Sheep blowfly biology

The Australian sheep blowfly, *Lucilia cuprina*, is responsible for initiating over 90% of sheep flystrikes in Australia. It preferentially, but not exclusively, breeds on sheep. Several other blowfly species are sometimes involved in flystrike but each of these breeds mainly in carrion.
The L. cuprina life-cycle (figure 1) is intimately linked with sheep. Variation in strike incidence relates mainly to the occurrence of susceptible sheep, not the density of sheep blowflies in the area. Trap catches of as few as 1-2 flies / hour, or estimated densities of 7-10 blowflies / hectare are enough to cause extensive strike if susceptible sheep are present.

Sheep blowflies cannot lay eggs until they have consumed a protein meal. They then mate and the female flies develop eggs. Depending on the size of the female, batches of up to 200 eggs can be laid per ovarian cycle. Sheep blowflies can live for over a month in the field. During this time three batches of eggs may be laid.

L. cuprina eggs are not laid indiscriminately. Female flies seek out susceptible sheep. Putrefactive odours and odours associated with fleece rot bacteria or dermatophilosis are particularly attractive. Initially females are attracted by smell. Later visual cues are used. When a susceptible sheep is found, the preferred oviposition site is located using taste receptors on the tarses (feet), mouthparts and finally the ovipositor (genitalia).

The eggs are susceptible to desiccation, but there is safety in numbers. Ovipositing females produce a contact pheromone to entice other females to lay at the same site. Susceptible sheep may have very large egg masses laid on them by dozens of flies. Eggs will hatch in about 12 hours. First instar larvae are only about 1 mm long, and because their mouthparts are so tiny, are not capable of damaging the skin. First instar larvae feed in damp fleece, fleece rot and dermatophilosis lesions, in and around wounds or in dags.

Under favourable conditions larvae moult about 18 hours after hatching, to become second instar larvae, and resume feeding. The mouthparts are now capable of abrading sheep skin. After a second moult about 36 hours after hatching the third instar larvae are very active and feed voraciously. Third instar larvae do most damage to the sheep. Third instar larvae grow from about 9 to 45 mg each over a 24 hour interval. Larvae can be fully fed 3-4 days after hatching.

At full size the maggots are 12 mm long, creamy white and very active. They drop from the sheep, usually in camps at night, burrow into the top few centimetres of soil and empty their crops (stomach). Depending on soil temperature, development may halt at this stage (soil temperature less than 15°C) or pupation may occur.

During pupation the anterior and posterior three segments are retracted and chemical changes in the cuticle transform it to a rigid barrel-shaped puparium (cocoon). Inside the puparium metamorphosis occurs. Under ideal conditions an adult fly will eclose (emerge) from the puparium 12 days after the egg from which it was derived was laid.

When the soil temperature is low, larvae burrowing into the soil do not develop past the prepupal (retracted larva) stage. During winter waterlogging, cold, trampling by stock, predation by ants and parasitism by minute wasps reduces the number of larvae that survive. However, as the soil warms in spring, larval development resumes. Development is slow at first but as the soil temperature rises the overwintering population emerges en masse in mid to late spring.
If the overwintering population of flies encounter susceptible sheep, the next generation of flies is much more numerous. If conditions remain suitable for flystrike, these flies produce a third generation flywave.

It is often said that flywaves move across the country. In reality, overwintering populations emerge at different times in different places depending on climatic differences. Flies emerge in warm areas first, and as other areas warm up, flies emerge there too. So it appears as if the flies are moving across the country. In some areas, such as western Queensland, fly breeding continues year around, although peaks still occur in spring and autumn. Mid-summer is generally not favourable for flystrike as hot, dry conditions desiccate the eggs before the strike takes hold.

Although flywaves apparently move, blowflies themselves do not travel far. Flies

generally stay in one area, so to a large extent farms breed their own flies. Sheep blowflies do not move away from access to water and sheep. If fly traps are being used to monitor for the presence of blowflies, they should be placed near the sheep and moved when the sheep are moved.

Sheep susceptibility is determined primarily by fleece moisture. Moist wool may develop fleece rot, a bacterial infection caused principally by the bacterium Pseudomonas aeruginosa. Fleece rot can occur in sheep that have been wet to the skin once. However, a second or prolonged wetting can lead to an enormous proliferation of the infection and severe skin inflammation. This, in turn, causes serum to weep from the skin into the fleece. Blowflies find this highly attractive. Like fleece rot, dermatophilosis is also a prime site for blowflies to lay. The hatching larvae feed in the lumpy wool before invading the skin tissues.

Similarly, larvae from eggs laid onto dags will feed in the dags before moving onto the skin to feed. Moisture is the key to susceptibility. Urine or faecal stained wool, wounds of any sort, tissue damage such as footrot, weeping eyes and sweat around the base of the horns of rams all make sheep susceptible to flystrike.

Unless flystrike is treated properly, blowflies will continue to be attracted to and lay eggs on or near struck wool. Blowflies other than L. cuprina may lay their eggs in struck wool, causing the strike to extend. The putrefactive odours produced by feeding maggots are extremely attractive to the green, hairy maggot blowfly Chrysomya rufifacies and the small green hairy maggot blowfly Chrysomya varipes. As the common names suggest, the maggots of these two species have spines covering their dorsal surface. These larvae feed voraciously and invade deeply into the tissues causing extensive damage, and in some cases death. Sheep have usually been struck for over six days by the time hairy maggots become obvious. For strikes to have gone unnoticed or untreated for this length of time is an indication that sheep are not being checked often enough.

L. cuprina is the only fly to have developed resistance to the organochlorine and organophosphate insecticides. This is because its main breeding ground, live sheep, have been treated with these insecticides in an attempt to control flystrike and lice.

Other blowflies

Other blowfly species are lesser pests. The brown blowflies Calliphora stygia and

Calliphora augur/Calliphora dubia sometimes strike sheep in the eastern States. Calliphora albifrontalis and Calliphora dubia sometimes strike sheep in Western Australia. These flies are more attracted to wounds than to fleece rot. C. stygia and C. albifrontalis are present in largest numbers in spring and autumn but also occur throughout winter in smaller numbers.

These species mainly breed in carrion. L. cuprina also lay its eggs in carcasses, but the larvae are outcompeted by the Calliphora larvae and are actively repelled by Chrysomya larvae. Because of the competition from other species of flies, most Lucilia larvae die or leave a carcasse before having eaten enough to survive. Chrysomya is the main controlling influence for L. cuprina in carcasses, except in Tasmania where it is too cold for the other species. To overcome this disadvantage, Lucilia has adapted to breeding on live sheep. Unless an animal has died from flystrike, most carcases form few, if any, L. cuprina. Burying carcases does not kill the maggots but does prevent Chrysomya species access. Consequently, buried carcasses may produce L. cuprina flies that would otherwise have been displaced by hairy maggots.