African black beetle

(Heteronychus arator)

Figure 1 African black beetle adult (Image: Trevor James, AgResearch, NZ)

African black beetle (ABB), an introduced scarab pest, is found in Western Australia, South Australia, Victoria, New South Wales, and Queensland. ABB has not been recorded in Tasmania. ABB is a major agricultural pest, damaging several pasture species, cereal crops, horticultural crops, and some forestry species.

ABB is emerging as a major pest in pasture based agriculture, including in the dairy industry due to the use of pasture and crop species that the beetle feeds on. Pasture grass species favoured by ABB include ryegrasses, paspalum, kikuyu and phalaris. Cereal crops (including wheat, barley, triticale, maize and sorghum) are also vulnerable to ABB attack.

In addition to crop and pasture species, climate can influence ABB activity. ABB outbreaks are associated with warm springs. Larvae (the immature form) growth during spring is optimal at soil temperatures between 20–25°C, while temperatures below 15°C are detrimental to development (King et al. 1981a). High soil moisture during early larval development is also considered unfavourable (King et al. 1981c). In New Zealand, ABB distribution is limited to areas with a mean annual surface temperature above 12.8°C (Watson 1979).

While there are limited chemical options available for controlling ABB, several agronomic practices can be implemented to renew damaged paddocks. As ABB is often mistaken for other scarabs in pastures and cereals, best practice management begins with correct species identification.

Identification and behaviour

ABB larvae have six legs, a brown head capsule, and a ‘C-shaped’ body. The larval body is grey in appearance when young but transitions to creamy-white when mature. They are ~5 mm when they hatch, growing to ~25 mm in length. The larvae damage pastures by pruning or completely severing grass roots close to the crown of the plant. In severe cases where infestation occurs, pastures become patchy and can be rolled back like a carpet.

Figure 2 African black beetle larvae

Figure 3 Blackheaded pasture cockchafer larvae (Image: Andrew Weeks, cesar)

The adult beetle form of ABB is 12-14 mm long, has a brown to black body with indented longitudinal striations on the wing covers, and flares and spurs on its legs. Adult beetles have strong nocturnal flight activity, and disperse during their 'roaming' stage primarily in autumn, leading to paddocks becoming infested. The adults feed on the stems of a variety of young plants either underground or above the soil surface, often killing growing points so that the central shoots wither and the plant dies.

ABB can be easily mistaken for other scarab pests, including the redheaded pasture cockchafer (Adoryphous coulonii), the blackheaded pasture cockchafer (Acrossidius tasmaniae), and yellowheaded cockchafers (Sericesthis spp.). These common cockchafer pests share features with ABB that are only discernible to a trained eye or when comparing species side-by-side. Nevertheless, ABB can be distinguished from these cockchafers by considering behaviour and biology in addition to physical attributes.

The following parameters should be considered and used in a process of elimination:

Species life stage

A key difference between ABB and other common scarabs is that ABB attack plants as both larvae and as adults. Only the larvae of blackheaded pasture cockchafer, redheaded pasture cockchafer, and yellowheaded cockchafers are regarded as pests. Therefore, if adult beetles are found with accompanying stem damage below or just above the soil surface, ABB is a likely a suspect.

Pest biology

Understanding the biology and lifecycle of common scarabs can assist with distinguishing ABB at different times of the year:

ABB

ABB have a one year life cycle. Adults lay their eggs in the soil in spring, and larvae emerge in 2-5 weeks depending on temperature, and reach the most damaging third instar larval stage from mid-January to March[1]. Larvae then pupate in the soil and emerge as adults, which go on to feed on pastures and crops throughout autumn, winter and spring.

