

Notes on the Sicilian cave-dwelling species of Auchenorrhyncha (Insecta Rhynchota)

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ABSTRACT

Up to now, there are very few species of troglobitic Auchenorrhyncha identified for Europe outside the Macaronesian region belonging to the Cixiidae family. From the biospeleological point of view, Sicily is a very interesting island because the presence of both limestone caves and lava tubes that allow a variety of specialized taxa belonging to different groups of Invertebrates. Concerning Auchenorrhyncha, at least two obligately cave-dwelling species belonging to *Ibleocixius* D'Urso et Grasso, 2009 and *Cixius* Latreille, 1804 genera inhabit the Sicilian caves. *Ibleocixius* is a troglobitic genus, endemic from Sicily with a unique species, *Ibleocixius dunae*, living in a limestone cave of the Hyblean plateau (South-eastern Sicily). Recently, a new troglobitic taxon (under description) has been found in some lava tubes on the Etna volcano; it belongs to *Cixius* genera, to *C. pallipes-wagneri* group. Both taxa live on the roots that penetrate the caves. They have a different palaeogeographic history. *Ibleocixius dunae* is a paleoendemic taxon showing strong degree of troglomorphy, and the genus differs from *Cixius* and related taxa in a different arrangement of several characters which are also present in other taxa. *Cixius* n. sp. is a neoendemic taxon showing morphological characters close to those of the epigeal species *Cixius wagneri* sensu Holzinger et al. (2003).

KEY WORDS

Cixiidae; lava tubes; limestone caves; Sicily; troglobitic species.

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INTRODUCTION

Biospeleological researches in Sicily are relatively recent, they have been carried out since the 1970s and have outlined a picture of the regional cave-dwelling populations, even if still incomplete (Caruso & Costa, 1978; Caruso & Grasso, 1996).

In Sicily, more than 700 caves are known; only a few hundred studied from the biological point of view and today there are new discoveries. There are

lava tubes, limestone caves and other interesting caves in chalky soils.

Caves in gypsum (sulphurous chalky series) are present in the South-central portion of the Island; limestone caves are more common; lava tubes are present only on the Etna volcano (located in the eastern part, near Ionian Sea) but not in the volcanic rocks of Iblean Mounts that are more ancient due to submarine and sub-aerial pre-Etna volcanism during Pliocene and Pleistocene.

Etna is a Mediterranean mountain, 3300 meters

high, arose around 500.000–600.000 years ago (Quaternary); it has more than 200 lava tubes.

From the biospeleological point of view, Sicily is a very interesting island because of the different geological origin of caves which reflects on a great variety of trogliphilic and troglobitic taxa.

Adaptation of Auchenorrhyncha to hypogean life occurred in several Fulgoromorpha strains, but most of the cave-dwelling species (trogliphilic and troglobitic) are included in Cixiidae and Meenoplidae families. Taxa belonging to those families are dependent on soil during a part of their life cycle because immature stages feed on roots and live underground or near the ground. The only known species living in soil interstices are two Delphacidae and one Hypochthonellidae (Hoch, 2002; Hoch et al., 2006).

There are more than 50 known cave-dwelling and endogean species belonging to 5 families (Hypochthonellidae, Delphacidae, Kinnaridae, Meenoplidae and Cixiidae), living in different regions of the world.

In particular, Hawaii Islands are very rich in species, in fact numerous lava tubes host cave-dwelling species (Fig. 1).

As far as Europe is concerned, only the Canary Islands and the Azores are relatively rich in cave

species; in fact for the Canaries three species of Meenoplidae and nine of Cixiidae are known while for the Azores two species of Cixiidae have been described.

Up to date, troglobitic Auchenorrhyncha described from Europe outside the Macaronesian region include two Cixiidae species: from Sicily *Ibleocixius dunae* D'Urso et Grasso, 2009 and from Croatia *Trirhacus helenae* Hoch, 2013.

In addition, for continental Europe there is a (still unpublished) report of a Cixiidae living in a single cave in southern France. This species has not been described, since only a few nymphs without eyes have been found (Hoch, 1994).

New discoveries are under study (Hoch personal communication) and concerning Sicily, an additional new troglobitic taxon under description is here reported.

MATERIAL AND METHODS

Here are summarized the results obtained from speleological research carried out for more than a decade in caves in eastern Sicily. These are lava tubes of Mount Etna and limestone caves of the Hyblean region.

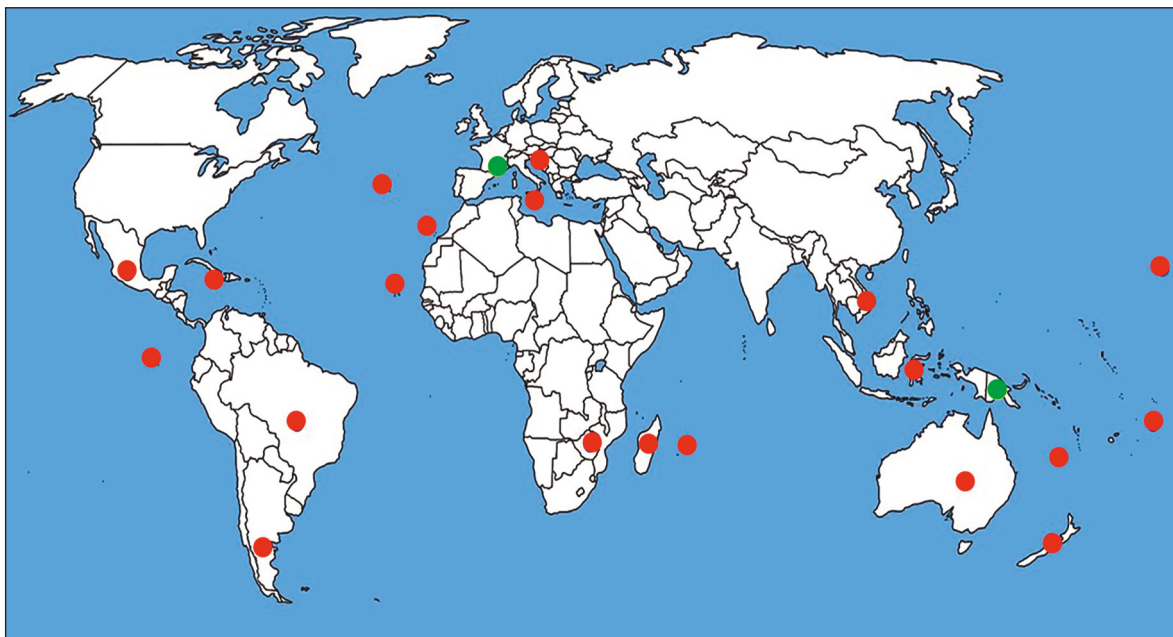


Figure 1. Distribution of Auchenorrhyncha cave-dwelling and endogean species living in different regions of the world. Red dots: described taxa; green dots undescribed taxa.



Figure 2. *Ibleocixius dunae*, male: Sicily, Grotta Di Natale, Priolo Gargallo, Siracusa (photo by V. D'Urso).



Figure 3. *Cixius* n. sp., male: Sicily (Catania), Etna (photo by A. Puglisi).

RESULTS

Up to date, in Sicily two troglobitic species are reported:

1. one belonging to *Ibleocixius* (a troglobitic genus), endemic from Sicily with a single species, *Ibleocixius dunae* D'Urso et Grasso 2009 (Fig. 2), living in a limestone cave of South-eastern Sicily.

2. the second species, under description, has been found in some lava tubes in the Etna volcano; it belongs to *Cixius* genus, within *C. pallipes-wagneri* group (Fig. 3).

Ibleocixius dunae inhabits Grotta Di Natale; it is located at about 200 m asl, in a Oligo-Miocene carbonate succession, where Climiti mountains originate, not very far from the sea. The definitive emersion of this area started during medium Pleistocene, about 0.7 Ma. The epigeic vegetation is typical of the Mediterranean bush (*Olea oleaster*, *Ceratonia siliqua*, *Celtis australis*, etc.) and its roots penetrate the cave. *Ibleocixius dunae* is a paleoendemic taxon showing strong degree of troglomorphy (reduction of eyes and wings, cuticle depigmentation, abundant wax production, etc.) due to the cave-dwelling life. The main characteristics of the species concerning the strong reduction of the eyes and the male and female genitalia. The genus differs from *Cixius* and related taxa in a different combination of several characters which are also present in other cixiids genera.

Specimens of *Cixius* n. sp. have been found in several lava tubes at high and low altitudes (about

200 to 1300 m asl). The vegetation on lava flow surface is typical of the different altitudinal planes of Etna where there are lava tubes inhabited by the new species.

DISCUSSION

It is possible to hypothesize that the genus *Ibleocixius* could have arisen from an epigeic species of *Cixius*, today extinct, that colonized the hypogeic habitat to exploit new rich food resources represented by roots. However, it is not possible to exclude that the driving force leading to adaptation to the hypogeic life could have been the deterioration of the epigeic habitat (D'Urso & Grasso, 2009). Considering the recent emersion of the area with the cave in which *Ibleocixius dunae* has been found, it very probably originated before, in a different area; only subsequently the species reached the current location through the cracks and caves network of the karstic Hyblean Plateau.

Cixius n.sp. is a neoendemic taxon showing morphological characters close to those of the epigeic species *Cixius wagneri* sensu Holzinger et al. (2003). The taxa of the *C. wagneri* group (*Cixius wagneri* - *C. pallipes* complex) create some taxonomic problems since it is not ascertained that they are two distinct species. The external morphology is similar but there are differences in the copulatory organs of males that some specialists evaluate as simple intraspecific variability.

Given the young age of Etna, where the lava flows have followed and succeeded one another, and the presence of the new species in several caves with specimens having similar range of variability, it is possible that a taxon belonging to *C. wagneri* group could have adapted to complete its whole life-cycle underground and was able to move between different lava flows through cracks and cavities.

CONCLUSIONS

The two troglotic endemic species living in Sicily inhabit geologically different caves and show a different palaeogeographic history. Their presence once again proves the scientific importance of the Sicilian caves also from the point of view of the richness of biodiversity. It should be emphasized that currently there are only three troglotic species of Auchenorrhyncha identified for Europe outside the Macaronesian region and two of these are exclusive to Sicily. It is therefore evident that the different types of caves, especially karstic and volcanic, represent an added value for the Island and that all cavities deserve to be investigated in depth, hoping that in the future they may offer other new interesting discoveries.

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