



Further life history observations in the myrmecophilous genus *Chrysoritis* Butler, plus notes on dwarfism in reared specimens

Published online: 15 March 2013

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Abstract: Associated host-ant species and larval host-plants are recorded for *Chrysoritis pelion* (Pennington, 1953), *Chrysoritis irene* (Pennington, 1968) and *Chrysoritis natalensis* (Van Son, 1966). Instances of undersize adults obtained when reared in captivity from eggs, without ant attendance, are recorded and discussed.

Key words: *Chrysoritis*, ant-association, larval host-plant, life history, aphytophagy, under-size adult.

Citation: Heath, A. & Kaliszewska, Z.A. (2013). Further life history observations in the myrmecophilous genus *Chrysoritis* Butler, plus notes on dwarfism in reared specimens. *Metamorphosis* 23: 16–21.

INTRODUCTION

Clark & Dickson (1971) produced the first major publication dealing with the life histories of South African lycaenids; however, they focused more heavily on the morphology of the juvenile stages than on their associated ants and natural larval host-plants. Subsequent publications on southern African butterflies, e.g. Pringle *et al.* (1994), Heath (1997) and others added to the information on these associations, in particular Kroon (1999) who compiled associated data for all Lepidoptera of Southern Africa.

Heath & Claassens (2003) reviewed the ant-associations for all southern African lycaenids and claimed that over three quarters of them are ant-associated (myrmecophilous). Of these, two thirds are considered to be obligately associated, where larvae are always tended by ants, and that without them, the mortality would rise significantly (see Pierce *et al.*, 1997; 2002). Hence these ant-associations are a vital component of a myrmecophilous lycaenid's survival needs. A summary of all known trophic and ant-associations for the genera *Chrysoritis* Butler, 1898 and *Aloides* Hübner, 1819 was produced by Heath *et al.* (2008); the species in both these genera being regarded as obligately

myrmecophilous (Heath & Claassens, 2003). As part of an ongoing research into these relationships we record three new life history accounts herein for the genus *Chrysoritis*.

In rearing *Chrysoritis* butterflies from egg to adult in captivity, it has usually been convenient to do so without the presence of ants; however the resulting adults have been invariably undersize (pers. observ. A Heath). This phenomenon is discussed herein.

MATERIAL AND METHODS

Heath & Claassens (2003: 2) described the method used to induce oviposition among captive *Chrysoritis* adults. The method adopted for rearing the *C. irene* larvae was as follows: The first instar larvae were each transferred to a separate potted *Tetraena retrofracta* (Thunb.) Beier & Thulin (Zygophyllaceae) plant covered in netting (see Fig. 7) by means of a fine paintbrush. The plant's stem was loosely wrapped in dark netting to serve as a larval refuge and the pot was placed in partial shade, but otherwise it was open to the elements. Care was taken to limit the amount of water applied to the base of the pot. A fine mist-spray was applied to the upper part of the plant on most mornings to simulate morning mist. This was found to be most important during the pupal stage, as the pupae could otherwise dehydrate.

The plant used for rearing *C. irene* was not its normal larval host-plant, and was chosen as a substitute for convenience, e.g. its smaller size and availability. In nature *T. retrofracta* is commonly used by *C. thysbe osbecki* (Aurivillius) and others in the genus.

When searching for juvenile stages in the veld the method has been to search the base of potential

Received: 6 November 2012

Accepted: 15 December 2012

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food-plants for the presence of ants. Where potential ant-associates occur, a more detailed search is made among leaf-litter, curled leaves and other refuges close to the host-plant. On finding larva or pupae, some attending ants are collected for later identification and some for attending the larva or pupa. Further discussion on rearing larvae found in the veld is given in Heath & Pringle (2007).

In the many cases of final (6th) instar *Chrysoritis* larvae having been found in the veld and reared through to adult, the attendant ants were always retained with the larvae along with plant cuttings (A Heath pers. observ.). The ants were present to prevent mould developing on the DNO, since it would have already been stimulated by the ants to produce a secretion. In all such cases, the resulting adults were full-size. When rearing from egg, without ants, the DNO was not stimulated and so mould did not occur but the resulting adults were always under-size.

RESULTS

Chrysoritis pelion (Pennington)

Four visits were made by the authors in January 2011 to the summit of Blue Mountain Pass in Lesotho (Fig. 1) in an attempt to establish the ant associate and larval host-plant used by *C. pelion*



Figure 1 – Blue Mountain Pass locality for *C. pelion*



Figure 2 – *Thesium* sp. where three *C. pelion* pupae were found

in that locality. The weather was cool, generally overcast with occasional showers, and infrequent periods of sunshine, hence only one adult female specimen was seen on the wing, despite extensive

searches. On the 13th of January three pupae were discovered at the base of a *Thesium* plant growing flat against a rock face (Fig. 2) at 29°25.98'S, 27°58.01'E, 2664 m.



