

2. BIOLOGICAL CONTROL OF INVASIVE CACTUS SPECIES (FAMILY CACTACEAE)

2.5 *Harrisia* cactus mealybug (*Hypogeococcus pungens*)

Since its first use as a biological control agent, this mealybug had been known as *Hypogeococcus festerianus*, but an entomologist recently discovered that this was an incorrect identification, and that it should have been called *H. pungens*.

Mealybugs are very similar to cochineal in appearance and life history. The *Harrisia* cactus mealybug, *H. pungens*, attacks most of the organ-pipe cactus species. It was first imported from Argentina to Australia where it was used to control *Harrisia* cactus in Queensland. South African researchers obtained a starter colony from Australia in 1983, which was then released locally on *Harrisia* cactus.

The mealybug effectively controls the following two invasive cacti in South Africa:

- *Cereus jamacaru* (queen of the night cactus)
- *Harrisia martinii* (*Harrisia* cactus).

Indications are that the organ pipe cactus is also being attacked.

Life cycle

Mealybugs usually live in colonies or clusters of individuals grouped together within the shelter of a distorted stem tip (fig. 2) or on actively dividing growth tips (fig. 3) of their cactus host. The adult females are round, fat, light-pink, about the size of a pinhead, with six short, weakly-developed legs and long, thread-like, sucking mouthparts. They are normally not seen because they are covered with a woolly, white mass of waxy threads that protects the insects from predators. The adult males (fig. 1f) bear no resemblance to the females. They are tiny, pink, mobile insects with two semitransparent wings and long "tail" filaments.

The female mealybugs lay their eggs singly (fig. 1a) and, within about 20 minutes, the eggs hatch to produce tiny, pink nymphs, less than 1 mm in diameter. The newly-hatched nymphs are known as crawlers because they have functional crawling legs. Upon hatching, the nymphs crawl up towards the tip of the stems from where they may be blown away by the wind. If the crawlers land on another host plant, they usually move towards the stem tip and settle down under the base of a spine, in a crack or between buds on a stem, staying close to other crawlers. They immediately start feeding by inserting their piercing mouthparts into the plant to suck the plant sap. At the same time, the nymphs produce their cover of waxy threads.

Male nymphs (fig. 1e) move to a more exposed part of the plant just before their second moult and spin a white, cottony cocoon in which they pupate. About a month after hatching, they emerge as sexually mature insects, which fly away to find a female to fertilise. Mature male mealybugs do not feed at all and live for a couple of days only.

Female nymphs (fig. 1b) will stay attached to the one spot for the rest of their life. They continue producing wax (fig. 1c) and moult (shed their skin) three times as they grow. Females reach sexual maturity (fig. 1d) about a month after hatching, and are then fertilised by a male.

About three weeks after fertilisation, females start laying eggs at a rate of 2 to 4 eggs per day and continue doing so for up to 35 days. Adult females have a lifespan of 50 to 90 days.

Mealybugs continue to develop and breed throughout winter, but at a slower rate than in summer.

