

OBSERVATIONS ON THE LIFE HISTORY OF *SYNCLISIS BAETICA* RAMBUR 1842 (NEUROPTERA: MYRMELEONTIDAE) AT THE RAMLA L-HAMRA SAND DUNES IN GOZO (MALTA, CENTRAL MEDITERRANEAN)

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ABSTRACT

Although the neuropteran species *Synclisis baetica* was recorded in the Maltese Islands (Central Mediterranean) way back in 1996, and is the largest neuropteran species on the Islands, no research on the local ecology of this species has ever been conducted. This study summarises the observations on the behaviour of the species made in the wild within the sand dune remnants of Ir-Ramla l-Hamra (Gozo, Maltese Islands) over the 2003-2009 period, as well as observations on the life cycle of the same species made on a number of captive-bred individuals.

KEYWORDS: *Synclisis baetica*, Neuroptera, Myrmeleontidae, Malta.

INTRODUCTION

Very little research has been published to date on the neuropteran species of the Maltese Islands. The first works that mention these insects are those of Borg (1932) and Hepple (1954), with the latter recording two species. Aspöck & Holzel (1980) recorded four species. Valletta (1984, 1985), in turn, lists 10 neuropteran species, most of which were new records and Duelli's visit in 1990 revealed 7 additional species for the Islands (Duelli, 1992). The observational study of Plant & Schembri (1996) is the most recent work, as they reviewed the existing literature and came up with a total number of 29 confirmed neuropteran species in addition to a number of other species which were not fully identified.

Synclisis baetica was previously recorded from the Maltese Islands by Plant & Schembri (1996), who collected a larva of this species from Ramla l-Hamra on the 29th May 1988, with an adult female eventually emerging from the pupa in August 1988. Practically no research has been conducted locally on the ecology of this species, such that reference had to be made by the authors of the present study to the few foreign works on the ecology of different neuropteran species which exist. One such comprehensive work is that by Stange & Miller (1985), which, although is a study of the family Myrmeleontidae, still provides interesting information on the ecology of the genus *Synclisis*.

The aim of the current work is to document the life cycle observations made for *Synclisis baetica* made at Ramla l-Hamra (Gozo, Maltese Islands) throughout the 2003-2009 period. Although most of the observations match published records, some behaviour seem not to tally and this is suspected to be due to the specific local microhabitat, lack of specimens available for study and that this species is characterised by a very high variability in the population parameters.

MATERIALS AND METHODS

Adult individuals of *Synclisis baetica* were located in the field by means of ultra-violet (UV) lamps deployed after sunset; individuals of the same species were taken from the wild from late July till early October, over the 2003-2009 period. Larvae of the species were observed *in situ* in 'observation posts', which were demarcated by placing cane sticks in the sand to mark the area. Some specimens of the species were raised in captivity to calculate the life span of the species from egg stage (or early larval stages) to adulthood.

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RESULTS AND DISCUSSION

Synclisis baetica, in spite of being the largest Neuroptera species in the Maltese islands, is rather inconspicuous. It is quite a rare species and its distribution is restricted only to the Ramla l-Hamra sand dune remnants in Gozo (Figure 1). A few (<10) larvae of the species were recorded (2005-2007) in a 10m² pocket within such dune remnants, situated ca. 50m away from the shoreline (location is demarcated by a circle in Figure 2), while 60 individuals at the last larval stage were recorded in the spring of 2007, in a different part of the dune remnants, ca. 30m further inland than the previous location (location is demarcated by a box in Figure 2).

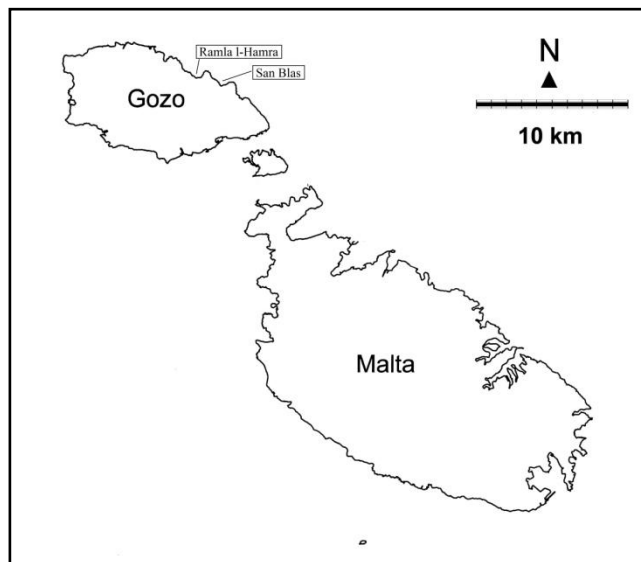


Figure 1. Location of the two sandy beaches where *Synclisis baetica* was recorded in the present study.



Figure 2. The two locations at the Ramla l-Hamra sandy beach (Gozo, Maltese Islands) where the two larval cohorts of *Synclisis baetica* were collected.

Sporadic additional sightings of individuals of the species (amounting to 7 larvae) were made during the 2003-2009 period, within the same dune remnants. On one occasion (4th September 2004), a single adult female of *Synclisis baetica* was collected from San Blas Bay, also in Gozo (Figure 1). This individual is the largest adult specimen known of the species ever to be collected locally with a wingspan of 105mm. This specimen was found dead. It is unlikely that the latter locality is supporting a breeding population of the species due to the absence of favourable habitat conditions; this consists of dry sandy, sloping areas, sheltered along the upper rim by vegetation. Most of the larvae of the species were located on the slope just below the vegetation rim. Adult specimens of the species were only observed in the field when UV light was deployed, in twilight-pitch black conditions from late July till early October. It is interesting to note that no individuals of *S. baetica* were ever collected under conditions of bright moonlight. The highest number of adults collected and released back into the wild during a single night at Ramla l-Hamra was 8 specimens, on the 23rd August 2006. Other observations made in the field at Ramla l-Hamra on the behaviour of *Synclisis baetica* include the following:

- (i) larvae 'hunted' at distances of less than 10cm away from each other;
- (ii) individuals at early stages of development fed mainly on micro-Coleoptera, Hymenoptera (Order: Formicoidea) and small Diptera individuals;
- (iii) on only one occasion an arachnid (Order: Opiliones) was predated upon by *Synclisis baetica*, with two individuals at an early stage of development collaborating to entrap the opilionid;
- (iv) the highest larval mortality rate was observed during the first and second instar stages;
- (v) cannibalism was also observed, especially in individuals bred in captivity, which also readily accepted dead material as long as it could be wielded by their pincers.
- (vi) foraging rates observed were prodigious – for instance, on one occasion a mature (final instar larva) *Synclisis baetica* individual consumed 5 dipteran individuals and 1 *Talitrus* sp. individual, over a period of 4 hours. Many individuals, especially in their final instar, were observed to be incessant feeders and required a fairly high sand surface temperature to pupate;
- (vii) Stange & Miller (1985) stated that this genus does not construct pitfalls; this is only partly true, since for the mature stages, the authors observed gently-sloping pitfall traps with diameters of 20mm and a maximum depth of 11mm;
- (viii) forward and backward movements by individuals of the species were observed, but when threatened by predators or when searching for prey, individuals performed backward movement only;
- (ix) the larvae were generally encountered on relatively open tracts of sand, where sand depth was considerable and was ideal for temperature regulation, protection of the large cocoon, escape and concealment from predators, as well as providing space for hunting prey;
- (x) the cocoon was observed to be constructed in a single day and the period from construction of the cocoon to the emergence of the adult spanned between 54-60 days, a length of time which is almost equivalent to that in cited in Stange & Miller (1985). However, there were instances in the field where individuals emerged from the cocoon later, after 90 days, and these were the ones which encountered scarce food resources. It was observed that the larvae rarely moved from their post, even when food resources were very low;
- (xi) individuals embarked on feeding as soon as the sand temperature was warm enough (at around 8:00 am during the summer months), but extremely low or high sand surface temperatures were avoided with individuals burrowing deeply in the sand;
- (xii) individuals were most active on the sand surface during mid-morning, late afternoon, and during very warm nights.

The different development stages observed are shown in Figure 3 below.



Figure 3: Different developmental stages of *Synclisis baetica*: (a) second instar stage as observed in captively bred individuals; (b) last instar stage as observed in captively bred individuals; (c) cocoon stage; (d) pupal stage as observed in captively bred individuals; (e) fully-developed adult, with cocoon, larvae shedding and meconium; (f) the specimen found dead in the field on the 04.9.04 at the beach of San Blas (Gozo, Maltese Islands).

Photographs by A. Sciberras.

Only two specimens were observed laying eggs. As soon as the female expelled the eggs, she coated them with sand, using the posterior gonapophysis. The eggs were buried at shallow depths. The other female caught just after dusk still had egg material at the end of its abdomen, some of which had been broken. Her abdomen was devoid of eggs. One female emerged in captivity along with 3 males. They were fed on *Tenebrio molitor* but only one specimen was observed feeding on a larva of this species. At a later stage, one of the adult females laid 23 eggs. The latter was large (varying from 4-6mm) and oblong and hatched in 26 days. The 'free' larvae (not developing within the cocoon nor inside the egg) went through three larval instars, and a diapause stage. The silken cocoon, with sand grains covering the surface, was constructed beneath the sand surface. The mobile pupae dug their way to the surface of the sand, with the adult emerging and then climbing on wrack material before expanding its antennae, wings, and abdomen. The observed complete morphological transformation (from the shedding of the pupal skin to the fully-formed adult) took around 2.5-3 hours before the insect was ready to fly and during this period they egested volumes of a semi-liquid substance constantly (about 15-17 times) and along this process a dry coated meconium substance was also produced. 10 adult specimens of *Synclisis baetica* were later released back to Ramla l-Hamra dune remnants.

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