Figure 3 – *Crematogaster* sp. ant tending a *C. pelion* pupa

A sample of *Crematogaster* sp. ants that were tending the pupae was taken for identification. One female and two male *C. pelion* emerged from the pupae (Fig. 3) a few days later. A further search was made in the area, and on the 14th of January a late instar larva (Fig. 4) was found at



Figure 4 – *C. pelion* 5th (penultimate) instar larva

the base of a *Thesium* sp. plant. A sample of *Crematogaster* sp. ants tending the larva was also collected for identification. The *C. pelion* larva was much darker than typical *Chrysoritis* larvae. At first sight the *C. pelion* larva appeared to be plain dark grey, although a closer examination showed it to be a dull reddish-brown and underneath the dark color it had a similar pattern to other late instar larvae in the *C. thysbe* species group. Both ant samples were later identified as

Crematogaster sp. near *peringueyi* Emery. The species of *Thesium* was common in the area but many of the plants growing amongst the grass gave the appearance of grass having been grazed, and so might easily be overlooked.

***Chrysoritis natalensis* (van Son)**

A known locality for *C. natalensis* at Umtamvuna Nature Reserve, KwaZulu Natal, 31°00.39'S, 30°10.59'E, 355 m, was visited on 8th January 2011. Four males were seen and following an examination of a bush of *Osteospermum moniliferum* L. (Asteraceae) (= *Chrysanthemoides monilifera*), a third instar larva was found in a curled dead leaf. It was attended by the ant *Crematogaster* sp. near *liengmei* Emery. Shortly after, a final instar at a pre-pupation stage was found in a cluster of dead leaves; this too was attended by the same species of ant. The latter larva was collected; it pupated the next day and later eclosed as a female *C. natalensis*. G.A. Henning is recorded similarly finding pupae and larvae of *C. natalensis* attended by *Crematogaster* ants (Pringle *et al.*, 1994).

***Chrysoritis irene* (Pennington)**

A well-known locality (Fig. 5) for *C. irene* above the summit of Du Toit's Kloof Pass, 33°41.88'S, 19°04.22'E, 884 m, near Paarl was visited on October 19th 2010 in order to discover the butterfly's life-history. A female was seen to oviposit on a dead stem resting against a plant with yellow flowers (Fig. 6), growing close to the base of the cliff.



Figure 5 – Typical *C. irene* habitat at Du Toit's Kloof Pass, Paarl.

The egg and the live female were collected. Samples of the plant and of *Crematogaster* close to *C. peringueyi* Emery ants found at the base of the plant were also collected for identification purposes. The plant was later identified as the 'Chrysanthemum-leaved Cape Marigold', *Dimorphotheca chrysanthemifolia* (Vent.) DC. (Asteraceae); however, the authors do not wish to



Figure 6 – *Dimorphotheca chrysanthemifolia* (Vent.) DC.



Figure 7 – Potted plant used for rearing *C. irene*

imply that this is the only foodplant of *C. irene*. In captivity the female was induced to lay two more eggs. The resulting larvae were raised on a potted *Tetraena retrofracta* (Thunb.) Beier & Thulin (Zygophyllaceae) plant covered in netting (Fig. 7). At no time were ants or other insects allowed access to the larvae. The three larvae rested and later pupated within the stem wrapping; two males and a female eclosed in late February 2011. These specimens were noticeably smaller than wild ones, with the two males each having a wingspan (set) of 20.5 mm. This compared with an average wingspan of 26.5 mm ($n = 15$) among free-flying males, hence the two males reared in captivity had a reduction in wingspan of almost 23%. The one female was similarly undersize.

On 1st March 2011 the authors paid another visit to the same locality above Du Toit's Kloof Pass. The autumn brood was in evidence, with eight males and two females having been seen on the wing in this small locality (~8 m x 80 m) below the cliff face. Early stages were sought amongst the *Dimorphotheca* plants at the foot of the cliff face. One 3rd instar larva was discovered in a brown curled-up leaf, the edges held together by silk (Fig. 8). The larva was tended by a single



Figure 8 – *C. irene* 3rd instar, tended by *Crematogaster* sp. ant

Crematogaster sp. ant that was highly protective and unwilling to leave its charge. In the process of collecting a few more ants at the base of one of the plants, a pooter was used. On examining the collected ants, a 3rd instar larva was discovered

among them, having been aspirated accidentally from the base of the plant.

DISCUSSION

Dwarf adults

Over the past 25 years many *Chrysothrix* species and subspecies have been reared in captivity by the first author. This was originally done to observe their morphology through different stages of development; hence they were reared from egg to adult. In all such cases, except for *C. dicksoni* (Gabriel), they were reared without ants being present, and without exception these resulted in undersize adults (Heath & Pringle, 2007). In most of these cases, the appropriate plant was used to feed the larvae; however, an alternative plant species was used in some instances. The larval host-plant was usually grown in a pot as shown in Fig. 7, outdoors but in partial shade.