Figure 4 African black beetle pasture damage (Image: cesar)

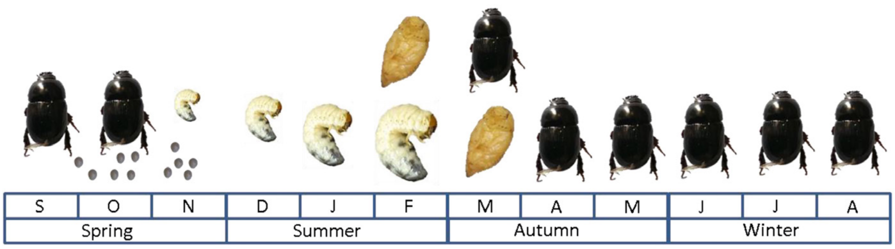

Figure 5 Lifecycle of African black beetle (Image: Karpyn et al. 2017)

Blackheaded pasture cockchafer

Blackheaded pasture cockchafers also have a one year lifecycle, but unlike ABB, adults lay their eggs between January and February. Blackheaded pasture cockchafer larvae emerge in 3-4 weeks and reach the most damaging third instar larval stage in late autumn and winter. The larvae pupate in spring and adults emerge in mid-late summer.

Redheaded pasture cockchafer

Redheaded pasture cockchafer has a two-year lifecycle. In year one, redheaded cockchafer adults emerge from pupae from late summer to mid-autumn, but they do not surface from the soil until August to October when they take flight and lay eggs. The eggs hatch in late spring and the larvae reach the most damaging third instar stage by early autumn in the second year. Most damage is caused from March to June until winter temperatures hinder larval activity. Further feeding damage can occur from late August to December until pupation occurs.

Yellowheaded cockchafers

There are multiple yellowheaded cockchafer species and while their lifecycles are largely unknown, they are thought to reach the most damaging third instar larval stage during winter.

Hosts

ABB larvae have a strong preference for forage pasture species such as ryegrass, tall fescue, kikuyu, and paspalum. Legume species are considered unfavourable, although they may feed on white clover in absence of their preferred host species (King et al. 1981b). In contrast, the larvae of redheaded pasture cockchafer are common in pastures with a high subterranean clover content. The larvae of blackheaded pasture cockchafer will also feed on legumes.

Larval feeding behaviour

Larvae of ABB and other scarabs are generally subterranean feeders, consuming and pruning plant roots. The blackheaded pasture cockchafer larvae, however, is the exception to this rule. After rainfall and heavy dews, blackheaded pasture cockchafer larvae move onto the surface to feed on foliage, resulting in small mounds of dirt surrounding tunnels on the soil surface.

[1] These observations were made in New Zealand and may vary with local climate

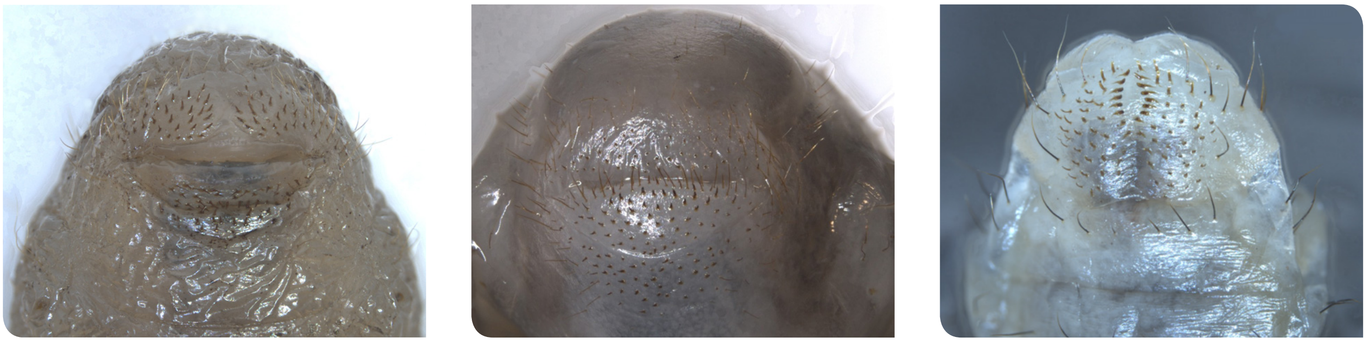

Figure 6 ABB, redheaded pasture cockchafer and blackheaded pasture cockchafer anal openings, respectively (Images: Agriculture Victoria)

Figure 7 ABB, redheaded pasture cockchafer and blackheaded pasture cockchafer head capsules, respectively (Images: Agriculture Victoria)

Anal opening

Scarab larvae have an anal opening at their rear end which is visible with a hand lens. This opening is a horizontal split in ABB and redheaded cockchafers. In the yellowheaded cockchafer and blackheaded pasture cockchafer larvae, a Y-shaped anal opening is evident.

