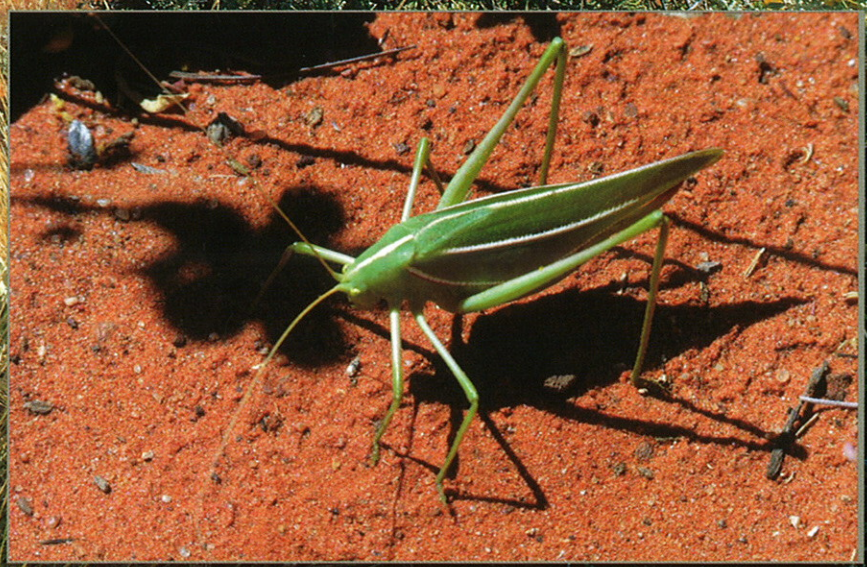
The hidden katydids of the Kennedy Range

Katydids, also known as bushcrickets, are abundant in the Kennedy Range National Park, and fascinate keen-eyed visitors thanks to their spectacular camouflage and outrageous designs.



by John Alcock and Winston Bailey

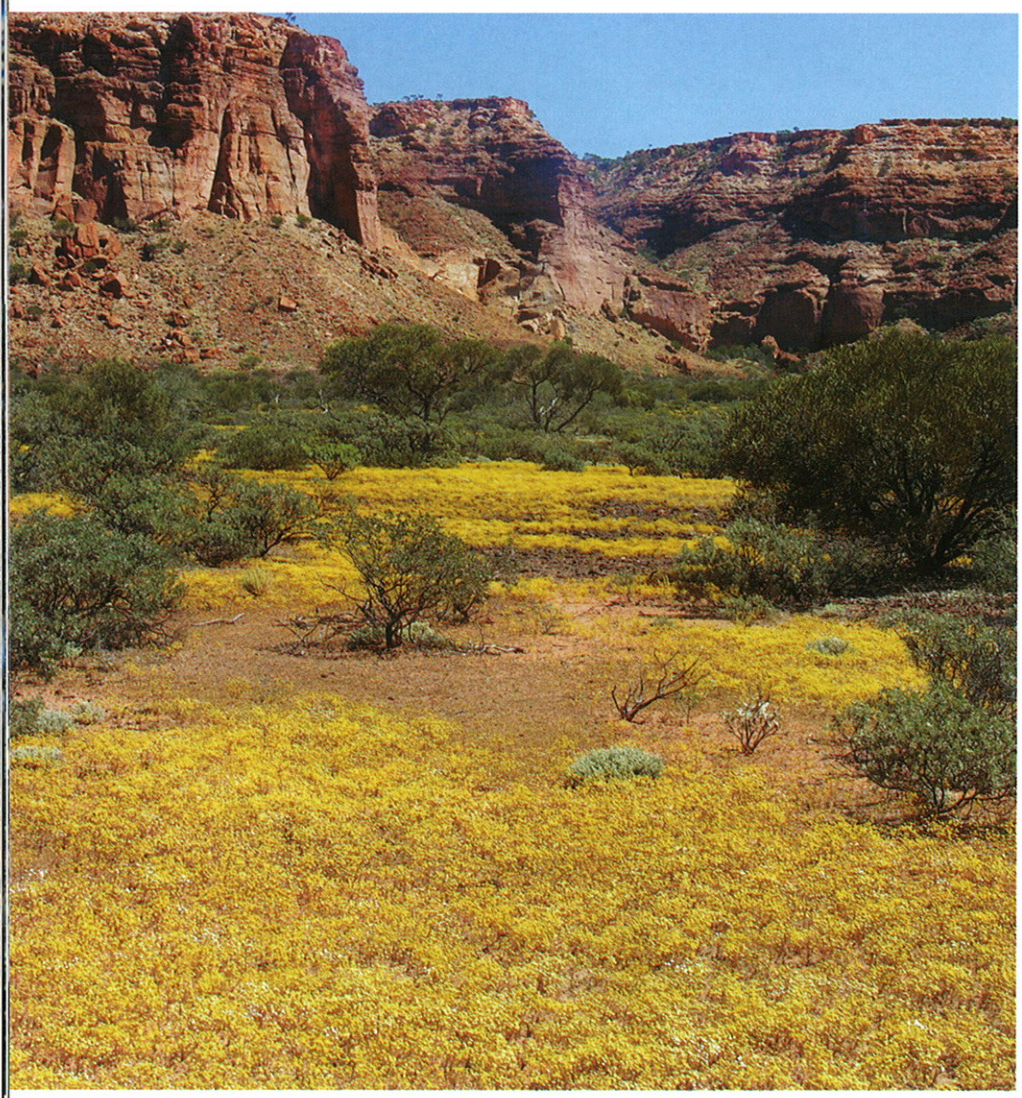
The barren sandstone cliffs that characterise the eastern edge of the Kennedy Range National Park looked down on an unusually cheerful desert scene we observed during a visit last year. Rain had drenched the area at some point earlier in the winter, interrupting the ongoing drought in the Gascoyne region. As a result, we were able to wander among large fields of yellow everlastings while also admiring the flowering flannelbushes, grevilleas, mulla mullas, and many other blooming shrubs scattered through the national park, 150 kilometres east of Carnarvon.

