

Integrated Management of Hadda Beetle in Ashwagandha (*withania somnifera*): A Sustainable Approach

Ashwagandha [*Withania somnifera* (L.) Dunal] is a highly valued medicinal plant in India, known for its bioactive compounds such as withanolides, which are extensively used in traditional medicine systems like Ayurveda. However, its cultivation is threatened by the Hadda beetle (*Henosepilachna vigintioctopunctata*; Coleoptera: Coccinellidae), a notorious pest that feeds on the plant's foliage, leading to significant defoliation, reduced root yield, and diminished medicinal quality. An integrated pest management (IPM) approach is crucial for suppressing its incidence by combining cultural practices, biological control, mechanical methods, and the judicious use of chemical pesticides. By focusing on IPM as a sustainable pest control strategy, farmers can effectively manage Hadda beetle infestations, minimize economic losses, and ensure the production of high-quality, phytochemically rich **ASHWAGANDHA**. The implementation of IPM not only enhances crop productivity but also promotes ecological balance in medicinal plant cultivation systems.

ASHWAGANDHA [*Withania somnifera* (L.) Dunal] is a vital medicinal plant in India, renowned for its significant role in traditional Ayurvedic medicine. Its roots and leaves are used in a variety of formulations due to their restorative and therapeutic properties, which notably enhance immune function, alleviate stress, and address numerous health conditions. Currently, *Ashwagandha* is cultivated over an area of approximately 10,780 ha in India, yielding about 8,429 t. With increasing awareness of its health benefits, the demand for *Ashwagandha* is projected to rise to around 12,500 t. This important crop is grown in several states across India, with Madhya Pradesh, Gujarat, Haryana, Maharashtra, Punjab, Rajasthan, and Uttar Pradesh being the primary producers. In Madhya Pradesh alone, cultivation spans more than 5,000 ha, particularly in the Manasa, Neemuch, and Jawad tehsils of the Mandsaur district.

However, the production of this crucial crop is significantly threatened by various insect pests. Among these, the Hadda beetle (*Henosepilachna vigintioctopunctata*) is one of the most destructive pests of *Ashwagandha*. Infestations by this pest lead to severe defoliation, stunted plant growth, and reduced root yield, which adversely affect the concentration of valuable phytochemicals. In light of the economic and medicinal importance of *Ashwagandha*, adopting an integrated pest management (IPM) approach is essential for effectively managing

Hadda beetle infestations while promoting sustainable cultivation practices.

Pest identification and biology: Hadda beetle, also known as the spotted leaf-eating beetle, is a notorious pest widely distributed across Southeast Asia, Korea, Australia, Sri Lanka, China, Japan, and India. This beetle belongs to the Coccinellidae family, which is commonly known for beneficial species that prey on pests; however, the Hadda beetle is a phytophagous species, meaning it feeds on plant tissues. It is considered polyphagous, feeding on a wide range of cultivated and wild host plants, particularly those belonging to the Solanaceae family—such as potato, brinjal, tomato, tobacco, *Datura* spp., and *Physalis* spp. as well as members of the Cucurbitaceae family, including melon, gourds, and cucumber. In India, the Hadda beetle is recognized as a major pest of *Ashwagandha*, causing extensive damage to the plant's foliage and leading to economic losses for farmers and reduced quality of the produce.

- **Adult beetles:** The adult beetle is brownish and hemispherical, with 28 distinctive black spots on its elytra (wing covers), making it easily identifiable. Adults measure around 6–8 mm in length and have a characteristic spotted appearance.
- **Eggs:** Female beetles lay spindle-shaped, yellowish eggs in clusters of 10 to 30 on the undersides of leaves. During its lifetime, a female beetle can lay between 500 and 1,500 eggs in multiple batches.

The incubation period lasts 2–5 days, depending on environmental conditions.

- **Grubs:** The grubs are yellowish and covered with spiny tubercles. They feed on the plant for about 10–15 days, passing through four instars. They typically feed gregariously on the leaves, causing significant damage.
- **Pupae:** The grubs pupate either on the leaf or stem of the plant. The pupal stage lasts for 5–9 days, during which the pupa is yellowish with spines on the posterior part of its body.
- **Life cycle:** The life cycle (egg to adult emergence) of the Hadda beetle is completed in about 18 to 22 days, depending on environmental conditions. Male and female beetles live for 27–108 and 37–108 days, respectively. The pest can have multiple generations during a single growing season, which exacerbates its impact on *Ashwagandha*.

