In search of the elusive western flat

Originally described in 1888, the western flat butterfly is found only in Western Australia. For more than 100 years, the life history of this rare butterfly remained unknown. Andrew Williams and Matthew Williams describe how the door to this mystery was finally unlocked.

by Andrew A. E. Williams
and Matthew R. Williams

Illustrations by Andrew Atkins

When European settlers first arrived in Australia, they found a continent very different from their previous homeland. The vastness of the land and its flora and fauna were unlike anything they'd seen before. No doubt, they would have been intrigued by the array of new mammals, birds and plants. Not only were the animals and plants new and varied, so too were the butterflies they encountered.

Butterflies have always attracted attention. Many of the species found in Australia were spectacular, and it wasn't long before naturalists had named a host of different kinds. As time went by, life cycle details, such as what plants the caterpillars fed upon, were progressively documented. However, for more than 100 years, the life history of the rare western flat butterfly remained unknown.

The western flat (*Exometoeca nycteris*) is a small skipper butterfly known only from a few localities in the south-western corner of Western Australia. It usually occurs in or immediately adjacent to forest habitats from as far north as the Chittering Valley to Albany in the south. It belongs to the subfamily Pyrginae, a group of butterflies collectively known as 'flats' because of their moth-like habit of resting with wings spread out flat rather than closed.

FLAT OUT SEARCHING

More than 1000 species in the Pyrginae subfamily occur throughout the world, but only eight species are known from the Australian region. The western flat is the only species to occur in the temperate south-west. Most butterflies have extremely restricted diets in their caterpillar stage, and will only feed on particular plant species. The food plant of the western flat was previously unknown, and discovering its identity was the key to finding the early stages.

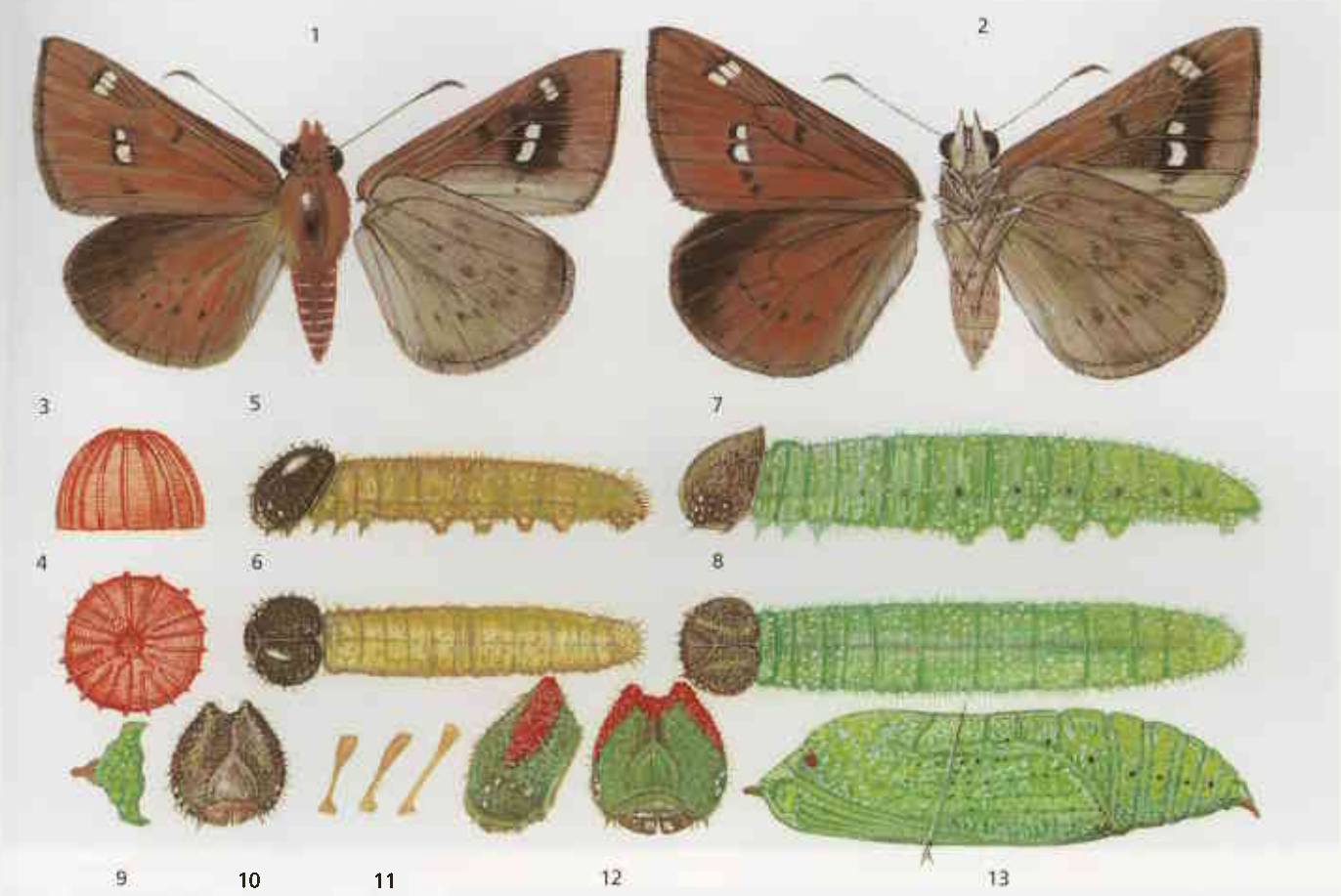
The butterflies are on the wing only between October and December. Like many butterflies, they have a one-year life cycle, with the egg, caterpillar and pupal stages taking around 11 months to complete; only the one remaining month of their life is spent as a butterfly. Butterflies spend most of their time seeking out mates and feeding at nectar-producing flowers; females have the additional task of finding suitable plants on which to lay their eggs. Like most butterflies, the eggs, caterpillars and pupae are well camouflaged and trying to find them, without knowing which species of plant to look on, is a near-impossible task.

