

Carrying of a worker pupa by a singly-dispersing foundress of *Acropyga palearctica* MENOZZI, 1936 (Hymenoptera: Formicidae)

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Abstract

An alate queen of *Acropyga palearctica* MENOZZI, 1936 was observed to carry a worker pupa during dispersal for independent colony foundation. The observed behaviour is suspected to represent a redirected activity in connection with the fixed behavioural mechanism of *Acropyga* to carry a coccoid larva during dispersal, mating, and nest foundation.

Key words: ants, independent colony foundation, *Acropyga palearctica*

Introduction

Colonies of social insects, and in particular ant nests, are very stable systems with a long life expectancy. The most vulnerable period of an ant queen's life cycle is undoubtedly during the stage of independent nest foundation. The success of an individually founding queen is significantly reduced by factors such as predation by a multitude of zoophages, drifting to unfavourable environments, unsuitable climatic factors, and intra- or interspecific competition. In this context, and in view of the large ergonomic capacity and mobility of many ant queens, it is surprising how few "baggage" strategies to improve the success of colony foundation are known. The widely spread reports of ARNOLD (1915) and WHEELER (1923), that suggest *Carebara vidua* queens to transport minute nestmate workers clinging to their tarsi during dispersal flight in order to have assistance during nest foundation, was recently rejected as a myth by ROBERTSON & VILLET (1989). They did not find any sign for nestmate assistance in founding *C. vidua* queens as it was earlier observed by LOWE (1948) for *Carebara lignata*.

Thus, the cases of *Acropyga* and *Tetraponera* seem to be the only verified reports for a baggage strategy in ant foundresses. Young queens of *Acropyga paramibensis* and *Acropyga palearctica* were observed to carry a coccoid larva (Coccoidea: Pseudococcidae) in their mandibles during dispersal flight (BÜNZLI 1935, BUSCHINGER et al. 1987). The coccoid larva is placed by the queen at the root of a host plant within the founding chamber. This food-shelter coincidence and the immediate development of a trophobiont population from the very beginning of the colony cycle must represent a significant advantage. A similar coccoid-carrying behaviour was observed in a queen of a further *Acropyga* (*Atopodon*) species (ROEPKE 1930; Roepke's erroneous genus determination as *Cladomyrma* was later corrected by REYNE 1965) and in *Tetraponera* (KLEIN et al. 1992). Here, we report the first observation of carrying a worker pupa by a singly-dispersing ant foundress.

Observation and discussion

The observation was made by G. Heller in the Samaria gorge in Crete on 19 September 1979 at an elevation of 300-400 meters. A single alate queen of *Acropyga palearctica* MENOZZI, 1936 was seen wandering across the surface of a big boulder at 14.00-15.00 h local time, carrying a minute worker pupa of 1 mm length in her mandibles. The queen was transferred into a glass vial with a moist bottom of plaster of Paris and shed the wings one day later. She constantly stayed near the worker pupa and picked it up whenever disturbed (e.g. when opening the vial). Unfortunately, she died in the transport vial a few days later. A dissection of the specimen to assess the reproductive status was not performed.

According to the present state of knowledge, the only species of the pantropic ant genus *Acropyga* found in Europe is *A. palearctica*. However, this determination remains provisional as long as a profound taxonomic revision of the genus on a world-wide basis is lacking. Because of its hidden life style, *Acropyga* is largely unknown to the majority of European myrmecologists. The genus *Acropyga* has morphological similarities to *Plagiolepis*, and this explains that the observation of BUSCHINGER et al. (1987) was originally referred to the latter genus. The determination was later corrected to *Acropyga* (HÖLLDOBLER & WILSON 1990) but with an erroneous specific name. *Acropyga* is entirely subterranean and has small workers of 1.3-2.8 mm overall body length. It is generally believed to have small populations and to live in exclusive trophobiosis with root-sucking coccids.

Was the observed pupa-carrying *Acropyga* queen in the stage of dispersal and colony foundation or was it an accidental behaviour that might be explained differently? Four principal causes for an alate, pupa-carrying ant queen to walk outside its mother nest seem plausible:

- (a) The queen left the nest for mating to later return to the nest.
- (b) She helped her nestmates in brood transport during a nest site change.
- (c) There was an extreme disturbance of the nest immediately before (e.g. by lifting of nest stone by collecting entomologists).
- (d) The queen left the mother nest with the motivation to found a new colony.