Nature of damage

Hadda beetle affects *Ashwagandha* primarily through defoliation, leading to significant crop damage. Both the grubs and adult beetles feed on the leaves, causing characteristic "skeletonization." They scrape off the leaf surface, removing the green tissue and leaving parallel bands of uneaten tissue in between. In severe infestations, the epidermal layer is entirely removed, resulting in complete defoliation. This significantly reduces the plant's ability to photosynthesize, weakening its growth and lowering biomass accumulation.

Since *Ashwagandha* is primarily cultivated for its roots, any damage to the foliage directly impacts root development. Defoliation weakens the plant, leading to poor root growth and reduced yield. This not only diminishes the overall productivity of the crop but also compromises its medicinal value, as the concentration of key phytochemicals—such as withanolides and alkaloids—is reduced. The loss of leaves due to pest infestation impairs the plant's ability to produce and store important bioactive compounds, particularly withanolides, which are concentrated in both the roots and leaves.

A reduction in these compounds affects the medicinal efficacy of the plant and the overall quality of *Ashwagandha*-based products. Pest activity on *Ashwagandha* in northern India is typically observed during the months of November to December and from March to September.



Henosepilachna vigintioctopunctata (adult and grubs)



Damage symptoms caused by *Henosepilachna vigintioctopunctata* feeding

Integrated pest management

Given the significant damage caused by the Hadda beetle, a comprehensive IPM strategy is necessary to manage its population while safeguarding ecological balance and reducing reliance on chemical pesticides.

Monitoring and early detection

Regular field monitoring is crucial for detecting the presence of Hadda beetles early in their life cycle. By identifying infestations at the egg or early larval stage, timely interventions can be implemented to prevent severe damage.

Cultural control

- Planting Hadda beetle-tolerant varieties, such as 'Arka *Ashwagandha*', can significantly reduce damage, as these varieties are better adapted to withstand infestations.
- Removing alternate host plants and clearing plant debris from the cultivation area eliminates potential food sources and breeding grounds, thereby preventing the carryover of the pest.
- Practicing crop rotation with non-host plants disrupts the lifecycle of the Hadda beetle, reducing its population density in *Ashwagandha* fields.
- Intercropping *Ashwagandha* with non-preferred crops deters the Hadda beetle by limiting its access to its primary host.

Incorporating trap crops, such as *Physalis Angulata*, can attract Hadda beetles away from *Ashwagandha* plants, serving as a diversion that helps minimize damage to the primary crop.

Mechanical control

- During the early stages of infestation, manually collecting and destroying adult beetles, grubs, and pupae in the morning can effectively reduce their population on the crop.

Biological control

- Biopesticides such as neem oil (4 ml/litre), *Azadirachtin* (1500 ppm at 2.5 ml/litre), or Karanj (*Pongamia pinnata*) extract (5% concentration) can effectively suppress Hadda beetle infestations while protecting beneficial organisms.



Damaged Ashwagandha, plant by *Henosepilachna vigintioctopunctata*

The use of these biopesticides helps conserve natural enemies of the hadda beetle, thereby enhancing biological control efforts. The larval parasitoid *Pediobius foveolatus* and the egg parasitoid *Quadrastichus ovulorum* contribute to the natural reduction of pest populations. Additionally, encouraging predatory reduviid and stink bugs, which prey on the larvae and adults of the Hadda beetle, can further support effective pest management.

CONCLUSION

The Hadda beetle poses a significant threat to *Ashwagandha* cultivation, affecting both the yield and quality of the crop. An integrated approach that combines cultural, biological, mechanical, and chemical methods is essential for effective pest management. By adopting sustainable IPM strategies, farmers can protect their *Ashwagandha* crops from damage, preserve the valuable phytochemicals that make the plant medicinally important, and ensure the long-term productivity of their fields.

Integrated pest management not only minimizes the economic losses associated with hadda beetle infestations but also promotes ecological balance, contributing to the sustainable cultivation of *Ashwagandha* in India.

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Food Loss Index (FLI)

Food Loss Index (FLI) for India and food loss percentage under the project entitled “Study on reviewing the Food Loss Index (FLI) estimates for India was compiled. The assessment report for inclusion of the SDG Indicator 12.3.1 in the National Indicator Framework of India” funded by Food and Agriculture Organization of the United Nations (FAO), Rome through FAO-India using the FAO methodology and the data generated through three post-harvest losses surveys conducted during 2005-07, 2012-14 and 2020-21 was prepared. The statistics has been calculated using 12 commodities as per procedure of FAO and all the 45 commodities were common to all the three surveys. Stepwise and year wise decrement method has been suggested for imputing the index during intervening years. Moreover, some suggestions of weighting the imported quantities only for storage losses has been suggested.

Source: ICAR Annual Report 2023-24, p.145