Although we derived aesthetic pleasure from the rain-stimulated burst of plant productivity in the park, other creatures derived more practical benefits from the plant growth that followed the winter rains. Among the beneficiaries were the feral goats that picked their way along ledges in the dramatic red sandstone cliffs. Although the Department of Environment and Conservation (DEC) had successfully removed more than 2,000 goats earlier in the year through its goat eradication program, some of the surviving goats were hungrily working their way through the now-leafy local plants. Happily, native Australian herbivores were also well fed, including the big reddish euros, which leapt from rock to rock on the escarpment.

Grasshopper and katydid metropolis

To the east of the high mesa that dominates the park, a multitude of grasshoppers burst up and away from us whenever we strolled across the *Acacia*-dominated flats. Some species were little more than a centimetre long while others were much bigger, a few even exceeding eight centimetres. Many of the grasshoppers of the Gascoyne and Pilbara live on or among the rocks and pebbles of this dry land and as a consequence they have evolved with a remarkable resemblance to their resting places. Perhaps the most spectacular of these grasshoppers are members of the tribe Catanopini, which include the living stone grasshoppers of the genus *Raniliella* and the toad-hoppers (*Buforania*). The living stone grasshoppers active in August in the Kennedy Range looked astonishingly like the dark chocolate pebbles on which they perched during the day. Other grasshoppers nearby had less remarkable but still serviceable camouflage suits that made them look like a loose collection of pebbles or a lump of reddish sand. Whatever their appearance, all species we encountered were busily engaged in converting plant matter into grasshopper tissues. Such was the skill and hunger of these plant consumers that the total grasshopper biomass surely exceeded that of the plant-eating marsupials of the range by a great margin.

As well as the wonderful array of Kennedy Range grasshoppers (see 'Glorious grasshoppers of the Kennedy Range', *LANDSCOPE*, Winter 2004), the bushland to the east of the mesa was home to a smaller number of katydids of



Previous page
Main Clay pans after rain in Kennedy Range National Park.
Photo – Jiri Lochman
Inset Katydid *Elephantodetta* sp.
Photo – John Alcock

Left Kennedy Range National Park in bloom.
Photo – John Alcock

Above A female katydid *Elephantodetta* sp on mulla mulla flowers.
Photo – John Alcock

the family Tettigoniidae. Katydids (also known as bushcrickets by Europeans and most Australians) and grasshoppers are fairly close relatives, as seen in their placement within the same insect order, the Orthoptera (*ortho* means straight and *ptera* means wings). The insects within this order share leathery flat-sided forewings that cover their pleated hindwings when the animals are at rest. Males of most katydids, grasshoppers and other orthopteran species, such as true crickets, use their wings to attract mates by producing sounds, sometimes by rubbing their legs across their wings, like many grasshoppers, or by rubbing their wings together, as do all crickets and katydids. Another distinguishing feature of the group is that immature orthopterans look like miniature versions of the adults (except that their wings are incomplete) whereas in many other insects, like beetles, flies and wasps, the young stages are grubs that look nothing like the creatures that appear after the metamorphose into adults. Finally, many orthopterans have large hindlegs that their owners use to fling themselves up into the air and away from their enemies, when threatened by a predator.

