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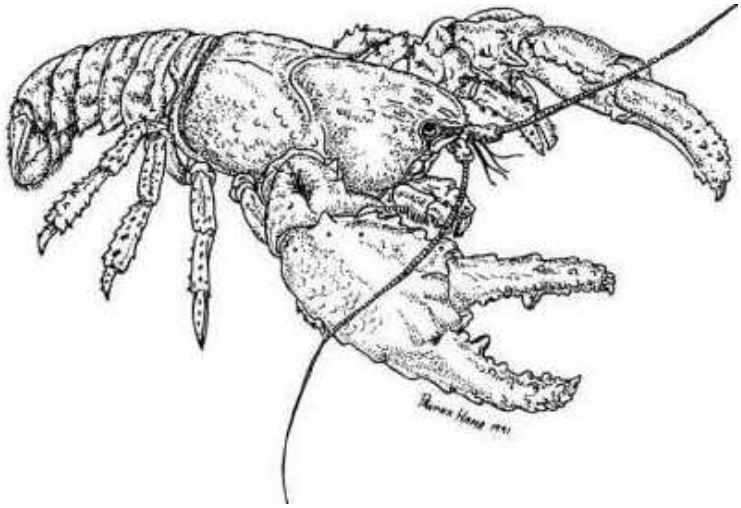

Footprints in the Pollen (Part 2)

by **Phil Watson**

Eastern spinebill at Waratah

Following Part 1 of this article dealing with the fascinating roles that bees play in the plant's mating game, Part 2 will expose the equally enthralling interrelationships played out with other groups of insects as well as with birds and mammals.

Pollination by birds

Recent studies have revealed the partnership that exists between over 100 species of birds frequenting around 1000 native plants. The large, robust flowers are often characterised by brilliant colours and voluminous flows of sugary nectar.

Although there is no direct bird to plant (1:1) relationship in Australia, (common amongst hummingbirds of America or sunbirds and sugarbirds of South Africa), our brush-tongued honeyeaters and parrots are strongly attracted to scentless, brilliant red or orange flowers. With insects blind to red colours this gives birds a distinct advantage. Many birds thrive on the brush

type flowers of gums, banksias, hakeas and bottlebrushes, whilst others feed on the tubular flowers of *Grevillea* spp., *Richea* spp., *Epacris* spp. and *Correa* spp. The colourful floral features of bird–pollinated flowers make them vibrant additions in any garden. They attract a diversity of nectar feeders such as Eastern Spinebills, Wattlebirds, Noisy Miners, Swift Parrot, Eastern Rosellas and Crescent and New Holland Honeyeaters.

[A cautionary note: Too many nectar producing plants attract aggressive honeyeaters such as wattlebirds and New Holland Honeyeaters. These birds will defend a rich nectar source and chase away small birds such as fairy-wrens and thornbills. Noisy Miners are strongly associated with dieback in eucalypts. Ed]

Kangaroo Paws are architecturally designed to have only one receptive flower each day which are staged along its flowering stem. The new flower pivots boldly into position while the spent flowers hinge away after pollination. The curvature of the flower leading to their nectar target matches closely the shape of the bird's head and beak. Consequently the pollen is dusted on the bird's head, before being inadvertently carried from flower to flower.

Junk food for Mammals

Current estimates indicate over 25 species of mammals actively visit native flowers. These furry fellows include 7 species of possums, arboreal mammals such as Sugar gliders as well as bats and rodents. All are recognised as pollinators of Myrtaceae and Proteaceae in dry woodland communities. For example the Grey-headed flying Fox, like other flying foxes, flies up to 40 kilometres across cleared and urban landscapes to forage in flowering gums such as the Spotted Gum *Corymbia maculata*. These animals can comfortably survive without nectar, but the flowers provide a type of junk food option in exchange for their services of transferring pollen.