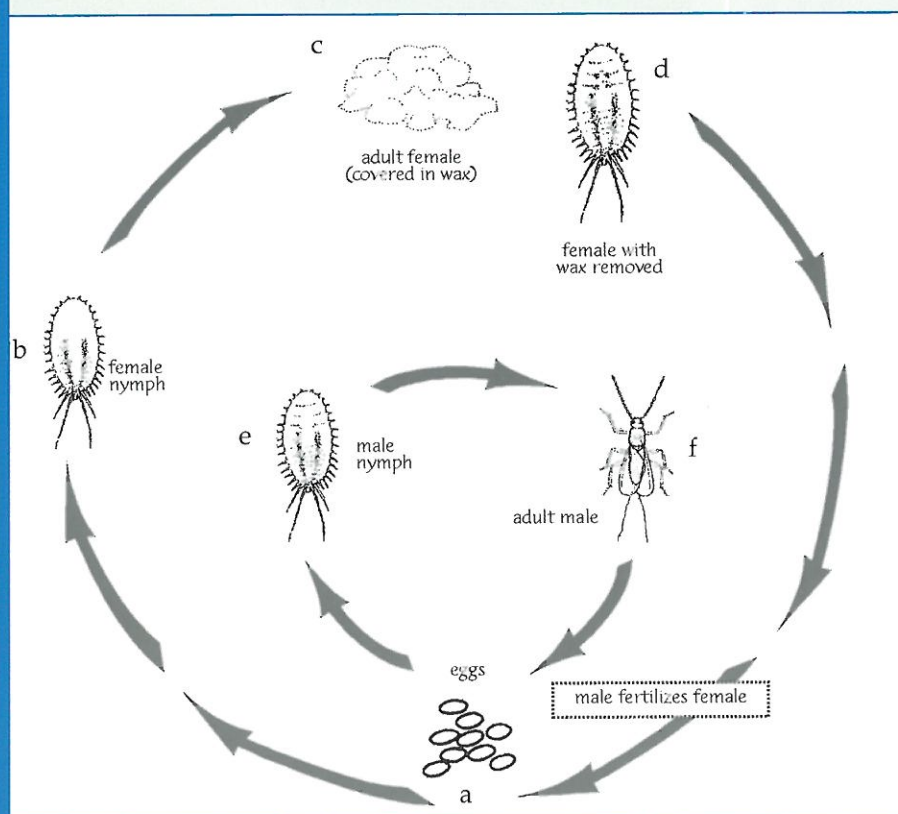


Figure 1. Life cycle of a typical mealybug.

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How to tell whether the *Harrisia* cactus mealybug is present

The first indication of the presence of the mealybug is that the tips of the cactus stems become distorted, and soon afterwards white, woolly masses appear on the tips of the stems (figs 2 and 3). In queen of the night cactus, masses of mealybugs sometimes sit on each areole (the clusters of spines on the ridges of the cactus) (fig. 3). Affected plants have very few flowers and fruits.

How the *Harrisia* cactus mealybug damages its host plant

Mealybugs tend to live and feed on the growth tips of their cactus hosts, causing them to stop growing.

Although mealybugs resemble cochineal so closely, these two insect groups differ from each other in their effect on the cactus host. Whereas cochineal insects kill mature plant tissue, mealybugs affect or even stop the growth of growth tips but do not affect mature tissue. If only one insect feeds on a growth tip, the side of the stem where it is sitting, will grow more slowly than the opposite side, with the result that the tip of the stem will curl around. If several mealybugs feed on the same growth tip, all growth could stop.

The typical appearance of a plant infested by mealybugs, is a mass of twisted and distorted stems (figs. 2 and 3). These clusters of knotted stems form an ideal, sheltered living area for the mealybugs.

The flowerbuds are also attacked and *Harrisia* cactus plants that have been infested by mealybugs for three years hardly flower or produce any fruit. Eventually the entire plant dies, although a large queen of the night plant might take several years to succumb. Seedlings in the vicinity readily become infested and die within a year or two, with the result that the weed does not invade any new areas.

In South Africa, small black coccinellid (ladybird) beetles feed on mealybugs, but it does not appear as if the mealybug numbers are affected in a significant way.

Factors limiting the efficacy of the mealybug

- Female mealybugs are sessile, except during the first nymphal instar (crawler stage). Even the crawlers are unable to fly and can only walk short distances. They depend on wind for long-distance dispersal.
- After the dieback of the cactus plants, food limitations may drive the local populations of mealybug to extinction so that no insects remain to recolonise the new plants that arise from the underground tubers or germinate from seeds.
- While passive crawler dispersal is effective in dense infestations of cactus, dispersal becomes inefficient and wasteful in sparse cactus infestations because most crawlers "miss" the target hosts.
- The prostrate *Harrisia* cactus plants and small queen of the night cactus plants are protected from prevailing wind by other, taller plants. Under these relatively calm conditions, crawlers are not easily dislodged and dispersal is limited. Also, surrounding vegetation often conceals the cactus plants and thereby restricts the target area for the wind-dispersed crawlers, further reducing the chances of successful establishment.
- Rainfall dislodges the adult insects and crawlers from the plants, resulting in population declines and reduced impact in high-rainfall periods or regions. This is compounded by the fact that the wet weather favours growth of most cactus plants and improves their chances of recovering from mealybug attack.
- Because they cannot move around independently, the insects will die prematurely along with the treated plants when the cactus is



Figure 2. The tip of a *Harrisia* cactus stem that has been twisted around by the feeding damage of the *Harrisia* cactus mealybug. The female mealybugs as well as nymphs are protected by a white, waxy covering.



