FEEDING BEHAVIOUR OF A PURPLE-CROWNED LORIKEET ON FLOWERS OF EUCALYPTUS BUPRESTIUM

INTRODUCTION

The Purple-crowned Lorikeet *Glossopsitta porphyrocephala*, a bird distributed throughout temperate and semi-arid areas of south-western and south-eastern Australia (Busby and Davies 1977), is well known for its nomadic wanderings associated with the flowering of species of *Eucalyptus* (Elliott 1916; Carter 1923; Sedgwick 1940, 1949; Serventy 1948; Ford and Stone 1957; McGill 1959; Bourke 1960; Forshaw 1969; Ford 1971; Cayley and Lendon 1973; Masters and Milhinch 1974; Dell 1977). The staple diet of Purple-crowned Lorikeets has long been assumed to be the nectar of *Eucalyptus* flowers (e.g. Gould 1865; Barrett 1949; Leach 1958; Cayley 1966; Hill 1967; Forshaw 1969; Holyoak 1973; Cayley and Lendon 1973). However, contents of stomachs examined by Cleland (1912, 1918, 1969) and by Churchill and Christensen (1970; Christensen 1971) have shown that these Lorikeets ingest the pollen of *Eucalyptus* species, as well as the nectar. Furthermore, Churchill and Christensen (1970; Christensen 1971) proposed that pollen is the principal item of diet for Purple-crowned Lorikeets when feeding on the small flowers of Karri *Eucalyptus diversicolor* and that nectar alone could not satisfy the daily energy requirements of an average-sized bird. This view, which regards nectar as, at best, a dietary supplement to pollen, is now gaining acceptance in standard texts of Australian ornithology (e.g. Serventy and Whittell 1976).

Though Churchill and Christensen (1970) presented sound evidence that Purple-crowned Lorikeets may use pollen as a major nutritional resource, the assertion that these birds could not satisfy their daily energy requirements from nectar alone when feeding on small-flowered eucalypts deserves critical scrutiny. Using data on average nectar flow and pollen production in Karri, Churchill and Christensen (1970) calculated that a fifty-gram Purple-crowned Lorikeet would have to harvest pollen from 300–500 flowers in a day to maintain basal energy metabolism and that 3,000 flowers would have to be visited to do the same using nectar as an energy source. In a twelve-hour day, this would entail harvesting pollen at the rate of one flower every 90–150 seconds, compared with harvesting nectar at the rate of one flower every fourteen seconds. Churchill and Christensen (1970) regarded the latter feeding rate as improbable and hence concluded that the lorikeets could not satisfy their basic daily energy requirements from Karri nectar alone in conditions of average flow. However, no data on feeding rates were given to support this view. Clearly, if Purple-crowned Lorikeets can harvest nectar at a greater rate than one flower each fourteen seconds, then the energetic argument against Karri nectar being an adequate nutritional source would be questionable.

In the present article, we describe observations made at close range on a Purple-crowned Lorikeet that was feeding on Apple Mallee *Eucalyptus buprestium*, a species with small flowers approximately the same size and shape as those of Karri (Chippendale 1973). We were able to estimate the feeding rate of this bird during these observations and also to see at close quarters the precise behaviour adopted to harvest pollen and nectar.

OBSERVATIONS

Observations were made nineteen kilometres east of Cranbrook, WA, on the northern boundary of Stirling Range National Park on 17 January 1978. There *E. buprestium* and *E. decipiens* were emergent mallees growing up to three metres high among numerous heath species. *E. buprestium* was flowering profusely on the day of observation and nectar was being harvested by large numbers of European honey-bees as well as several native hymenopterans. In addition, New Holland Honeyeaters *Phylidonyris novaehollandiae*, Western Spinebills *Acanthorhynchus superciliosus* and Brown Honeyeaters *Lichmera indistincta* were observed in the stand of *E. buprestium* but were not actually seen harvesting nectar.

The Purple-crowned Lorikeet was observed at distances of one to three metres for twenty minutes (a hide was not used), during which it visited several hundred flowers on two neighbouring *E. buprestium*. While feeding, the bird perched in dense clusters of flowers and foraged on all within reach before moving a few centimetres. The total horizontal distance moved during observation was three metres.

It appeared as though freshly opened flowers, with stamens in a tight vertical cluster round the floral cup, were selectively chosen by the bird. When feeding, the entire flower was positioned inside the beak and released one to three seconds later. Movements of the tongue, apparently in a circular sweeping motion round the floral cup, were observed on several occasions through the semi-open beak of the lorikeet. These movements would have compressed stamens between the tongue and beak and so have forced pollen out of the anthers on to the sticky surface of the tongue. At the same time, any nectar at the base of the floral cup would also have been gathered by the villous-like projections on the tip of the tongue.

