-round in the Cardamom Hill Reserves (CHR), Kerala, primarily due to congenial weather conditions characterized by intermittent rainfall and prolonged dry spells, which are attributed to climate change. Cardamom scales (*Aulacaspis elettaria* Joshi and Nafeesa), Egyptian cotton leaf worm (*Spodoptera littoralis* Boisduval), horntail snail (*Tanychlamys indica* Godwin-Austen), and Malabar Parakeet (*Psittacula columboides* Vigors) are some of the recent infestation reports on cardamom in the Cardamom Hill Reserves, Kerala.

1. Cardamom scale (*Aulacaspis elettaria* Joshi and Nafeesa)

Scale insects are small sap-sucking insects that cause enormous agricultural and horticultural loss and damage. There are about 8,000 described species spread over 30 families worldwide. Among the scale insects, the armoured scales (Diaspididae) are the most diverse family. *Aulacaspis* Cockerell is one of the largest genera of armoured scale insects, and *Aulacaspis elettaria* Joshi and Nafeesa, is a recently described species infesting the crop "cardamom".

In adult female scales, the scale cover is flat, circular to oval, bright opaque white on the margins, and slightly transparent in the median area with coloured body of female visible through it. Bodies of immature stages



Aulacaspis elettaria

and teneral adult females are yellow, but adult females turn orange-brown as they mature. Eggs are light orange brown. Male scale cover is white and elongate with three longitudinal ridges.

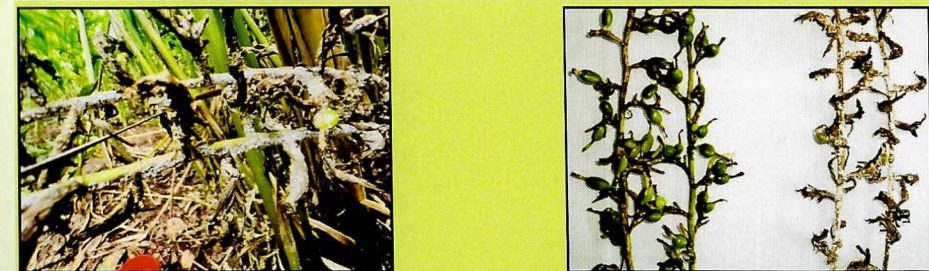
Nature of infestation

Infestation is mainly noticed on the pseudostem just beneath the older leaf sheaths. Both mature and immature scales are aggregating and covering the infected area like a white mat. Three to five such groups are detected within a single stem in cases of heavily infested fields. In severely infested plots, the infestation is also observed in the basal swollen region of the stem as well as panicles. Yellowing and brownish discoloration are initially noticed on the infected portion of the pseudostem. Leaves turned yellow-brown and later the pseudostems dried up, leaving an unhealthy and dead appearance to the clump.



A. elettaria Infestation on cardamom tillers

When the infestation occurred on panicles, browning, shrinking, darkening and drying of the whole panicles, including flowers and capsules were noted. Infested capsules have changed its green shiny appearance into a dirty, gloomy appearance and upon processing; the capsules became a brown dull colour instead of a golden green colour.



A. elettaria infestation on cardamom panicles



Infested and uninfested capsules

Management initiatives

As the CHR system is very sensitive, careful and need based selection of less toxic and more specific botanicals and chemical pesticides are advocated. Frequent occurrence of predatory coccinellids and chrysopids were noticed in the cardamom plantations infested with *A. eleitaria*. Conservation of such natural enemies are essential to reduce the pest density. Among the botanicals tested, infestation percentage was much reduced and a decline in pest density was noticed on plants treated with Neem Seed Kernel Extract (NSKE - 5%). Lower infestation and higher reduction levels in pest density were noticed in plants treated with spiromecifen 22.9 SC (0.7 ml/ l), spinetoram 11.7 SC (0.4 ml/ l), quinalphos 25 EC (2 ml/ l) and thiamethoxam 25 WG (0.2 g/ l). But most of the above chemicals don't have label claim for the CHR system.