Many people had previously speculated on the likely food plant of the western flat. Because some related African and Indian species of flats, and the Australian pied flat, fed on species of yams (*Dioscorea* spp.), the native yam was thought to be a probable candidate—especially as it occurred in the same habitats as the flat. Many years ago, the native *Hibbertia* had also been suggested, although no-one seemed to know why!

In early December 1999, we began searching areas around Albany where the butterfly was known to occur in reasonable numbers. A large population at Bakers Junction Nature Reserve gave us a wonderful opportunity to closely study their ecology and behaviour.

Above left: A perched western flat butterfly, showing the underside pattern of the wings.
Photo – Andrew Atkins

Left: Department of Conservation and Land Management researcher Andrew Williams searching for the elusive western flat butterfly.
Photo – Eleanor Williams



Western flats were active during sunny spells between nine in the morning and three in the afternoon. Both males and females congregated in small open areas of winter-wet heathland, surrounded by jarrah and sheoak woodland. Males established territories in these open areas, often perching on prominent dead sticks or taller sedges. At other times, they were seen spiralling together high above the ground. Both sexes were seen visiting the flowers of small herbs and shrubs, particularly *Pimelea* sp. and pineapple bush (*Dasypogon bromeliifolius*).

We then saw a western flat fly directly and swiftly from a flower, across an open area of heathland, to a shaded damp area of the surrounding woodland. Here, it laid a single tiny pale yellow egg on the extreme tip of a small purple-flowered shrub. Close inspection (and subsequent identification by botanists) revealed that the plant in question was *Tetratheca hispidissima*.

ILLUSTRATIONS
Figure 1. Western flat–Male upper and underside.
Figure 2. Western flat–Female upper and underside.
Figure 3. Lateral view of egg.
Figure 4. Dorsal view of egg.
Figure 5. Lateral view of 1st stage larva.
Figure 6. Dorsal view of 1st stage larva.
Figure 7. Lateral view of 3rd stage larva.
Figure 8. Dorsal view of 3rd stage larva.
Figure 9. Pupal cap.
Figure 10. Frons of 4th instar larva.
Figure 11. Larval setae.
Figure 12. Lateral view and frons of final instar larva.
Figure 13. Lateral view of pupa.