Flies, gnats, midges and mosquitos

As quiet achievers in the pollination game flies frequent flowers ranging from complex orchid blooms to simple radial flowers. Remarkable in the extreme are the specialised **long-proboscis** South African flies whose needle-like mouth part is up to 70mm or 4 times their body length. Without the ability to retract its prodigious appendage, it must fly with it extended forward or tucked loosely below its body. They have co-evolved with purple, red or bluish flowers of *Pelargonium* spp. which exhibit intensely coloured nectar guides and long–floral tubes containing deep nectar pools. While this intricate symbiotic relationship excludes nectar raiders, the impacts of climate change or habitat loss could easily result in extinction. Other typical examples are iris-like plants including *Babiana, Sparaxis*, and *Ixia* spp. Some of these species are flower garden favourites in south eastern Australia, but with no specialised flies here they lack the ability to be open-pollinated.

Commonly known for their biting and uncouth behaviour are the **short–tongued** flies such as blow flies, carrion flies and march flies. These species have lapping mouth parts and are attracted to decaying putrid scents and livid-coloured flowers such as the Milkweeds *Asclepiaceae*. An excellent example in Western Australia is the brown and yellow Stinking Roger flower *Hakea denticulata* which smells of rotting wallaby. Pollination is carried out when blowflies, attracted by the smell, seek egg laying sites.

Using a similar style of smelly attractant, the Helmet Orchid *Corybus recurvus* entices flies and gnats to their dull, ground hugging fungus–like flowers. Once pollinated the fungus-scented flower shrivels and then rises on an elongated stalk blocking further pollination.

The cryptic orchid-like, ground-dwelling Fairy lanterns *Thismia* sp., which also emit a fleshy odour, are considered to be pollinated by gnats, midges, as well

as beetles and other invertebrates.

Greenhoods, *Pterostylis* spp., emit alluring pheromones of the female **fungus gnats** or, less commonly, of a mosquito species. This is intended to entice the male onto the cocked elastic labellum. Once triggered the labellum flips inwards encapsulating the insect inside the flower. In its frantic attempts to escape, the gnat initially brushes its pollen load onto the stigma before being directed by columnar wings to be pollen dusted and finally set free. As a testament to their very short memories and the power of the pollination process, they soon forget the experience and suffer a repeat episode. Those people who have been attacked near wetlands by swarms of blood thirsty female midges, flies and mosquitos, can be consoled in the knowledge their blood is fuelling these pollinators to skim around the flowers on the water's surface.

Wasps, sawflies and ants

One can only be amazed by recent reports indicating that over 500 species of male thynnid wasps have evolved close relationships, some 1:1, with indigenous terrestrial orchids eg Duck orchids *Caleana* sp. Hammer orchids *Arthrochilus* sp. Spider Orchids *Caladenia* sp. and Mosquito Orchids *Acianthus* sp.. In contrast, ants are poor pollinators, due to their lack of body hair and tendency to damage the pollen during its transport.

In recognition of the importance of thynnids to pollination, some species of Hammer or Elbow Orchids have been renamed *Thynninorchis* sp. to highlight their symbiotic relationship. Two species of *Thynninorchis*, namely *T. huntianus* and *T. nothofagicola*, are able to mimic the shape and scent of the flightless female wasp after she emerges from her underground cell and climbs up on a grass stalk or low shrub. Here, posing with erect antennae, she releases a pheromone unique to her species. Mistaking the orchid for a female, with which he expects to fly off and mate on the wing, the male wasp seizes the elasticised labellum only to be thrown into the pollen presenter. Records indicate that many of these thynnid wasp pollinated orchids are at their peak of flowering just before the females emerge. After mating the male relocates the female to her original site where she parasitises corby or curl grubs, using her long proboscis to inject her eggs.

A similar scenario occurs between the male *Scoliid* Wasp and the Bearded Orchid *Calochilus herbaceous*. The strikingly big hairy labellum with its pair of eye-like glands at its base combines with the pheromone scent to lure the male wasp.

Sawflies, a variety of wasp, are also active pollinators of plants such as the large Flying Duck Orchid *Caleana major*. Their upside down flowers, with broad columnar wings, presented on a wiry scape mimic the female wasp sufficiently to entice the male to attempt copulation.

