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OBSERVATIONS ON THE POLLINATION OF CALOCHILUS CAMPESTRIS R.Br.

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Summary

The interaction between a male scoliid wasp, *Campsomeris tasmaniensis* and a flower of the Copper Beard Orchid, *Calochilus campestris* R.Br. is reported and illustrated by photographs. The behaviour of the wasp was consistent with the pseudocopulation pollination mechanism.

Photos showing sequence of pseudocopulation pollination of *Calochilus campestris*

Introduction

The Beard Orchids, genus *Calochilus* R.Br., are among the more unusual and attractive of Australia's terrestrial orchids. Most of the ten species currently recognised (Clements, 1989) have prominent labellums covered in long, dense, lustrous reddish or bluish hairs. Inflorescences consist of racemes of a few, or up to 20 flowers on a single erect stern. Despite the relative abundance of some *Calochilus* species and their showy displays, there are only two previous reports of pollination by insects (Fordham, 1946; Jones and Gray, 1974). All species undergo self-pollination if insect mediated pollination does not occur (Jones and Gray, 1974), thereby ensuring high levels of seed set. The relative importance of insect and self-pollination is likely to vary between species and some may he entirely self-pollinating.

Male wasps in the scoliid genus *Campsomeris* are the only reported pollinators of both *Calochilus campestris* R.Br. (Rupp in Fordham, 1946) a*nd C. caeruleus* L. 0. Williams (recorded as *C. holtzei* F. Muell. in Jones and Gray, 1974). Jones and Gray (1974) concluded that *C. caeruleus* and *C. campestris* belonged to the pseudocopulation pollination syndrome. In this article we report observations on the pollination of C. campestris made by one of us (PB) at Albury, N.S.W. in October, 1988, along with key photographs from a series taken of the event.

Observations

Whilst photographing a flower on another plant on a warm sunny day a large yellow and black wasp was observed to land on the labellum of a nearby fresh *C. campestris* flower. Over the next two to three minutes a series of ten photographs were taken showing the various interactions of the wasp with the flower. Plates 5 to 10 are from this series. A conscious effort was made to record all the different positions of the wasp on the flower.

Pollination of *C. campestris*

The following account of the event is constructed mainly from the photographs aided by recollection. The first photograph (Plate 5) shows the wasp on the labellum with his abdomen curled below. The genital claspers at the tip of the abdomen are partially open and show the wasp is a male. The claspers are adjacent to the narrow strap-like labellum apex. There is no pollen on the wasp and an intact pollinium is clearly visible in the anther at the top of the column. The wasp's wings are moving rapidly. The wasp then quickly entered the flower, pushing its head below the angled column pollinia from the anther, smearing fragments onto the face of the wasp between the bases of the antennae. At this point the wings are still and the abdomen remains curled below the labellum. The wasp then backed out of the flower (Plate 7) with wings waving vigorously. Large fragments of pollinia are obvious on the face of the wasp and a small one is stuck to the upper edge of the near petal. The wasp then moved below the flower (Plate 8) and rested briefly. Plate 8 shows the absence of pollinia in the visible side of the anther in comparison with Plate 5. The wasp then remounted the labellum with wings waving rapidly (Plate 9), its abdomen again curled below in, the vicinity of the labellum apex. However, neither of the two photographs of the wasp re-entering the flower show its head below the column or in the vicinity of the stigma. Following the second entry, the wasp backed out and flew away after resting on the outside of the flower. The final photograph (Plate 10) shows copious pollen fragments smeared over the stigma with a dusting of particles at the base of the labellum and on the column. An additional photograph, not reproduced here, showed complete removal of the pollinia from the anthers.

The activity of the wasp on the flower was vigorous with waving of wings and abdominal probing. It is not known if there was pollen on the stigma prior to this wasp's visit, so these observations do not show conclusively that it pollinated the flower. However, there is no doubt that it removed the pollinia from the anthers. At least one pollinium was intact in the anthers before this wasp's visit, so it is probable there had been no previous visitors capable of causing pollination. It is therefore most likely that pollination resulted from the observed visit. If so, the photographs suggest it occurred on the first entry to the flower rather than the second where the wasp's head does not appear to have reached the stigma.

The wasp in the plates was not captured, but comparison with mounted specimens

indicates it is the common scoliid, *Campsomeris tasmaniensis*.

Discussion

The above account is remarkably consistent with observations made by Fordham (1946) in September, 1945. Over two mornings he observed nine visits by dark, yellow-banded wasps to flowers of *C. campestris* placed in a vase on his verandah. Two were captured, one with pollinia on its forehead and identified as males of *Campsomeris tasmaniensis* (see foreword by Rupp to Fordham's'(1946) paper).

