The Wattle bagworm

By Luki-Marie Scheepers

Current Importance

The wattle bagworm*, Chaliopsis junodi* Haylaerts (Lepidoptera: Psychidae) has been a sporadic insect pest of black wattle (*Acacia mearnsii* De Wild) since these trees were introduced in South Africa.

The management of these unique insects is difficult due to this insect's interesting life history. Some of the factors include being hidden during most of their life cycle, unpredictable infestation spread, and high female fecundity.

The bagworm bag: A hidden life

The wattle bagworm*, C. junodi* is a unique indigenous moth species to South Africa. Before starting to feed, the larvae - or caterpillars- make irregular bags encompassing their abdomens with particles and whole pieces of foliage and twigs by using silk threads with a camouflaging effect as the larvae grow (Hardenberg 1917; Ripley et al. 1939).

Wattle bagworms pupate in their bags. Male pupae undergo metamorphosis to become blackish hairy moths with transparent wings, but females become worm-like: wingless, legless, without eyes or mouthparts. Females are thus immobile in their pupal cases, where they stay to mate and lie fertilized eggs until they die (Hardenberg 1917).

Wattle bagworms are unique

The wattle bagworm is the only bagworm to reach adulthood mid-winter (Hardenberg 1917). Other bagworm species emerge in summer. Not all bagworm species have females that mature, mate, lay eggs and die in her self-constructed larval bag like wattle bagworms (Rhainds et al. 2009). Other species females may exit the bag to mate and lay eggs, or even fully mature as winged moths (Rhainds et al. 2009)

Outbreaks and predictability

Since wattle bagworm larvae are wind-dispersed, infestations are unpredictable. First-instar larvae produce excessive amounts of silken threads which are easily transported by the slightest breeze, or travelling agent like a bird or passing hare (Hardenberg 1917). Larvae can therefore be dispersed miles from their origin and fall anywhere. Bagworms that reach unfavourable conditions simply succumb to their environment, but others survive if they reach a palatable host, albeit in or near a wattle plantation. Dispersal like this is often unnoticed at first and is characterized by the presence)of bagworms on one or few trees in an otherwise bagworm-free plantation. In the next season, the bagworms infest the whole plantation seemingly out of the blue due to the extremely high fecundity of females and abundance of food resources (Hardenberg 1917).

Defoliation occurs from top to bottom of a tree and instars feed on the freshest flush after the first rains commence, on increasingly mature leaves as they grow (Hardenberg 1917).

Only larvae, not adult moths, cause damage in *A. mearnsii* plantations during the larval feeding period from September to February in South Africa (Ossowski 1956). The wattle bagworm has been reported as black wattle pest in South Africa since the early 1900's.

Damage by pupae

Larval behaviour just before pupating has a negative impact on some wattle trees. The larvae become gregarious (moving toward another) just before pupating and generally move their bags to inconspicuous twig forks, thereby forming clusters of bags. Each bag is tightly fastened to the twig by tightly spun silk around the twigs. This tight grip by closely-arranged pupation bags reduces the wattle's effective water transport to foliage and may cause breakage of distal parts of the tree when winds arise. It also adversely affects foliage growth in the next growth season.

Female fecundity

Despite their univoltine, short life cycles, each female is able to lay more than 3000 eggs during her lifetime (Hardenberg 1917), depending on food availability during the larval stage (Ossowski 1956). This makes management of these pests extremely difficult. Ossowski (1956) explained this through an example: the presence of only 21 females has the potential for a conservative amount of 40 000 eggs to be lain in a single season, even if most of the progeny succomb to natural predation or insecticide application.

Behaviour

Wattle bagworm male moths are attracted to pheromone-producing females, after which mating occurs in the same bag where the female lays her eggs. The male is adapted with an extendable abdomen to reach the female reproductive tract deep in the bag for normal copulation to occur (Bosman and Brand 1971).

Impressive female fecundity of flightless bagworms accounts for the loss of offspring due to the lack of her role in dispersal of her young.
Interestingly, it has been reported that evergreen bagworm females, *Thyridopteryx ephemeraeformis,* lose fecundity when they are exposed to their own pheromone (Klun et al. 1986).

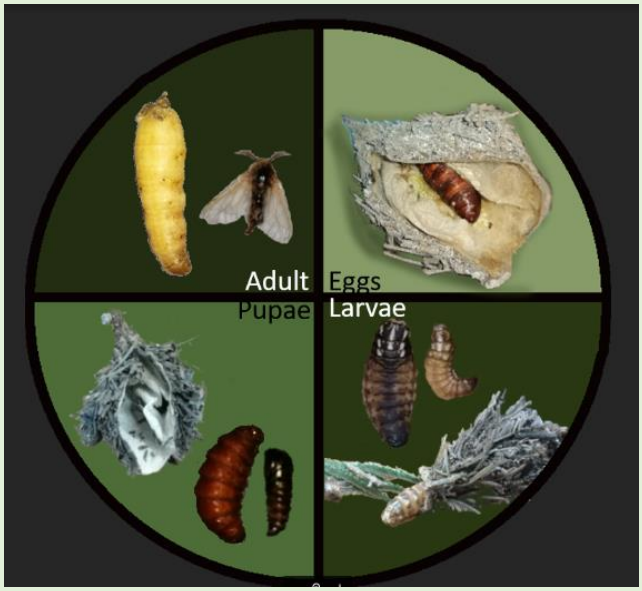
Control of the wattle bagworm

Current control of the bagworm is through timed insecticide application when larvae are very small. The timing is important since targeted approaches are unsuccessful against enclosed larvae, pupae and adult females. Unfortunately, timing of insecticide applications is not predictable yet since available monitoring techniques are laborious and difficult to interpret. Management via biocontrol agents is also difficult because more mature larvae are able to ward of natural enemies like wasps by vigorous shaking (Hardenberg 1917).
The only sustainable way to approach the population management of this insect pest, is through integrated pest management strategies. For example, monitoring for male wattle bagworm presence, and if found, utilizing systemic insecticide in a spatially and temporally targeted manner to reduce bagworm numbers in sudden population outbreaks. It is possible to determine when males emerge from the bags since their open pupal shells remain exposed at the lower extremity of the bag.

Pheromone knowledge

It is not surprising that wattle bagworms use pheromones as mating cues, given the inability of females to move at all to find a mate (Rhainds et al. 2009). Pheromones of bagworms from USA and various areas in Eurasia have been identified (Leonhardt et al. 1983, Subchev, 2000; Schwarz and Klun 1986; Gries et al. 2006; Rahmani et al. 2020), but not of the wattle bagworm. The existence of a pheromone and the pheromone production site for the wattle bagworm was confirmed by Bosman and Brand (1971). The molecular identity, type and number of constituents in the wattle bagworm pheromone have not been elucidated.
Modern analytical instruments enables the identification of compounds using smaller samples than ever before. This work is currently being done by Luki-Marie Scheepers, a PhD candidate at FABI (Forestry and Agricultural Biotechnology Institute), based at the University of Pretoria.

The aim of her study is to determine the pheromone composition of volatiles produced by female *Chaliopsis junodi* and how to apply these volatiles as a pest management tool in South African Black Wattle plantations or nurseries.



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