Right: A large population of western flat butterflies was found at Bakers Junction Nature Reserve, giving researchers the chance to discover their larval food plant.
Photo – Andy Williams

The mystery surrounding the butterfly's larval food plant had at last been solved—and this unlocked the door to discovering the details of its life history.

Tetratheca is a genus of plants in the family Tremandraceae, which is restricted to temperate southern Australia. Previously, no species from the family had been recorded as a food plant for an Australian butterfly.

Following the food plant's discovery, further eggs were located, and these were transferred to potted *Tetratheca* plants, located at Wanneroo, for observation.

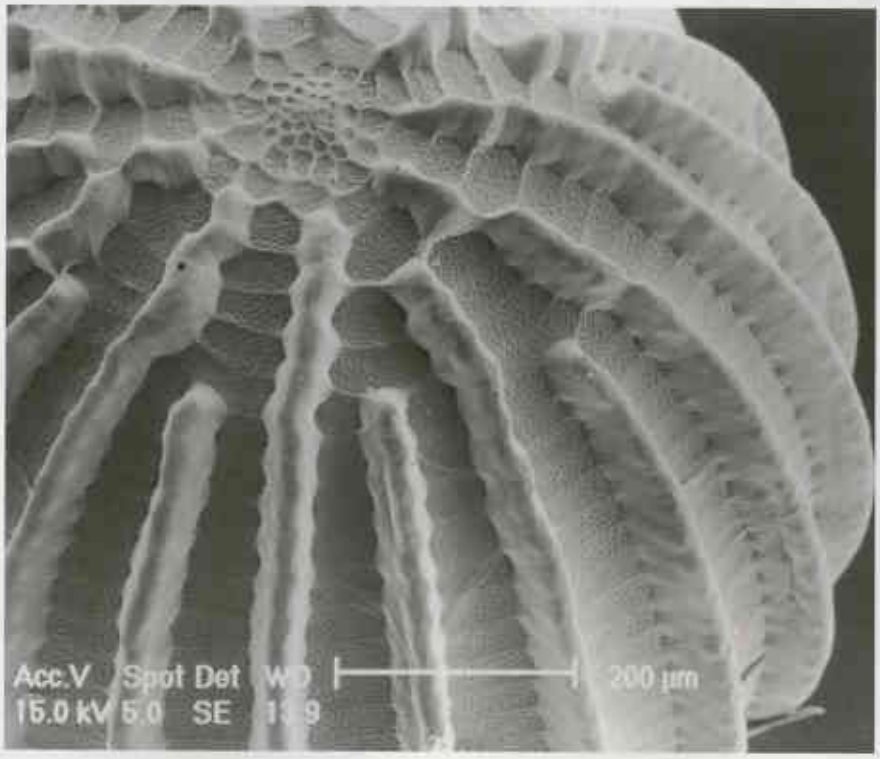
INSTARS

All butterflies start life as eggs, which hatch into tiny caterpillars. Most caterpillars feed on leaves or flowers. As

Top: The western flat has been seen visiting the flowers of *Pimelea*.
Photo – Marie Lochman

Centre left: A pupa removed from its shelter.
Photo – Matt Williams

Left: Western flats were recently found breeding on the black-eyed susan (*Tetratheca hirsuta*) at Lesmurdie.
Photo – Jiri Lochman



Above: Scanning Electron Micrograph (SEM) of an egg of the western flat butterfly.
Photo – Gary Weber

they increase in size, they go through a series of moults, shedding their old skins for new larger ones. The intervals between moults are called instars. When fully grown, the caterpillars stop feeding, shed their final skins and become pupae. In this immobile pupal state, the internal organs of the chrysalis break down and the adult butterfly's structures begin to form.