Inspection of several flowers foraged in this way showed that little damage to the stamens had occurred.

DISCUSSION

Our observations suggest that Purple-crowned Lorikeets can harvest pollen and nectar from small-flowered *Eucalyptus* species at the rate of one flower every one to three seconds, some five to ten times faster than the rate of nectar harvesting estimated by Churchill and Christensen (1970) as being necessary to satisfy basal energetic requirements. If the feeding rate that we observed was maintained throughout the day, it would take a lorikeet only two and a half hours to harvest pollen and nectar from 3,000 flowers, leaving ample time for other behavioural activities such as preening, flying and social interactions. Our findings cast considerable doubt on the claim that nectar is at best a supplementary item of diet of these lorikeets and that pollen is the staple item. It now would seem that either pollen or nectar could be used as the principal food, because each alone can be harvested at a rate more than adequate to fulfill daily nutritional needs. Probably, as suggested by Cleland (1969), the two items serve different purposes in the nutrition of the lorikeets, pollen being a prime source of nitrogen and nectar a major source of carbohydrates. If this were so, then both would be important to ensure the balanced nutrition of the birds. Indeed, the foraging behaviour and tongue-morphology of Purple-crowned Lorikeets combine to produce an efficient means of harvesting *both* pollen and nectar from small-flowered eucalypts. In any event, it seems clear that an adequate understanding of the relative importance of pollen and nectar in the diet of Purple-crowned Lorikeets will only emerge when critical field and laboratory studies of basic metabolism, time and energy budgets and feeding preferences in varying conditions of nectar and pollen availability are at hand.

Churchill and Christensen (1970) did not report details of the feeding behaviour of the birds that they studied, presumably because of the difficulties of observation in a Karri forest, where flowers are borne in the canopy up to eighty metres above the ground (Hall *et al.* 1970). The ease with which we observed our Lorikeet at close range when feeding on *E. buprestium* indicates the value of conducting field studies in areas of mallee, where flowers are rarely borne higher than three metres above the ground (Chippendale 1973). If most birds are as fearless as the one we observed, it would be possible to investigate accurately the time- and energy-budgets at a site in mallee.

Cleland (1911, 1969) and Churchill and Christensen (1970) noted that few filaments and anthers occurred with ingested pollen of Cup Gum *Eucalyptus cosmophylla* and Karri in the alimentary canals of Purple-crowned Lorikeets, suggesting that pollen could be harvested without the consumption of entire stamens. We have been able to confirm this suggestion by checking flowers of *E. buprestium* immediately after the Lorikeet had fed on them. Most stamens were found intact and the flowers showed little damage. Presumably, for small-flowered species, pollen is gleaned from the anthers by compression associated with the circular sweeping movement of the tongue while the flower is held within the beak.

It is noteworthy that most species of *Eucalyptus* on which Purple-crowned Lorikeets have been recorded feeding (Elliott 1916; Forshaw 1969; Cleland 1969; Churchill and Christensen 1970; Dell 1975, 1976; Paton and Ford 1977) have small flowers with hypanthia (receptacles) less than five millimetres in diameter. These species include *E. accedens, E. baxteri, E. buprestium, E. cornuta, E. diversicolor, E. fasiculosa, E. leucoxylon, E. marginata, E. odorata, E. salmonophloia, E. sargentii* and *E. wandoo* (for floral dimensions and photographs see Hall *et al.* 1970; Chippendale 1973; Hall and Brooker 1973). However, a few species have larger flowers, including *E. cosmophylla, E. calophylla* and *E. globulus* (Hall *et al.* 1970; Hall and Brooker 1974). For these latter species a different foraging behaviour from that which we observed must be adopted to harvest pollen and nectar. Further field observations are needed to determine the nature of this behaviour.

The harvesting behaviour that we observed would probably lead to effective pollination of small-flowered eucalypts, because the stigma of a flower would be brushed frequently by the pollen-bearing tongue as it moved round the ring of stamens. Indeed, Purple-crowned Lorikeets may well be more efficient pollinators of small-flowered eucalypts than honeyeaters, because the latter, when probing for nectar, are not compelled to orientate their beaks in a direction that ensures that the stigma will be brushed by pollen-bearing surfaces (Paton and Ford 1977).

Surprisingly few scientific data have been published on the pollination of *Eucalyptus* (but see Paton and Ford 1977 and Hopper *et al.* 1978, for some recent work in this field). It seems clear that further studies of the foraging behaviour of Purple-crowned Lorikeets (and other related species) would make valuable contributions in this neglected area of research.

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