Figure 3. A growth tip of a queen of the night cactus that has been deformed by the feeding damage of the *Harrisia* cactus mealybug.



Figure 4. A stem of queen of the night, with white masses of mealybugs sitting on each areole.

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sprayed with herbicides (e.g. MSMA). The problem is compounded because, like the insects, the teams applying herbicides are most efficient in finding and dealing with large clumps of cactus plants, where most of the mealybugs are usually concentrated. By destroying the dense aggregations of plants (with mealybugs) and overlooking small, isolated ones (without mealybugs), herbicidal control methods are in direct conflict with biological control.

Collection and redistribution of the mealybug

The purely passive dispersal of mealybugs is very limited, as discussed earlier. Manual distribution of the mealybug is essential to ensure that the insects reach every cactus plant.

Redistribution should only take place during spring and summer as mealybugs only affect the growing plant tissues. Do not collect insect material for redistribution after heavy rain, because the rain might have washed most of the insects off the plants.

If any *Harrisia* or queen of the night cactus plants in your vicinity are already infested with mealybug, the affected growth tips from those plants should be collected for redistribution of cochineal. If no mealybugs occur on plants of those two species in the vicinity, contact your Provincial Office of D:LRM to find out where a starter colony can be obtained.

Cut off several mealybug-infested growth tips and check that mealybugs are actually present by searching for the white waxy covering in the folds of the twisted growth tips. Carefully place each of these infested growth tips in contact with the growth tips of an uninfested *Harrisia* or queen of the night cactus plant, preferably in a position where it will be protected from wind and rain. Young queen of the night plants should be inoculated by splitting the stem at the tip and pushing the infested growth tip into the cleft. The plant will react to the wound by producing new growth, which is ideally suited to be colonised by the mealybugs. If the cactus is too tall for you to reach its tip, the incision could be made at any point where side shoots arise. Alternatively, the cactus spines or a length of sticky tape could be used to attach the severed growth tip to the upright-growing queen of the night cactus. Once the insects have settled and started multiplying, their dispersal can be accelerated by manually carrying mealybug-infested growth tips to distant plants. The insects should be able to survive on a cut growth tip for several days or even weeks, as long as the plant tissue remains firm and juicy.

As mealybugs disperse better in dense stands of cactus than between isolated plants, one or two mealybug-infested growth tips might be enough to control a dense cactus stand. Isolated plants (more than 10 m apart) will need one infested growth tip each. If the cactus grows amongst dense vegetation, the mealybugs will not disperse effectively, and more infested growth tips will be needed.

Always take care to remove some mealybug-infested material for redistribution before the cactus plants in a particular area have been destroyed, otherwise the insects could become extinct locally. After wet periods it will probably be necessary to supplement the mealybug populations with colonies from elsewhere.

CONTACT PERSONS

Consult leaflet 1.4 in this series for the most updated contact details.

- Biocontrol research: Weeds Research Division, ARC-PPRI (Rietondale), Private Bag X134, Pretoria 0001; Tel (012) 329 3269; Fax (012) 329 3278; e-mail weeds@plant2.agric.za.
- Supply of biocontrol agents: National Department of Agriculture: Directorate of Agricultural Land and Resource Management (D:LRM): your nearest Provincial Office.

FURTHER READING

McFADYEN, R.E. & TOMLEY, A.J. 1980. Biological control of *Harrisia* cactus, *Harrisia martinii*, in Queensland by the mealybug *Hypogeococcus festerianus*. *Proceedings of the Fifth International Symposium for Biological Control of Weeds*, Brisbane, Australia: 589-594.

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