In 2010 four *C. lycegenes* (Trimen) individuals were reared from egg and successfully fed on *Acacia karoo* Hayne (Fabaceae) without ants being present, but as with other *Chrysothrix* species reared, these also eclosed significantly undersize (A. Heath & A. Morton, unpubl.). In 1990 a number (>30) of *C. chrysaor* were reared in captivity under similar conditions by the first author. The adults were all undersize in varying degrees, and it was noticed that the adults eclosing later were progressively smaller than those eclosing earlier. Rearing large numbers of the palaearctic lycaenid *Polyommatus icarus* (Rottemburg) on two of its natural larval host-plants, without ant presence, resulted in dwarf adults (pers. observ. A. Heath). Similar results were obtained with *P. icarus* and *Zizeeria knysna* (Trimen) (K. Fiedler, pers. comm.).

Not all rearing of lycaenids results in dwarf specimens. In a study of the Australian lycaenid *Jalmenus evagoras* (Donovan), reared under natural conditions, it was found that larvae tended by ants developed more quickly than larvae that were not tended; however, they pupated at a significantly lower weight than their untended counterparts, and the adults that emerged from these pupae were smaller (Pierce *et al.*, 1987). In contrast to this, the same species reared under artificial conditions, both with and without ants at Harvard University generally produced smaller adults than those found in the field with ants (R. Eastwood, pers. comm.). Despite being anecdotal, this last observation suggests that artificial as opposed to natural conditions may influence the size of the adult.

We have considered the absence of ants as a potential cause of undersize adults, but current life history knowledge (Heath *et al.*, 2008) mitigates against some of the more obvious possibilities of aphytophagy, such as carnivory or trophallaxis. Except for *C. dicksoni* (Gabriel) (see Heath, 1998), trophallaxis has never been observed in this genus, whose larvae are assumed



Figure 9 – Final instar larva of *C. lycegenes* with *Crematogaster* sp. ants gathered around its head
(Photo: Richard Kinvig)

to be wholly phytophagous but always ant-attended (Heath & Claassens, 2003; Heath & Pringle, 2007). There are usually only one or two ants constantly attending a larva in early instars, with later instars often having more ants attending. The ants palpate the dorsal nectary organ (DNO) at regular intervals, seeking the honeydew secretion (Clark & Dickson, 1971). Attendant ants are almost always present at the DNO, but in January 2010 we observed and photographed ants clustering around the head of 4th instar larvae of *C. lycegenes* (Trimen). A fine photograph of this same phenomenon taken in December 2008 by Richard Kinvig (Fig. 9) also shows a concentration of ants around the head of a final instar *C. lycegenes* larva. In these instances, without magnification, it is impossible to see what exactly is taking place, but it is unusual to see such activity at the head of a larva. Perhaps in this and other species of *Chrysoritis*, aphytophagous behaviour can occur and trophic interchange takes place. A further possible explanation for these observations with *C. lycegenes* is that each of them could have been in the early stages of ecdysis at the time of the photograph, and this process would doubtless attract the ants' attention.

Persistent attention by ants tends to keep the larvae active, and we suspect that this might stimulate them to feed more frequently than would be the case without ants, as they need to renew their metabolic resources to provide honeydew for their host ants. Hence the absence

of ants could conceivably result in less well-fed and inferior larvae, resulting in smaller adults.

In their study of *Orachrysops niobe* (Trimen) Edge & van Hamburg (2010) found that its final two larval instars (3 & 4) fed exclusively on the rootstock of its leguminous host plant under natural conditions but that larvae reared in captivity only on plant cuttings resulted in dwarf adults.

Unsuitable or poor quality of host plant is known to be one cause of dwarfism both in nature and in captivity (R. Eastwood, K. Fiedler, pers. comm.). Although supposedly healthy potted plants were used in rearing *Chrysoritis* species under artificial conditions, the protective measures might have adversely affected the plants, and/or the larva and adult. To summarize, the one common factor involved in these instances of under-size adults appears to be the artificial conditions. This could be because the larvae and host-plant are under some form of protective cover and not fully exposed to the elements; however, further research would be required if a quantitative conclusion is to be reached.

ACKNOWLEDGEMENTS

We acknowledge the Western Cape Nature Conservation Board and the KwaZulu-Natal Nature Conservation Board for permits to study and collect material under their jurisdiction. We thank the Putnam Expedition Grant Committee (USA) for funding our travels. We are grateful to Simon Joubert for drawing our attention to the *C. lycegenes* photograph by Richard Kinvig. We especially wish to thank Andrew Morton

for arranging for the Compton Herbarium (SANBI), Kirstenbosch, Cape Town to identify the *C. irene* foodplant. We thank Nokuthula Mbanyana, Iziko South African Museum for identifying the ants. Finally, Steve Woodhall is thanked for taking us to Umtamvuna; also for his and Jayne's hospitality during our stay with them.

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