Our eggs from Bakers Junction Nature Reserve hatched into tiny caterpillars after 12 days. They immediately fed on the young shoots of the potted *Tetratheca* food plant, where they were difficult to see. Before long, they constructed dome-shaped shelters on the underside of leaves, pulling the edges of the leaf closer together with strands of silk. The caterpillars habitually lived within these shelters, only venturing out for short periods to feed. They grew slowly over summer and autumn, periodically moulting their skins before reaching mature size in late October. They then pupated inside their shelters—the pupa (or chrysalis) supported by a strong silken girdle around its mid-section. The adult butterflies emerged three weeks later.

Under the microscope, the eggs of the western flat proved to be dome-shaped, with exquisitely sculptured vertical ribs (their sculptured surface can be clearly seen in the micrograph). The newly hatched caterpillars were two millimetres long, with greenish-yellow bodies and shiny black heads. After the first moult, the body became green with an indistinct mid-dorsal line. Mid-stage (third instar) larvae were six to eight millimetres long, with green bodies and a darker mid-dorsal line. By this time the dark head capsule had developed two pronounced dorsal horns. Mature (fifth instar) caterpillars were similar but larger (17–19 millimetres), though the head capsule was now green with variable reddish-brown markings. The pupa was bright green in colour and had an unusual projection on its head.

Soft-bodied caterpillars are generally vulnerable to predators such as spiders, wasps and birds, and different species use different techniques to avoid being eaten. Western flat caterpillars use two strategies to avoid detection; they build shelters and rely on camouflage for protection. Their shelters give them a place to hide, and offer protection from sun and rain. Their green body colour perfectly matches the foliage on which they feed, while the dark markings on their head capsules match discoloured patches on the leaves.

NEW LEADS

The western flat has an interesting life cycle. The adult butterfly may be visible for only two or three weeks, but in its juvenile state it actually lives for a year. The discovery of the *Tetratheca hispidissima* food plant at Bakers Junction has given researchers the opportunity to search for butterflies in other places where this plant occurs. Recently, butterflies were found breeding on a similar species, black-eyed susan (*Tetratheca hirsuta*), which grows near Lesmurdie east of Perth.

Dried *Tetratheca* material held in the Western Australian Herbarium collections has also been examined for signs of eggs and shelters. One hatched eggshell was found on a plant specimen collected near Beraking, south-east of Sawyers Valley, indicating the presence of western flats at this locality.

As more information on the western flat's distribution and habitat requirements becomes available, the Department of Conservation and Land Management will be better able to adequately manage this rare endemic Western Australian skipper.

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Andrew Atkins is an authority on Australian skipper butterflies and has been **involved in collaborative research with** the Department of Conservation and Land Management's Science **Division.**

Over the past few years both Andrew and Matthew have been documenting the distributions, life histories and conservation status of Western Australian butterflies.

Winner of the 1998 Alex Harris Medal for excellence in science and environment reporting.

LANDSCOPE

VOLUME EIGHTEEN, NUMBER 3, AUTUMN 2003

Once thought to be extinct, Gilbert's potoroo has overcome many obstacles. What is being done to improve its chances of survival? See page 28.

Cane toads are poisonous, prolific breeders and are getting closer to the WA border. Hop to page 10.

Discover some of the prehistoric megafauna that once roamed the State in 'Walking with WA giants' on page 23.

The tuart once typified the coastal strip north and south of Perth. Why should we cherish this majestic tree? See page 16.

Lichens decorate Lake Muir, near Manjimup, with varying colours and shapes. Turn to page 43 to learn more about these fascinating life forms.

FEATURES

REGULARS

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Colour Separation by Colourbox Digital.
Printed in Western Australia by Lamb Print.

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Visit NatureBase at www.naturebase.net
Published by the Department of Conservation and Land Management, Dick Perry Avenue, Kensington, Western Australia.

COVER

Royal hakea rises above the surrounding heath, straight and column-like. When sunlit from above or below, its unusual large variegated leaves appear to glow like lanterns, so the shrub is also known as the Chinese lantern bush. Among the birds that obtain nectar from its flowers (hidden at the base of the leaves) is the western spinebill.

Royal hakea grows almost exclusively in Fitzgerald River National Park, an area that was reserved on the recommendation of then Government Botanist Charles Gardner (see 'Botanic Guardian' on page 36).

Cover illustration by Philippa Nikulinsky

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA