BOLL. SOC. ENTOMOL. ITAL., 142 (2): 81-84 30 LUGLIO 2010

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A previously unreported nymph cocoon of *Alphasida puncticollis* on the islet of Lampione (Sicilian Channel) (Coleoptera Tenebrionidae)

Abstract - In this paper we present an unusual case of cocoons produced by larvae of Tenebrionid *Alphasida (Glabrasida) puncticollis* (Solier, 1836), which has been observed on the islet of Lampione (Sicilian Channel). Pupal cocoons have never been recorded for species belonging to this genus, and their occurrence results rarely documented within the family Tenebrionidae. Some ecological implications are discussed.

Riassunto - *Prima osservazione di bozzolo ninfale per* Alphasida puncticollis *nell'isolotto di Lampione (Canale di Sicilia) (Coleoptera Tenebrionidae).*
Un inusuale caso di produzione di bozzoli a opera delle larve del Tenebrionide *Alphasida (Glabrasida) puncticollis* (Solier, 1836), osservato nell'isolotto di Lampione (Canale di Sicilia), viene descritto e illustrato nel presente contributo. Lo svolgimento dello stadio ninfale entro bozzoli costituisce un aspetto inedito della biologia delle specie appartenenti a questo genere e, in generale, risulta raramente documentato per i Tenebrionidi. Vengono discussi alcuni aspetti ecologici relativi alle osservazioni descritte.

Key-words: pupal biology, nymph cocoon, *Alphasida puncticollis*, Coleoptera Tenebrionidae, Pelagie Islands.

INTRODUCTION

Tenebrionids (Coleoptera Tenebrionidae) are one of the largest beetle families at global level, extremely common and widespread in different habitats, where it can represent a conspicuous part of the local invertebrate biomass, both as adults and larvae (Doyen & Tschinkel, 1973; Thomas, 1979). However, most part of the studies on their immature stages has been focused on species with economical relevance (see Watt, 1974; Lawrence & Spilman, 1991 and references therein), such as those with cosmopolitan or wide distribution, whose larval development is associated to storage products. On the contrary, for many other tenebrionids, biological information are scattered or lacking. In this paper we present an unusual case of cocoons produced by larvae of Tenebrionid *Alphasida (Glabrasida) puncticollis* (Solier, 1836).

MATERIAL AND METHODS

During a field trip on Lampione Islet (35°33'00"N 12°19'11"E, Sicilian Channel) in late August 2008, one of us (BM) had the opportunity to observe and collect several pupal cocoons of *Alphasida puncticollis*, containing tenerals together with the pupal exuviae (Fig. 1) or recently abandoned after adult emergence. We put together all the bibliographic references and some unpublished data on this subject.

RESULTS AND DISCUSSION

Alphasida puncticollis is a 10-12 mm long tenebrionid occurring in NE Algeria, Tunisia, and in Lampedusa and Lampione (Pelagie Islands); this latter population, originally ascribed to *A. tirellii*, was referred to the subspecies *moltonii* (Canzoneri, 1972), endemic to the islet. *Alphasida* species are adapted for burrowing into substrates, occupying the same habitats of their larvae, and have essentially detritivorous habits (Doblas Miranda, 2007), as most part of darkling beetles (Calkins & Kirk, 1973), even if they can also use other types of food resources (Sánchez-Piñero & Avila, 2004). Adults have nocturnal habits and their life is shorter compared to other tenebrionids (about 30 days: Viñolas & Cartagena, 2005). On Lampione Islet, active adults and larvae have been commonly observed from late winter to summer (PLC, pers. obs.). Despite the apparently wide phenology of both adult and larval stages, so far pupal cocoons were found only in summer, in the ground or under stones. Their shape is sub-spherical, with an external diameter ranging from 17.7 to 22.8 mm, while the irregular thickness of each cocoon ranges from 2.0 to 7.3 mm. The cocoons are composed by an internal cavity having a smooth surface and an outer wall of slightly rugose appearance (Fig. 2). The structure is made up of fine sand, debris, and includes minute calcareous parti-

cles and vegetal matter, probably cemented with faeces. Apart from the smaller size, these cocoons resemble considerably those of some Scarabaeoidea Cetoniinae. It is still unclear if the larva builds its cocoon in external environment or underground, even if this latter evenience seems seriously hinded by soil structure, as the pedogenesis on the islet is strongly affected by wind-erosion and the substrates are largely characterized by lithosoils and calcareous outcrops (Pasta, 2002). Pupal cocoons have never been recorded for species belonging to the genus *Alphasida* Escalera, 1905, and their occurrence results rarely documented within the family. Pupation takes place inside a cocoon in some species living in fungi, such as Diaperinae (Leschen, 1991), or in hollow trunks of dead trees, such as *Prionychus ater* (Fabricius, 1775), *P. melanarius* (Germar, 1813), *Pseudocistela ceramboides* (L., 1761) (F. Soldati, pers. comm.) and perhaps in other Alleculinae. Species inhabiting desertic environments show several pre-imaginal adaptations, as the sand-covered silken tubes used by larvae of some Drosochrini and Opatrini (Schulze, 1975), but just for *Parastizopus armaticeps* (Peringuey, 1892) the occurrence of pupal cocoons has been recorded (Rasa, 1994; 1998). Concerning the non-feeding pre-imaginal stages of Mediterranean darkling beetles, no data have been found in literature, and few information are due to occasional rearing of captive animals; e.g. for some species living in the ground the costruction of earthen pupal cells has been observed (*Blaps lusitanica* Herbst, 1799: F. Soldati, pers. comm.). Finally, in other micro-insular environments (Aeolian Archipelago, S Tyrrhenian) inhabited by the congeneric *Alphasida grossa* (Solier, 1836), pupae were occasionally found under stones or in the litter during summer, while pupal cocoons have never been observed (PLC, pers. obs.). In contrast to its uncommonness within Tenebrionidae, the construction of pupal cocoons results widespread among insects (see Grimaldi & Engels, 2005 and references therein), including other coleopteran groups with adecticous exarate pupae (Lawrence, 1991), such as the above-mentioned Cetoniinae, or some Staphylinidae (Staniec, 2004). Insect cocoons are frequently built using silk, but can incorporate material from the surroundings, such as faeces, vegetal matter, sand, clay. In most species they represent a protection against environmental damages, attacks by natural enemies (Danks, 2002), or the way to cross over the cold season (Danks, 2004). Some studies put also in evidence their protective function against dry environments and/or dryness, showing that cocoons act as a humidity buffer and reduce transpiration of their occupants (Nowbahari & Thibout, 1990; Rosner & Führer, 1996; Tagawa, 1996), even if this role has seldom been tested experimentally (Danks, 2002). Anyway, since the pioneer observations carried out by Fabre (1897) it is well known that an excessive dryness can seriously hinder the adult emergence in over-summering beetles from their cocoons. No da-

Figs 1-2. *Alphasida puncticollis*: 1 - Section of a nymph cocoon from Lampione Islet containing a teneral and its pupal exuvia; 2 - the remains of a nymph cocoon

ta about the climate of Lampione Islet are available, although it should not differ significantly from that of the nearby island of Lampedusa, with an average annual rainfall and temperature, respectively, of 320 mm and 19 °C (Pasta, 2002). During the xeric season (from early April to late October), rainfall generally results lesser than 35 mm and average monthly temperature ranges from 18.7 to 26.1 °C (Vittorini, 1973). Therefore, several environmental factors (e.g. a prolonged and strong drought period, the scattered vegetation occurring on the flat top, the scarce soil restricted to the calcareous rock crevices) could represent as many unfavourable conditions for over-summering immature tenebrionids, in particular during the phase characterized by reduced mobility. The pupation strategy observed in *Alphasida* of Lampione places some unresolved problems. From the available data, as above mentioned, it results to be the first case recorded for the species belonging to this genus. Anyway, further investigations are needed in order to clarify if, in other populations of *Alphasida puncticollis*, pupae development takes place inside a cocoon, and eventually the significance of this distinctive trait of the species life-history in evolutionary terms; or if it represents a peculiar and/or seasonal adaptation under environmental constraints, such as several behavioral modifications occasionally recorded for other insects (Danks, 2007).

Acknowledgements

We are grateful to Fabien Soldati, who kindly provided his personal observations and unpublished data on the biology of darkling beetles; to Julio Ferrer, Roland Grimm, Harol Labrique, and Piero Leo, for their useful suggestions.

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