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3. BIOLOGICAL CONTROL OF LEGUMES (FAMILY FABACEAE) OF AMERICAN ORIGIN

3.2 Prosopis seed beetles (*Algarobius prosopis* and *Neltumius arizonensis*)

Introduction

Both these beetle species were introduced from Arizona, USA. *Algarobius prosopis* was released in South Africa in 1987 and *Neltumius arizonensis* in 1993.

Neltumius was imported to supplement *Algarobius*, because it had been reported that *Neltumius* laid its eggs on younger pods than those utilised by *Algarobius*. It was hoped that this beetle would damage most of the seeds before the pods dropped from the trees and became available to livestock. Contrary to expectations, *Neltumius* does not lay its eggs on young pods, and it faces the same problem as *Algarobius* in that livestock normally ingest the pods before the beetle larvae have a chance to neutralise the seeds.

Life cycle of the prosopis seed beetles

The adult beetles (fig. 1a) are about 4 mm long, *Algarobius* (fig. 2) being mottled brown and *Neltumius* (fig. 3) mottled black and white.

The adult beetles of both species are active and readily fly, with the ability to cover long distances. Adult females live for several weeks. The females of *Algarobius* can each lay up to 300 eggs, while those of *Neltumius* lay about 70 eggs on average. The eggs (fig. 1b) are colourless, flattened and oval, about 1 to 2 mm long, and are laid on prosopis pods.

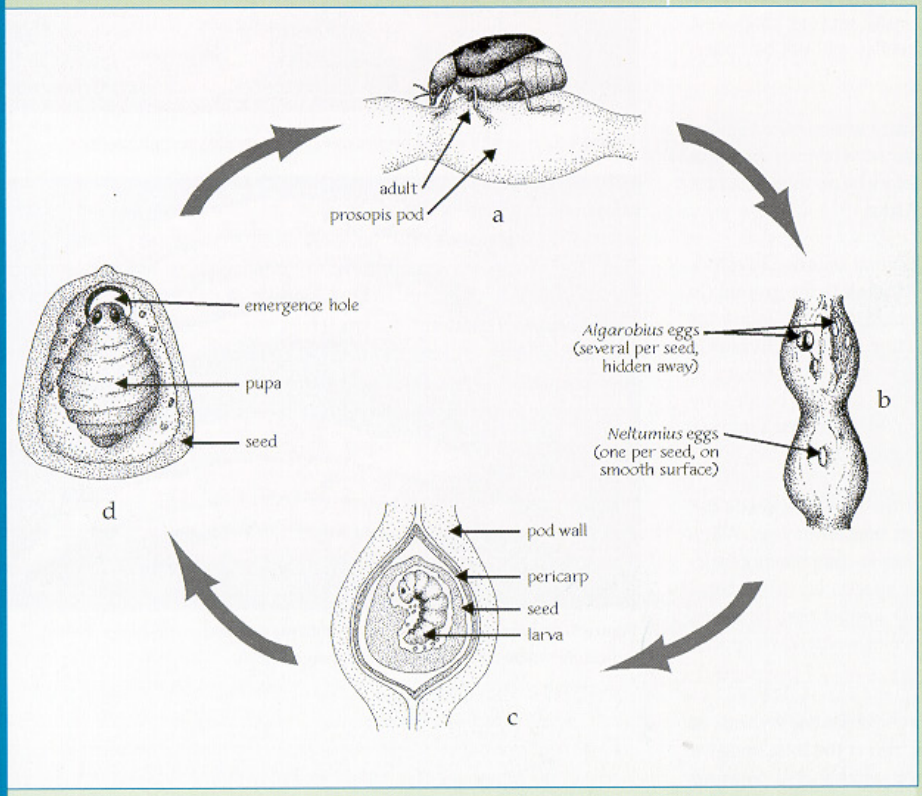

Figure 1. Life cycle of the prosopis seed beetles.

Figure 2. An adult of *Algarobius prosopis*.

The two beetle species differ from one another concerning their oviposition (egg-laying) behaviour. *Algarobius* deposits its eggs in clusters in cracks on mature prosopis pods or in old emergence holes of adult beetles. *Algarobius* almost invariably only oviposits on pods that are fully ripened, and the eggs are attached in place with one or two adhesive strands. In contrast, the *Neltumius* females are meticulous about where and how they lay their eggs. Each egg is deposited on the swollen area around a seed of a mature prosopis pod, but never on a seed that is already occupied by an egg of either *Neltumius* or *Algarobius*, if free seeds are available. Unlike *Algarobius*, eggs are usually laid on undamaged pods and each egg is carefully cemented onto the surface of the pod.

After a few days tiny, cream-coloured grubs or larvae hatch from the eggs. Those of *Algarobius* have well-developed legs and crawl around on, or burrow through, the pod until they find an undamaged seed; they then chew their way into the seed. The grubs of *Neltumius* have no legs and they burrow downwards through the eggshell and pod wall, directly into the underlying seed. While chewing through the plant material, the grubs of both species push the discarded material (frass) back into the empty eggshell, which then changes its appearance from almost transparent to white as it is filled up with frass. Once inside a seed, the larva (figs. 1c and 4) feeds on the contents of the seed, including the embryo, while it matures over a period of a few weeks. The larva moults (sheds its skin) three times during its

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A few parasitic wasp species that normally parasitise native seed-feeding bruchids on our indigenous *Acacia* species have adopted *Algarobius* as a host, but, so far, levels of parasitism are low and there has not been a noticeable reduction in the population levels of the beetles. In certain areas, *Neltumius* is more severely parasitised by indigenous wasps than *Algarobius*, especially in the egg stage, which is more vulnerable on the surface of the pod.