Head capsule

The head capsule of ABB larvae is mostly described as brown, whereas redheaded pasture cockchafers, yellowheaded cockchafers and blackheaded pasture cockchafers have head capsules that correspond to their common names. Note that head capsule colour alone should not be used to distinguish ABB from other scarabs due to subjectivity in colour perception from person to person, and variation in colour between individuals of the same species. In addition to differences in colour, redheaded pasture cockchafers have small pit marks on their head whereas ABB has a smooth head capsule.

Monitoring and control

There are monitoring guidelines that can be used to assess ABB pest pressure[2]. To estimate the risk of damaging larval populations over summer, take 10 random square-shaped soil samples per paddock in September (Watson et al. 1980). Each sample should be the width of a 20-cm spade and ~10 cm deep. Approximate pest pressure/m^2 can be determined by summing the number of ABB adults found in 10 samples and multiplying it by 2.5. If the average number of beetles is above 10/m^2, the paddock could be at risk from larval damage over summer (Watson & Wrenn 1979). The same method can be used in early February, in which case larvae and adult numbers exceeding 15-20/m^2 is considered a damaging level (Dairy NZ, 2012).

With few effective ABB control options available, the focus needs to be on reducing the risk of damaging levels being reached by adopting the following combination of strategies when renewing paddocks damaged by ABB:

Endophyte deterrents

Sow ryegrass varieties with endophytes that deter ABB. An endophyte is a fungus that lives harmoniously in a host plant, producing alkaloids which deter insects.

ABB adults

Egg laying by adults is reduced in pastures dominated by grasses infected with endophytes and hence larval damage may also be reduced. NEA2, AR37 and Endo5 are commercially available ryegrass endophytes which provide resistance to damage from ABB adults. Standard endophyte (SE) also provides good ABB control, however its use is not recommended as SE can cause severe ryegrass staggers and other animal health problems. AR1 endophyte will only provide a low level of protection against ABB and is unlikely to provide adequate control in situations with medium or high levels of ABB pressure. Other endophytes which provide good control of ABB include MaxP in tall fescue and U2 in festulolium.

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[2] These observations were made in New Zealand and may vary with local climate

ABB larvae

Commercially available endophyte strains do not appear to provide control of ABB larvae (Bell et al., 2011).

Always seek professional advice when using endophyte infected pasture varieties to ensure the correct choice is made for your farm and prevent the development of ryegrass staggers in livestock.

Insecticides

Consider the use of insecticide treated seed when renewing pastures. Poncho® Plus seed treatment is the only chemical option registered for ABB control in grass and broadleaf pastures. Control should be expected for 3-4 weeks after sowing, although seed treatments will not control heavy populations. Chlorpyrifos is registered for ABB in maize in NSW. Off-label application of organophosphates and synthetic pyrethroids are not recommended for control of ABB in pastures. Field trials show that while foliar applications of alpha-cypermethrin (pyrethroid) and chlorpyrifos (organophosphate) may kill adult beetles, they do not necessarily reduce ensuing larval populations (Eden et al. 2011).

Crop rotation

Rotate ABB-affected paddocks with an unfavourable crop or pasture. Planting a legume, chicory or brassica species in spring is likely to disrupt ABB at the larval stage of development (Bell et al. 2011). Adult ABB is migratory and can reinvade crops and pastures sown in autumn after a break crop, however the risk can be managed using endophyte varieties and seed treatments. Delaying sowing until May (if practical) will reduce the level of feeding damage by ABB adults, which decrease their feeding activity during the colder months.

Remove feed source

Before establishing a new pasture, remove alternative food sources from in and around the paddock. This includes winter grass (Poa annua), paspalum, annual ryegrass, phalaris, and kikuyu. Varieties of perennial ryegrass, tall fescue, and Italian ryegrass that do not contain the appropriate endophyte deterrents should also be removed. The level of control from sowing endophyte grass varieties and break crops will be hampered if ABB has an alternative food source in the pasture or in neighbouring areas.

Manage soil pH

Keeping soil pH high at around 6 helps reduce numbers of black beetle larvae (mechanism is currently unknown) but will not prevent damaging populations from occurring.

References and useful resources

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