Katydids and grasshoppers —defining the difference

Katydids and grasshoppers share the standard features that distinguish the Orthoptera from other insect orders but the two groups also differ in various ways. For example, grasshoppers are generally active during the day unlike katydids, which come out at night to feed and mate. Because they are more exposed to bird predators, grasshoppers usually have larger and more powerful hindlegs than katydids, the better to jump to safety. Likewise, the diurnal grasshoppers depend on their relatively large eyes whereas the nocturnal katydids tend to rely more on their olfactory and tactile senses, as reflected in their very long and delicate antennae.

During our daytime walks in Kennedy Range National Park, thousands of grasshoppers used their good vision to spot us before employing their big hindlegs and effective wings (if they were adults) to leap or fly away. Katydids were much less numerous, although we suspect that our record of seeing roughly one katydid for every 1,000 grasshoppers stems in part from the reluctance of the well-camouflaged katydids to move from their daytime retreats in shrubs and trees upon our approach.

Masters of camouflage

Perhaps because katydids were harder to find, we took special pleasure from each one we discovered during our time in the national park. One of the first katydids that we stumbled upon in the Kennedy Range belonged to the genus *Elephantodetta*, an elegant creature some six centimetres long without its antennae, which were longer than its body. The bold white stripes that ran down the camouflaged green of its body may serve to disrupt the overall outline of the katydid's body, drawing a predator's attention instead to two leaf-shaped images on its wings, which partially cover the beautiful purple patches on the sides of the abdomen. The 'leaves' formed by the insect's forewings are not too dissimilar from the actual leaves of some desert wattles, which provide food and shelter for this handsome species. One imagines that a white-

Top Perfect grasshopper camouflage. *Photo – Winston Bailey*

Above left The splendid katydid (*Terpandrus splendidus*).

Above A stick-like katydid *Phasmodes* sp. *Photos – John Alcock*

browed babbler could come close to an Elephantodetta and be fooled into ignoring what would be a fine meal, provided that the insect had nerves of steel and could hold absolutely still in the face of danger. Indeed, the only reason that we found our *Elephantodetta* at all was that one of us brushed against a shrub containing the insect, coming so close that the katydid flushed in desperation from its hiding place. The flight of the katydid was much slower than that of the speedy grasshoppers.

Later in the walk, contact with an *Eremophila* shrub enabled us to frighten one of the many katydids in the genus *Caedicia*, most of which have yet to be formally described and named in scientific literature. But the one that we saw was broadly representative of the genus as a whole, with its uniformly leaf-green body, perhaps four centimetres in length. The leaf motif so prevalent among katydids expressed itself most delicately in our *Caedicia* whose forewings looked as if they had been actually constructed from two long, thin *Acacia* leaves. The large mid-vein of each false leaf ran the length of the animal's forewings and was surrounded by a fine network of pseudo-veins that furthered the professional leaf mimicry of this katydid.

For the most part, species such as *Elephantodetta* and *Caedicia* are herbivores, as is the remarkable stick-like member of the genus *Phasmodes*, another katydid that we found serendipitously because it had for some reason taken shelter on the tent occupied by one of our party. When we were packing up to head out from the campground in the national park, this remarkable creature made itself visible to us. We took it to a nearby *Acacia*, released it in the plant, after which the *Phasmodes* quickly oriented itself parallel to the leaves of its new host plant. In this position, the katydid all but disappeared from view, a goal that it promoted by holding its antennae straight out in front of its head, thereby reducing the conspicuousness of that part of its body. The long white stripes that ran the length of its body almost

Above The splendid katydid (*Terpandrus splendidus*).
Photo – Winston Bailey

Right An acridid grasshopper adopting cryptic posture.
Photo – John Alcock

certainly had much the same disruptive function as those of *Elephantodetta*, assuming that these conspicuous stripes draw a predator's attention away from the rest of the body of the katydid by creating the illusion of several thin vertical strips of green. As with many katydids in the region, this species is almost certainly new to science, with the closest described species (*Phasmodes nungeroo*—named after an Aboriginal word meaning whiskers) found far away at Kalbarri National Park.