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. Alternatively: UCT.
- Supply of biocontrol agents: National Department of Agriculture, Directorate of Agricultural Land Resource Management (D:LRM), North-West Province.

FURTHER READING

IMPSON, F.A.C. & HOFFMANN, J.H. 1998. Competitive interactions between larvae of three bruchid species (Coleoptera) in mesquite seeds (*Prosopis* spp.) under laboratory conditions. *African Entomology* 6: 376-378.

IMPSON, F.A.C., MORAN, V.C. & HOFFMANN, J.H. 1999. A review of the effectiveness of seed-feeding bruchid beetles in the biological control of mesquite, *Prosopis* species (Fabaceae), in South Africa. *African Entomology Memoir No 1*: 81-88.

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development. If more than one larva enters the same seed, one larva will kill the others, and normally only one larva develops per seed.

After several weeks, when the larva has reached maturity, it tunnels up to the surface of the pod where it leaves a circular, weakened "trapdoor", which can be pushed out by the newly emerged adult. The larva then returns to the hollowed-out seed and pupates (fig. 1d). After a few days, an adult beetle emerges from the pupa and escapes through the trapdoor.

The beetles continue breeding throughout the year, and complete several generations per year. The larvae of *Algarobius* develop slightly faster than those of *Neltumius*. Growth rates of both species are dependent on ambient temperatures so the development times are most rapid in summer.

How to tell whether the prosopis seed beetles are present
Round exit holes are visible on the pods (fig. 5), indicating where adult beetles have emerged. It is impossible to distinguish the two beetle species by the exit holes alone. Usually white eggshells are easily distinguishable on the surface of the pods when *Neltumius* is active in an area, whereas the eggs of *Algarobius* are sheltered and therefore not easy to find.

Seed beetle damage to prosopis
The larvae of both species destroy the seed embryos and prevent the seeds from germinating. The pods remain nutritious to livestock in spite of the beetle damage and can still be used to provide stock feed. The seed beetles will not control the standing infestations of prosopis, but only reduce the number of seeds that are added to the seed bank in the soil. The seeds in the existing soil seed bank are very long-lived, however, and the effectiveness of the seed beetles will not be noticeable until this seed bank is exhausted.

The seed beetle species have dispersed widely and rapidly and at least one of the species is found in abundance wherever prosopis occurs in Southern Africa. There should therefore be no more need for redistribution of seed beetles within South Africa.

Despite this, levels of damage are often minimal because livestock and game ingest most seeds soon after the pods fall to the ground (in January/February) and before the larvae are able to fully colonise the pods. The larvae cannot survive in the digestive system of livestock. As a result, most seeds escape beetle damage unless infestations of the weed are fenced off to exclude livestock while the beetles are active. In fenced areas, beetles destroy up to 90 % of seed embryos within 8 months of the pods dropping to the ground.

Neltumius can account for more than half of the damaged seeds but usually destroys a smaller proportion of seeds than *Algarobius*. When both beetle species are present, *Algarobius* seems to compete more successfully than *Neltumius*, because the former species lays more eggs and its larvae develop faster. *Neltumius* avoids competition, however, by ensuring that its eggs are not laid near other eggs of its own species or those of *Algarobius*.

Algarobius attacks the seeds of all the invasive species and hybrids of prosopis in South Africa. *Prosopis chilensis*, which is the least invasive species in South Africa, seems to be the least suitable host plant for *Algarobius*.

Figure 3. An adult of *Neltumius arizonensis*.

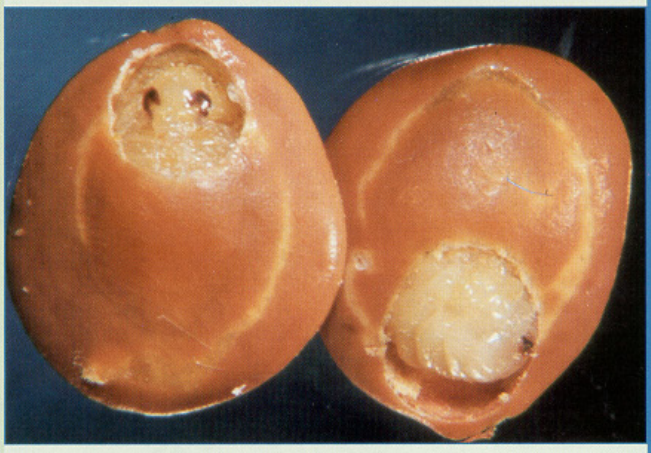

Figure 4. Larvae of the seed beetles developing inside prosopis seeds.

Figure 5. Undamaged prosopis pods (bottom) and pods with escape holes, indicating where adult beetles have emerged (top).