2. Egyptian cotton leaf worm (*Spodoptera littoralis* Boisduval)

Some of the most destructive army worms are species of *Spodoptera*, which are highly polyphagous, transcontinental in distribution, and destructive to a wide variety of crops. The Egyptian cotton leaf worm, also called the Mediterranean climbing cutworm, *Spodoptera littoralis*, is highly polyphagous, feeding on members of more than 50 plant families. It is mainly Afrotropical, ranging from southern Europe and Africa east to the Middle East and the western

Asia, including the Arabian Peninsula, Iran, Iraq and Pakistan. *S. littoralis* is almost indistinguishable from the native species *S. litura* by color and pattern on the wings. The only dependable external feature to identify *S. littoralis* is the colour of the scales on the hindwing veins. In this species, apices of hindwing veins appear whitish as there are no contrasting dark scales.



Spodoptera littoralis (male)



Spodoptera littoralis (female)

Nature of infestation on cardamom

Early instar larvae feed on the young, unopened leaves by scooping the tissues, resulting in the formation of several holes on newly unfurled leaves. Later instar larvae mostly feed on recently unfurled light green leaves, removing the entire lamina, often leading to total defoliation. They feed only at night and descend to the base of the plant and take refuge in the soil beneath the mulch during day. In the night, the larvae became active, climbed up, and defoliated the plants. In the affected fields, the infestation resulted in 10–65% loss of leaf area, and the mean larval population per cardamom clump was 2–16.



Spodoptera littoralis larvae in soil



Defoliated plants

Biology of *Spodoptera littoralis* on cardamom

Eggs are laid in masses on the abaxial surface of leaves covered with yellow brown hair-like scales. Each egg mass contains cream-colored spherical eggs, and the colour of the eggs changes to black before hatching. Neonate larvae and the final instar larvae are about 2 mm and 40 mm long, respectively. The larval period is 15–21 days till they enter the prepupal stage. Longitudinally contracted prepupae, moulted to pupae within two days. Pupation occurs in the soil at a depth of about 1.5–4.0 cm under field conditions. Pupae, when formed, look greenish brown and later change to reddish brown. A cremaster with two spines is present on the posterior end of the pupae. The pupal period was 12–15 days under laboratory conditions, and the adult longevity was 7–12 days when fed with honey solution.



Egg mass



Larvae feeding on night



Spodoptera littoralis pupae

Discussion on management initiatives

The reported host range of *S. littoralis* includes more than 158 species under 126 genera belonging to 57 families. Management of a destructive polyphagous pest such as *S. littoralis* is a challenge and its possible impact on a high value crop such as small cardamom is yet to be fully understood. Chlorantraniliprole 18.50 % SC at the dose of 0.3 ml per litre as a curative spray found effective in reducing the larval population of *S. littoralis* at the time of massive infestation. The main constraint in chemical management is the development of resistance in the field population of *S. littoralis*. Hence early detection of infestation is critical in the prevention of damage and further spread.

3. Horntail snail (*Tanychlamys indica* Godwin-Austen)

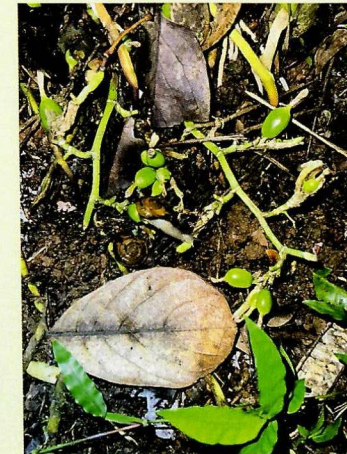
The land snail species *Tanychlamys indica* (Godwin-Austen, 1883), in the family Ariophantidae is probably indigenous across Eastern India, Bangladesh and Nepal and occurs in cultivated and settled habitats in the Western Ghats. It is one of the pestiferous land snails known to cause damage to various agro-ecosystems in India.

Nature of infestation on cardamom

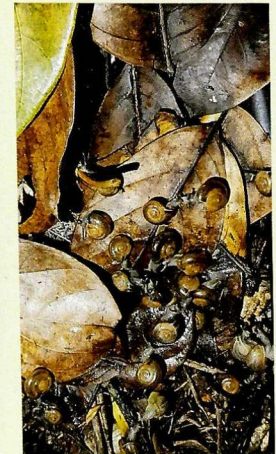
The horntail snail (*Tanychlamys indica*) is causing remarkable floral damage in cardamom plantations. Infestation is mainly during July-September in the Cardamom Hill Reserves. During the daytime, feeding is rare, and they hide under the leaf litter in the cardamom plantations. During night time, we can easily spot *T. indica* on cardamom panicles. In the case of heavily infested plantations, 12-43 snails were noted per cardamom clump in and around the panicles. The snails are mainly feeding on the upper portion of the flowers (labellum and corolla) and flower buds. Feeding injuries were not noticed on the fruits/capsules, even in the tender stage.



T. indica on cardamom panicles



T. indica feeding on flower bud



T. indica under the leaf litters

Discussion on management initiatives

As *T. indica* feeds mainly on the conspicuous portion of the flowers (labellum), the pollination by honey bees is hindered, leading to a reduction in fertilization and capsule formation. Even though the species *T. indica* is not an alien species, the spread of this species to different countries and its invasive nature were discussed by various researchers. The reason for its massive occurrence in the CHR system and its impact on other Western Ghat species remains unclear. Therefore, effective and eco-friendly strategies should be standardized to reduce the infestation and further outbreak of *T. indica*. As the CHR system is a part of the southern Western Ghats, advocated strategies should not cause any deleterious impact on the fauna wealth of the southern Western Ghats.

4. Malabar Parakeet (*Psittacula columboides* Vigors)

Malabar parakeet (*Psittacula columboides*), is a species of parakeet resident to the Western Ghats, and they are mainly found in upland evergreen rainforest but also in deciduous forest with bamboo and abandoned coffee. The diet of *P. columboides* is mainly grains and fruits, flower petals and nectar. The species has been assessed for the IUCN Red List of Threatened Species and has been listed as "Least Concern".

Nature of infestation on cardamom

The bird causing damage to the economic part of the plant (capsule) by scooping the fruit surface with its beak and feeding on the internal content. Fed capsules, along with their was tes, leaving at the base of the cardamom clu mps. The birds were very swift in flying and timid to even mild sounds in the cardamom plantations. The birds prefer feeding on green and tender capsules to fully ripe ned capsules. As *P. columboides* mostly prefer an arboreal type of feeding habit, ground-level feeding and considerable damage to the cardamom capsules were unusual and unexpected.



P. columboides feeding on cardamom



Fed capsules at the base of cardamom plants



scoops on immature capsules

Discussion on management initiatives

A clear and drastic shift in the diversity and endemism of tree species can be easily seen in the CHR system. Excessive shade lopping reduced the natural regeneration, flowering, and fruit setting in the above-ground tree canopy. Unavailability of natural and wild food sources in the infested area may be one of the reasons to trigger the acceptance of cardamom capsules as a new food option for Malabar parakeets.



scaring technique (by imitating predator's sound) installed by farmers

Crackers, beating drums, and making sounds of different predatory animals were practiced by the farmers to scare the birds at the time of massive infestation. Nonlethal scaring and botanical deterrence can be advocated to farmers as short-term options.

References

Chakravarthy, A.K. and Srihari, K. 2000. Vertebrate pests of cardamom (*Elettaria cardamomum* Maton) in hill region of Karnataka, South India. *Pest Management in Horticultural Ecosystems* 6(2): 139–148.

Gopakumar B. and Chandrasekar S.S. 2002. Insect pests of cardamom. In: Ravindran P.N. and Madhusoodanan K.J. (Eds.), *Cardamom The genus Elettaria*, CRC Press, London, pp. 180-206.

Grimmett, R., Inskipp, C. and Inskipp, T. 2014. Birds of the Indian subcontinent. Christopher Helm, London.

Joshi, S., Nafeesa, M., and Mendonce, V.P. 2023. A new species of Aulacaspis Cockerell, 1893 (Hemiptera: Coccothraupidae: Diaspididae) infesting cardamom from India. *Zootaxa* 5325(2):239-250. | <https://doi.org/10.11646/Zootaxa.5325.2.5>

Juniper, T. and Parr, M. 2010. Parrots A Guide to the Parrots of the World, Christopher Helm, London. P.584.

Murugan, M., Dhanya, M.K., Deepthy, K.B., Preethy, T.T., Aswathy, T.S., Sathyan, T. and Manoj, V.S. 2016. Compendium on Cardamom, Kerala Agricultural University, Cardamom Research Station, Pampadumpara, 2nd edn.

Murugan, M., Shetty, P.K., Ravi, R. and Subbiah, A. 2009. The physiological ecology of cardamom (*Elettaria cardamomum* M.) in cardamom agroforestry system. *Int. J. Environ. Res.* 3(1): 35-44.

Nafeesa, M., Aravind, N.A., Murugan, M. and Remya, J.S. 2025. Report of massive infestation of hornail snail [*Tanychlamys indica* Godwin-Austen, 1883 (Gastropoda, Ariophantidae)] on small cardamom [*Elettaria cardamomum* (L.) Maton]. *Indian Journal of Entomology* (Online):Ref.No.e25724. <https://doi.org/10.55446/IJE.2025.2724>

Nafeesa, M., Joshi, S., Murugan, M., Karthik, C.M., Kavya Yadev, G.A., Ajaykumara, K.M. and Chellappan, C. 2025. Expansion of geographic and host ranges of *Formicococcus polysperes* Williams (Hemiptera: Pseudococcidae) in India with small cardamom (*Elettaria cardamomum* (L.) Maton) as a new host record. Research Square-Preprint. <http://dx.doi.org/10.21203/rs.3.rs-7078202/v1>

Nafeesa, M. and Murugan, M. 2024. Nature of infestation and management of Aulacaspis elettaria Joshi and Nafeesa on cardamom. *Indian Journal of Entomology* (Online): Ref. No. e24889. <https://doi.org/10.55446/IJE.2024.1889>

Nafeesa, M., Murugan, M. and Raj, A. 2025. New record of infestation of Malabar Parakeet [*Psittacula columboides* (Vigors, 1830)] on small cardamom. *Pest Management in Horticultural Ecosystems* 31(1): 94-96. <https://doi.org/10.5958/0974-4541.2025.00013.9>

Nafeesa, M., Murugan, M., Remya, J.S., Preethy, T.T. and Jins, K.A. 2024. Pesticide scenario and reduction strategies in Indian cardamom farming – present and future perspectives. *Curr. Sci.* 126(8): 894-902.

Nafeesa, M., Prathapan, K.D., Murugan, M., Sujitha, P.S. and Astile Kuriakose. 2025. First report of the Egyptian cotton leaf worm *Spodoptera littoralis* (Boisduval) (Noctuidae) on small cardamom *Elettaria cardamomum* (L.) Maton (Zingiberaceae). *The Journal of the Lepidopterists' Society* 79(3): 168-174. <https://doi.org/10.18473/lepi.79i3.a2>

Ouvrard, D., Kondo, T., Gullan, P.J. 2013. Scale insects: Major pests and management. In Encyclopedia of Pest Management, Taylor and Francis: New York. 1-4.

Pogue, M.G. 2002. A world revision of the genus *Spodoptera* Guenée (Lepidoptera: Noctuidae). In: Woodley, N.E. (ed.), *Memoirs of the American Entomological Society* Number 43, American Entomological Society, Academy of Natural Sciences, Philadelphia. 202 pp.

Raheem, D.C., Taylor, H., Ablett, J., Preece, R.C., Aravind, N.A., Naggs, F. 2014. A systematic revision of the land snails of the Western Ghats of India. *Tropical Natural History*, Supplement 4: 1-294.

Ravindran P.N. 2002. Introduction. In: Ravindran, P.N. and Madhusoodanan, K.J. (Eds.), *Cardamom The genus Elettaria*, CRC Press, London, pp. 1-10.