Fordham (1946) observed the wasps to land on the labellum of the flowers and make ',stabbing movements, as if . . . stinging the hairless ribbon" at the labellum apex. They also stroked the hairs on the labellum with three appendages at the tip of the abdomen, which Fordham took to be stings, but were in fact part of the genitalia. The behaviour observed by Fordham (1946) is clearly attempted copulation, suggesting the hairy labellum is a mimic of the female wasp. In attempting unsuccessfully to couple with the labellum the male pushes its head forward below the overhanging column. Fordham observed both removal of pollinia from the anther and deposition of pollinia on a virgin stigma, thereby confirming *C. tasmaniensis* could effect pollination. Three wasps bearing pollinia visited Fordham's flowers, all with the pollinia on the forehead.

Pollination of *Calochilus caeruleus* in far northern Australia parallels that for *C. campestris* (Jones and Gray, 1974). The pollinator is the male of an undescribed species of *Campsomeris* with similar behaviour on *Calochilus caeruleus* flowers to that of *Campsomeris tasmaniensis* on *Calochilus campestris*. Male wasps usually approached *C. caeruleus* rapidly and directly, just above grass height and circled the flowers a few times before landing. They were also able to locate concealed flowers indicating attraction by odour rather than sight. Jones and Gray (1974) suggested *C. caeruleus* emits a sex attractant perfume, or pheromone, which is specific to the *Campsomeris* pollinator. No other insects were attracted and *Calochilus* flowers produce no nectar.

Jones and Gray (1974) noted that the actions of *Campsomeris sp*. on *Calochilus caeruleus* tended to break up the friable pollinia and push a large proportion straight onto the stigma. The observations given above suggest this also happens with *C. campestris*, though confirmation is needed. This suggests that *Campsomeris* pollinators merely accelerate the facultative self-pollination of *Calochilus* flowers. However, in all cases a significant amount of pollen is also removed on the wasps for cross-pollination of other plants (Fordham, 1946; Jones and Gray, 1974; Plate 7 above), thereby promoting some outbreeding.

The observations reported here support the conclusion of Jones and Gray (1974) that *C. campestris* is pollinated by the sexual deceit or pseudocopulation mechanism. Interestingly, van der Pijl and Dodson (1966) used Fordham's (1946) suggestion that *Campsomeris tasmaniensis* was attempting to sting the flower to support the creation

of a "pseudoparitism" pollination syndrome. This followed from the fact that female scoliids are parasitic on beetle grubs in the soil and paralyse each victim by stinging before laying an egg on it. However, both van der Pijl and Dodson (1966) and Jones and Gray (1974) overlooked the foreword to Fordham's (1946) paper in which H. M. R. Rupp noted the wasps had been identified as males by K. C. McKeown of the Australian Museum. This precludes the possibility of pseudoparasitism.

References

1. Clements, M. A. 1989. **Catalogue of Australian Orchidaceae. Australian Orchid Research** 1, p.1-160.
2. Fordham, F. 1946. Pollination of Calochilus campestris. **Victorian Naturalist 62**, p. 199-201.
3. Jones, D. L. & Gray, B. 1974. The Pollination of Calochilus holtzei F. Muell. **American Orchid Society Bulletin 43**, p.604-606.
4. van der Pijl, L. & Dodson, C. H. 1966. Orchid Flowers: Their Pollination and Evolution. University of Miami Press, Coral Gables, Florida.

Plate 5

Plate 6

Plate 7

Plate 8

Plate 9

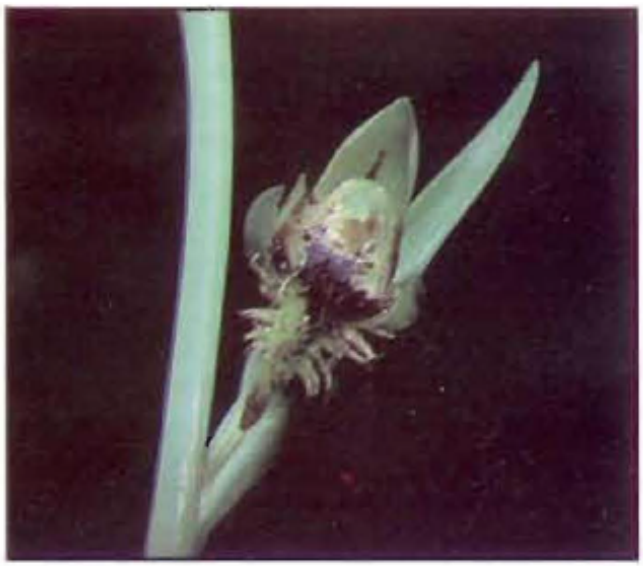

Plate 10

Pollination of *Calochilus campestris* by *Campsomeris tasmaniensis*.
Photos: P. Branwhite