Beetles

Although beetles may have pollinated some of the very earliest of flowers, their contribution is mostly limited to the diverse Myrtaceae and Asteraceae families. Some, such as gum beetles and cockchafers, are more prone to eat and damage the flower rather than pollinate them and their larvae also damage the plant's root system. Typically, Myrtaceae benefit mostly from beetles especially the jewel beetles whose footprints are common in the pollen of the gums, ti-trees, baeckeas, and paperbarks.

Importantly the gregarious behaviour of some brightly coloured hairy beetles

has been used to advantage by open flowered daisies including Billy Buttons *Craspedia glauca* and *C. alpina*, Dolly Bushes *Cassinia* spp. and Daisy Bushes *Ozothamnus* spp. where they feed on the pollen or gather to mate. During their frolicking the beetles become dusted with pollen. Beetle-pollinated plants have shallow, broadly concave or convex brightly coloured flowers held erect with short sturdy exposed organs. These make attractive landing platforms. Some flowers even have ornamental beetle–like markings to lure passing mates with the promise of company, and hence participate in the pollination process.

Butterflies and Moths

Since most of the 22,000 Australian moths are active after dark, plants adapted to moth pollination have white or pale colours, with little scent during the day. These help to camouflage them from day active insects. Some moth-pollinated plants remain fully closed during the day further minimising impacts from raiders. In the evenings majestic transformations occur, including alluring perfumes and luminescing colour patterns. By first light they begin reverting to their neutral day time forms. Typical native examples include *Boronia* spp, White Candles *Stackhousia* spp. and Hounds tongue, *Cynoglossum* sp., while the strongly scented cottage garden favourite *Cestrum nocturnum* exemplifies the moth pollination features found in some of the exotic weeds.

Both larva and adult moths or butterflies depend totally on living plants or their associated decaying organic matter. Consequently they have a major effect on plants by either aiding with pollination and organic matter breakdown for nutrient supply or by destructively feeding on the plant parts.

Bursaria spinosa is a butterfly favourite and attracts the Tasmanian butterflies Bright Copper (right) and Shouldered Brown to its prolific nectar- bearing flowers.

Bright Copper

Indigenous plants such as Rice flowers *Pimelea* spp., have adapted their form and structure by positioning their nectaries at the base of long thin corollas. Whilst the moth is probing deeply for nectar, the prominently exserted anthers and stigmas transfer the pollen to and from their hairy bellies. One of the earliest emerging spring butterflies, the Hobart Brown is strongly attracted to Rice flowers, *P. humilis* and *P. linifolia* whilst the Tasmanian species of Macleay's Swallowtail, whose larva feed on the foliage of Sassafras *Atherosperma moschatum*, seeks out *Pimelea* spp. on forest margins and road sides.

Alpine Pollinators

In the alpine zone the meandering low flying Leprea Brown butterfly is strongly reliant on the prostrate alpine heath *Pentachronda pumila*. The Mountain Blue is the most alpine-adapted butterfly in Australia and is an important pollinator of alpine daises such as Alpine buttons *Cotula alpina*, Mountain Daisy *Erigeron* sp. and Silver Snow Daisy *Celmisia saxifraga*. To protect itself from predation the undersides of its wings blend well with the grey lichens and dead twigs common in alpine areas.

The Dominula Skipper, White Grass Dart and the Yellow Banded Dart also feed and help pollinate the herbaceous daisies in montane woodlands. They have low whirring flight patterns ideal for seeking out the ground hugging Snow Everlasting *Helichrysum milliganii*, Paper Daisy *Leucochrysum albicans* and Everlasting Daisies *Craspedia alpina*. Whilst feeding they adopt a distinctive profile at rest with their forewings held erect over their bodies and hind-wings held horizontally.

Conclusion

The wondrous but cryptic world of pollination ecology is exciting and vibrant, but, like many ecological systems is subject to global climatic changes and rapid habitat degradation. No matter how insignificant or inconsequential a species may appear, it has a critical role in maintaining the checks and balances of a healthy ecological community.

Recommended Reading:

- S.L.Buchmann and G.P.Nabhan (1996) *The Forgotten Pollinators*; Island press, USA
- K.Faegri and Van der Pijl (1973) *The Principles of Pollination Ecology*; Collins London)
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- Simon Nevill (2001) *Guide to wildflowers of South Western Australia* Simon Nevill Publications

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