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Rundbrief für alle Freunde der akuleaten Hymenopteren

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Lestica alata (PANZER, 1797); ♀:
Bestimmung am lebenden Objekt
(Foto: R. THEUNERT)

Originalarbeiten

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Operculum-lifting behaviour in the Eucalypt-visiting hylaeine bees *Meroglossa impressifrons penetrata* (SMITH, 1879) and *Hylaeus (Hylaeorhiza) nubilosus* (SMITH, 1853)

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Zusammenfassung

Zwei Arten australischer Maskenbienen wurden auf einem blühenden *Eucalyptus infera* mehrfach dabei beobachtet, wie sie offenbar gezielt die Opercula reifer Blütenknospen abstreiften. So erhielten die Bienen einen Erstzugriff auf den Pollen und damit einen Konkurrenzvorteil gegenüber den zahlreichen anderen Blütenbesuchern.

Summary

Two species of Australian Masked bees repeatedly have been observed removing the opercula of partly dehisced buds of a flowering *Eucalyptus infera* allowing them to access pollen before other foraging insects have had an opportunity.

Observations

A small 2 meter mallee, *Eucalyptus infera*, flowering in early spring attracted numerous insects foraging for pollen and nectar and became a favoured location for observing and obtaining photos of native bees.

A first observation (MN) involved *Meroglossa impressifrons penetrata* where a series of photos (Figs. 1–4) were taken showing that the bee systematically worked around the partly dehisced operculum of the *Eucalyptus* bud resulting in final removal and gaining access to the anthers of the flower. The behaviour was later seen again several times by both authors and again documented photographically.

The second species observed and photographed (BJ) uncapping ripe Eucalypt buds was *Hylaeus (Hylaeorhiza) nubilosus* (Figs. 5-6). The technique applied was exactly the same as in *Meroglossa*. The mandibles were inserted under the rim of the operculum, the bee clinging to the free portion of the bunch of anthers with all legs and wedging the lower part of her head (mandibles and part of clypeus) between anther filaments and lower rim of operculum. The friction between the still compressed partially wavy filaments and the inner surface of the operculum seems to be comparatively strong, as the bee has to repeat the action several times from

different positions around the circumference of the bud until the operculum slowly gives way and starts slipping upward. The bee follows and with a last push the operculum is shed. The bee immediately starts harvesting the pollen with the front tarsal brushes and the short, broad and medially emarginated tongue.

Additionally, operculum removal was seen done by one of us (MN) by a pollen-collecting female *Lasioglossum (Parasphecodes) hiltacum*. Two photos (Figs. 7 and 8), taken a few seconds apart some while after the bee started struggling with the process do not clearly show the bee actively lifting the operculum. May be this rather happened as a consequence of the bee's activity of taking nectar from the base of the flower by wedging the tongue between the already freed filaments of the stamina?

Discussion

The photo sequences above indicate the hylaeine bees are able to progressively lift the lip of the operculum as they moved around the flower bud finally gaining access to pollen before any competition. The process is a struggle for a small bee and is not always successful. In one case the bee simply abandoned the bud and in another case a honey bee (*Apis mellifera*) was seen to force abandonment.

The name *Eucalyptus*, derived from the Greek, eu = well and kalyptos = cover, meaning well covered, refers to the operculum or cap of the flower bud which separates or dehisces at the appropriate time to release the filaments and anthers of the flower. The anthers then split or dehisce to release pollen. This is the favoured collectable food item with high protein content for bees and other insects.

E. infera (Durikai mallee; ANONYMOUS 2008), is a slender stemmed mallee which can grow up to 8 metres tall but in the case of the tree where the observations were made, it was about 8 years old and just over 2 metres high. During the early spring flowering the tree is an excellent source of food supplies for a large range of native bees and other insects, and, as the flowers were mainly at eye level, observations of behaviour and photography were facilitated.

The opercula of Eucalyptus species are variable in shape and size. Examination of shapes would suggest that operculum removal would be immediate in many cases so the strategy of gaining early access to pollen by cap removal would not be generally available.

Fig. 1: Female *Meroglossa impressifrons penetrata* working to dislodge an operculum of a *Eucalyptus infera* flower. Note contact of the bees head with the rim of the operculum. Photo: M. NEWMAN.

Fig. 2: Female *Meroglossa impressifrons penetrata* working to dislodge an operculum of a *Eucalyptus infera* flower. Note the bee's mandibles inserted under the rim of the operculum. Photo: M. NEWMAN.

Fig. 3: Female *Meroglossa impressifrons penetrata* working to dislodge an operculum of a *Eucalyptus infera* flower. The bee is changing position frequently. Photo: M NEWMAN.

Fig. 4: Female *Meroglossa impressifrons penetrata* ingesting pollen after having just dislodged the operculum of a *Eucalyptus infera* flower. Photo: M. NEWMAN.