Katydid courtship

At night, males of many katydid species attract searching females by stridulating noisily. In the subfamily *Phaneropterinae*, which includes *Caedicia* and *Elephantodetta*, the male calls and then the female replies with an acoustical signal of her own. The duration of the interval between male call and female reply varies among species, enabling the members of a particular species to communicate with one another. The duetting male knows he has a catch when he calls and then hears the stridulated reply of a female after a precisely timed interval. The male then calls some more, luring the female ever closer until they make contact in the darkness, often on a flowering *Acacia*, which can lead to copulation. After the female has received a packet of sperm from her partner, she is ready to fertilise her eggs and lay them by inserting her eggs into an *Acacia* leaf, known as a phyllode, after using a very clever device at the end of her abdomen to cut open the leaf edge.

Katydid cuisine

Although most katydids are plant consumers, often preferring nitrogen-rich flowers or ripe fruit, not all lead meat-free lives. On our Kennedy Range walks, we found one carnivorous katydid, which rejoices in the name *Terpandrus splendidus*, and what a truly splendid creature it is. This species eschews leafy meals and instead stalks and captures other insects, which it holds tightly with its large and spiny legs while it munches its way through its victims. At night, the loud staccato call of one male splendid katydid may attract other males, which form a loose chorus to compete against one another for the attention of females in their neighbourhood.

Like many other katydids, *Terpandrus* has a dorsal colour pattern that is largely green with some white stripes. You can notice that its disruptive white stripes are enhanced by the lines of black along its back and thorax. These lines surely draw a bird predator's eye to the small regions of high contrast, which presumably helps keep any would-be katydid consumer from

Above The underside of katydid *Terpandrus splendius*.

Top right A pair of toad grasshoppers (*Buforania*) mating with the smaller male on top.
Photos – John Alcock

Centre right One of the many species of duetting *Caedicia*.
Photo – Winston Bailey

Bottom right A living stone grasshopper (*Raniliella*).
Photo – John Alcock

seeing the head of the katydid or the outline of its body. Insect-eating birds that spot an edible insect's head have two advantages: first, they can readily identify a potential prey by its head, and second they then know how to direct an attack to best advantage (a blow to the head is more likely to disable the prey than a strike to the forewing or a leg). But *Terpandrus* does not rely on camouflage alone for its protection as one of us learned when he gingerly picked up the katydid. The unhappy insect promptly bit the finger of its captor and because this katydid's jaws are large (the better for disabling and consuming small insect prey), the bite drew blood. In addition, this species has strongly spiny forelegs, which it can use for slashing at its own enemies as well as for holding onto its prey. Other Australian species, like the crested katydid (*Alectoria superba*) are also spiny, which may protect them against birds during the day and bats at night when the katydids call for their mates.

Wild designs

By carefully holding the splendid katydid between thumb and forefinger we were in position to see the strikingly ornate green, orange and white colour pattern on the underside of its abdomen as well as the delicate patches of purple on the upper part of its forelegs. We were stymied when we tried to think of functions for these body colours but were delighted by this creature, just one of a diversity of katydids in the Kennedy Range, a diversity rich in questions for anyone interested in the natural history of Western Australia. We strongly recommend that bush walkers take advantage of those uncommon occasions when an inadvertently disturbed katydid flutters out of its hiding place. The colour pattern of the insect alone will be worth the price of admission to many Australian parks and reserves, home to so many species of these beautifully camouflaged insects.

John Alcock and Winston Bailey are both retired academics with an interest in insects. John is professor emeritus at Arizona State University in the United States who fell in love with the biology of Western Australia during a period of study leave in the 1980s.

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contents

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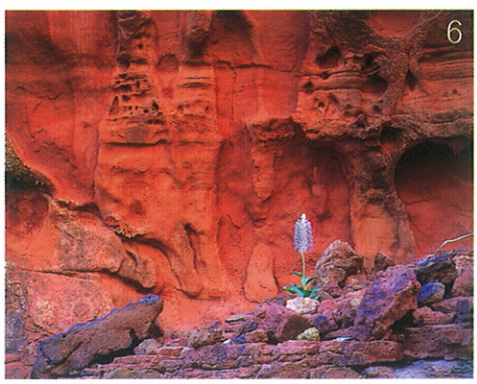
38


16


6


10