Interpretation (a) can be rejected since such behaviour is observed mainly in species with ergatoid queens in which case it makes no sense to carry a worker pupa. Interpretation (b) can also be rejected since no nestmates were seen in the vicinity and a negatively phototactic, subterranean species would not carry out an above-ground colony move during daytime. Interpretation (c) can not be excluded since alate ant queens were occasionally observed to carry and rescue broods in alarm situations (SEIFERT, unpublished observations in *Tapinoma*). The right rescue paths down to deeper chambers may be missed and some carriers may circle over the soil surface in search for an entrance hole or a dark crevice to hide. In negatively phototactic species such ground circling movements will be of short duration. This hypothesis, however, seems very unlikely because no obvious disturbance of the site has taken place before, and the quiet linear movement of the queen with no negative phototaxy did not indicate an escape behaviour from an enemy (e.g. from unseen subterranean arthropod predators). The most probable explanation is interpretation (d), namely that the *Acropyga* queen was in dispersal for independent colony foundation either before or after mating. Only then the negative phototaxy is inhibited and such a type of movement plausible.

Whether the queen had already been mated remains unknown. The fact of active dealation one day later must not necessarily indicate a preceding mating since unmated queens of some ant species occasionally shed their wings (e.g. observed in *Formica* (ROSENGREN, pers. comm.) and *Leptothorax* (BUSCHINGER, pers. comm.)). BUSCHINGER et al. (1987) observed dealation in *A. palearctica* immediately after mating.

Unclear also is whether the *Acropyga* foundress carried the worker pupa intentionally or by mistake. It is known that immature stages of aphids and coccids can be temporarily stored within the brood chambers of an ant nest - in particular in specialised, obligatorily trophobiotic ant species for which the homopteran immatures have a value comparable to their own offspring. It may be that the *Acropyga* foundress by mistake picked up a worker pupa instead of a coccoid larva, or she took the pupa as a substitute because there were no coccoid larvae available. Thus the fixed behavioural mechanism of *Acropyga* to carry a coccoid larva during dispersal, mating, and claustral nest foundation would have been replaced by a redirected activity.

The question whether the pupa-carrying behaviour may provide a selective advantage is also difficult to answer. The fresh weight of an *Acropyga palearctica* queen is estimated by morphometric

calculations as 0.85-0.90 mg. A coccoid larva of the size as depicted in BUSCHINGER et al. (1987) should have a fresh weight of only 0.025 mg. The weight increase by carrying a coccoid larva is thus only 3 % and should have negligible effects on flight ability. A Formicine worker pupa of 1.3 mm length has a weight of 0.135 mg, meaning a burden of 15 %. This could significantly reduce the capacity of the queen for long-range flight dispersal (a 1 mm-pupa would mean a burden of 7 % and a 1.5 mm-pupa such of 24 %). Systematic observations of nuptial flights in *Acropyga palearctica*, which take place in Greece in the afternoons of September/October, are needed to elucidate the phenomenon.

Zusammenfassung

Eine einzelne alate Jungkönigin von *Acropyga palearctica* MENOZZI, 1936 wurde im September 1979 auf Kreta beim Transport einer Arbeiterpuppe beobachtet. Der Gesamtzusammenhang der Beobachtungsdaten ergibt als höchstwahrscheinliche Interpretation, daß sich die Jungkönigin in Dispersion zur Gründung eines neuen Nestes befand. Die vorliegende Beobachtung ist damit der erste für soziale Hymenopteren berichtete Fall der Mitnahme einer Arbeiterpuppe durch eine einzeln gründende Königin. Es erscheint allerdings zweifelhaft, ob es sich hierbei um ein typisches Verhaltensmuster handelt. Wahrscheinlicher ist eine Deutung als neuorientierte Bewegung oder Ersatzhandlung im Zusammenhang mit der für koloniegründende *Acropyga*-Königinnen typischen Mitnahme einer Pseudococciden-Larve.

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