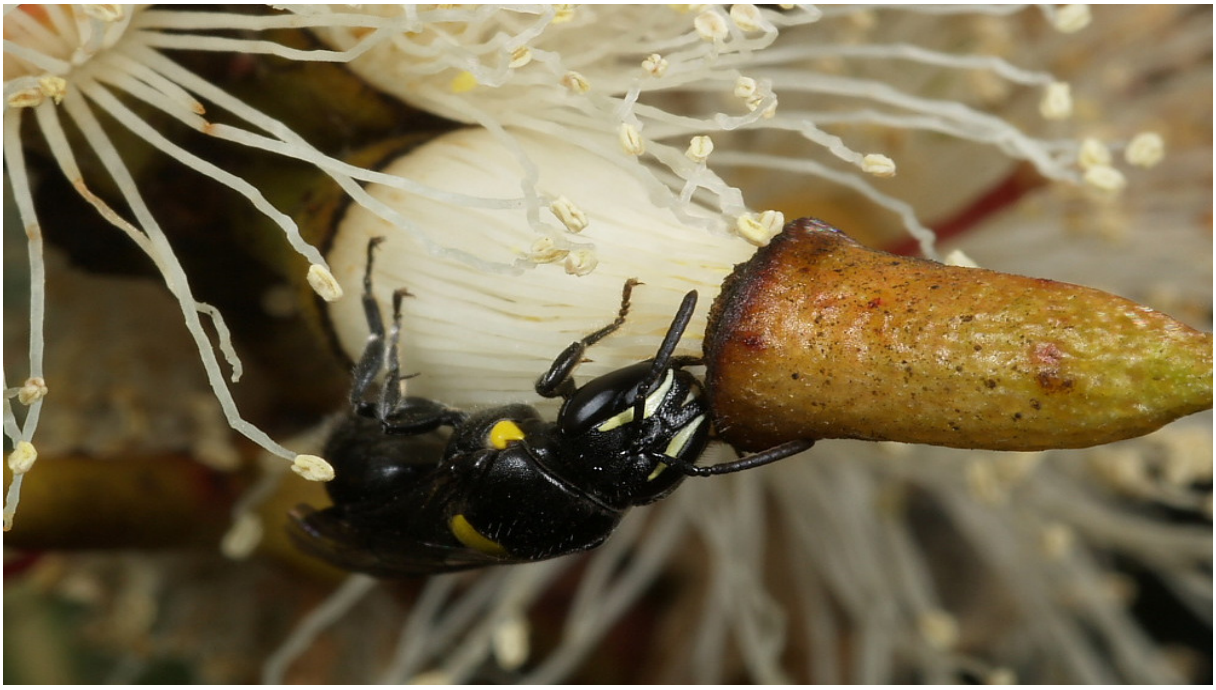

Fig. 5: Female *Hylaeus (Hylaeorhiza) nubilosus* pushing off the operculum of a *Eucalyptus infera* flower. Photo: B. JACOBI.

Fig. 6: Female *Hylaeus (Hylaeorhiza) nubilosus* ingesting pollen after having removed the operculum of a *Eucalyptus infera* flower. Photo: B. JACOBI.

Fig. 7: Female *Lasioglossum (Parasphecodes) hiltacum* female working an incompletely dehisced flower of *Eucalyptus infera*. The operculum of the flower is still attached, if loosely so. Photo: M. NEWMAN.

Fig. 8: Female *Lasioglossum (Parasphecodes) hiltacum* female working an incompletely dehisced flower of *Eucalyptus infera*. The operculum of the flower has now been shed. Photo: M. NEWMAN.

In the case of the *E. infera* on which observations were made, the operculum is basically cylindrical with a conical or almost hemispherical cap and at the opposite end a slightly enlarged section where connection to the hypanthium is severed. The shape of operculum is such that separation between it and the hypanthium can occur without immediate complete removal because of friction between the filaments and the cylindrical section. This situation has been observed to be typical.

It is interesting to note that *E. infera* is not a Ballandean local tree and is endemic to a location some 50 km distant from the point of observation. It may be significant that a local tree, *E. prava*, has a very similar shape of flower bud and in fact exhibits the same characteristic of partial dehiscence as *E. infera*.

It was initially thought that pollen was immediately available when the operculum was removed else the bees were wasting their time. To verify this, a simple experiment was carried out. Buds with separated operculum/hypanthium, but with the filaments and anthers still contained within the operculum, were selected. The operculum was then removed and the bud tapped on a black card to see if pollen was available. The initial test indicated pollen immediately available. Subsequent tests showed that pollen was not generally available.

The question arises as to whether the bee removing the operculum already senses availability of pollen. If not, the effort of removal of the operculum would be a waste of energy and therefore an unlikely situation. It is known, at least with *A. mellifera*, that they are equipped to detect humidity (YOKOHARI & al. 1982). It seems likely that the process of dehiscence of the anthers would be a matter of the outer membrane drying out and subsequently splitting to release the pollen. The humidity within the operculum would be dependent on the amount of time the operculum is separated from the hypanthium. It is therefore suggested that a native bee may be able to determine if the partly dehisced bud is likely to produce pollen by determination of humidity adjacent to the filaments. YOKOHARI & al. (1982) have found hygroreceptors in the antennae of honeybees.

Observations of bees foraging for pollen and nectar revealed that there is significant competition between native bees and the introduced honey bee, *A. mellifera*, and being the larger in size, the honey bee usually dominates. It was also observed that successful cap removal by a native bee sometimes resulted in an immediate takeover by *A. mellifera*.

A. mellifera were not observed to remove operculum from *E. infera,* though they were able to benefit once it was done by another species of bee.

Conclusions

Three species of Australian native bees were observed removing opercula of *E. infera*: *Meroglossa (Impressifrons) penetrata*, *Hylaeus (Hylaeorhiza) nubilosus* and *Lasioglossum (Parasphecodes) hiltacum.* All of these are medium sized bees and it is concluded that smaller species of native bees would not have the strength to succeed.

Apis mellifera were not seen to remove opercula of partly dehisced buds though they would clearly have the strength to do so. The bud type of *Eucalyptus* is peculiar to Australia so it seems that *A. mellifera* has not been present for a sufficient span of time in this continent to behaviourally adapt.

The two hylaeine bee species observed may be able to detect availability of pollen prior to removal of the operculum.

References

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