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A mass dispersal event of *Quedius hellenicus* (Coleoptera: Staphylinidae: Staphylininae)

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A b s t r a c t : In spring 2017, a mass dispersal event of *Quedius hellenicus* ASSING, 2017, the first observation of such a behaviour in the genus, was witnessed in the Greek island Corfu. Additional evidence is presented suggesting that *Q. hellenicus* inhabits a subterranean habitat and that this most likely also applies to other representatives of the *Q. coloratus* group.

K e y w o r d s : Coleoptera, Staphylinidae, Staphylininae, Quediina, *Quedius hellenicus*, Greece, Corfu, mass dispersal, superficial subterranean habitat, MSS.

Introduction

Quedius (Raphirus) hellenicus ASSING, 2017 was described recently in a revision of the group of *Q. coloratus* FAUVEL, 1875, which currently includes five described species distributed in the East Mediterranean from the southern Balkans to the Middle East (ASSING 2017). The known distribution of *Q. hellenicus* ranges from North Greece to the southern Pelopónnisos. A previous record of *Q. coloratus* from Corfu (COIFFAIT 1976) was tentatively attributed to *Q. hellenicus*. Based on available evidence (collecting data, scarcity of records) it was concluded that, like the other representatives of the *Q. coloratus* group, *Q. hellenicus* probably lives in a subterranean habitat, most likely the superficial subterranean habitat (MSS).

Observations of mass aggregations of insects have been documented on numerous occasions. Well-known examples are the monarch butterfly *Danaus plexippus* (LINNAEUS, 1758) and migratory locusts. In beetles, mass dispersal events have repeatedly been observed, e.g., for lady beetles. Very recently, CUCCODORO (2017) reviewed cases of mass aggregations in Steninae, a subfamily of Staphylinidae. However, to my knowledge, such observations have never been made for species of *Quedius* STEPHENS, 1829, a mega-diverse genus currently represented by more than 600 described species in the Palearctic region alone.

During a field trip to Corfu conducted by Michael Schülke (Berlin) and the author in spring 2017, a mass dispersal event of amazing dimensions of *Quedius hellenicus* was witnessed on Oros Pantokratoras (North Corfu). It is the first observation of this kind for the genus as a whole.



Map 1: Records of *Quedius hellenicus* on Corfu (black circles).

Material and methods

The material treated in this study is deposited in the following collections:

MNB Museum für Naturkunde, Berlin (including coll. Schülke; J. Frisch, M. Schülke)

ZMC..... Zoological Museum, Natural History Museum of Denmark, Copenhagen (A. Solodovnikov)

cAss..... author's private collection

cFel private collection Benedikt Feldmann, Münster

Observations

During the field trip to Corfu in 2017, Oros Pantokratoras (Mount Pantokrator) was visited four times. With an elevation of little more than 900 m, this calcareous mountain is the highest summit of the island. While the west, south, and east slopes are predominantly rocky with scattered trees, bushes, and a thin grass cover (Fig. 1), the vegetation of the north slope is characterized by a moderately sparse pine forest with scattered deciduous trees, and with undergrowth of bushes, herbs, and relatively long grass (Fig. 4). Even on the north slope, however, the soil is composed of a mix of humus and cal-

careous stones of various sizes, suggesting that here the MSS stratum is very close to the surface. The summit itself features the monastery Pantokratoros Ipsilou, a tavern, a parking area, and numerous antennae. The north and east sides of the monastery are delimited by high walls on the very edges of the summit (Fig. 2). Several localities at different altitudes were sampled on Oros Pantokratoras and its environs, primarily on the north slope.

The primary method employed for collecting Staphylinidae in Corfu was sifting litter and roots in various habitats, particularly forests. Using this method, 66 specimens were collected in several localities, all of them on the north slope of Pantokratoras or its immediate vicinity (Map 1). Details on the sifted material of *Q. hellenicus* are given below:

Greece: Corfu: 1 ♂, NW Pantokratoras, 39°45'40"N, 19°51'00"E, 660 m, oak forest margin, litter, roots, and moss sifted, 31.V.2017, leg. Assing; 1 ex., NW Pantokratoras, 39°45'41"N, 19°51'08"E, 670 m, oak forest margin with rocks, litter, roots, and moss sifted, 31.V.2017, leg. Schülke; 14 ♂ ♂, 13 ♀ ♀, 6 exs., Pantokratoras, N-slope, 39°44'56"N, 19°52'18"E, 860 m, rocky calcareous slope with scattered pine and deciduous trees, litter and roots between rocks sifted, 31.V.2017, leg. Assing & Schülke; 14 ♂ ♂, 6 ♀ ♀, 2 exs., same data, but 1.VI.2017; 2 ♀ ♀, 2 exs., same data, but 3.VI.2017; 1 ♂, Pantokratoras, N-slope, 39°44'57"N, 19°52'12"E, 800 m, slope with scattered pine, deciduous trees, and bushes, litter and roots between rocks sifted, 31.V.2017, leg. Assing; 1 ♂, 1 ex., same data, but 4.VI.2017, leg. Assing & Schülke; 1 ♂, 1 ex., W Pantokratoras, 39°44'54"N, 19°51'30"E, 740 m, cirque, litter and roots sifted, 1.VI.2017, leg. Assing & Schülke. Material deposited in cAss, cFel, MNB, ZMC).

None of the species of the *Quedius coloratus* group has ever been collected in such quantities by sifting. It seems, however, that the abundance of *Quedius hellenicus* in the upper layers of the soil is a seasonal phenomenon (see conclusions below).

While working on soil samples below the summit of Oros Pantokratoras on 31 May 2017, Michael Schülke and I were approached by the owner of the summit tavern, Dimitris Kolovos. Our activities had evidently raised his interest. When shown some Staphylinidae in my aspirator, among them several specimens of *Q. hellenicus*, he informed us that there were millions of them at the monastery on the summit, a tourist-annoying pest he was fighting with insecticides every day. We informed him that the pest insect at the monastery was most likely something else and that *Q. hellenicus* was an extremely rarely found species that, at that time, had not even been described. The tavern owner admitted that he did not know a lot about insects and left.

It was when we went up to the tavern for some coffee that we met Dimitris again. As soon as he caught sight of us, he invited us to join him for a visit to the monastery and have a look at the insect pest. When we arrived at the north wall we realized that we could not have been more wrong regarding his judgement. Indeed, what we saw was millions of specimens of *Q. hellenicus*, most of them sprayed to death and lying along the bottom of the wall, but many thousands of them alive and crawling all over the place, especially where the monastery walls formed corners (Figs 5-8; two short video clips can be downloaded at <http://www.zobodat.at/pdf/Quedius%20hellenicus.mp4> and <http://www.zobodat.at/pdf/Quedius%20hellenicus1.mp4>). Dimitris kindly accepted our request to refrain from spraying insecticides at least on the following day, so that we had a chance to assess the full extent of this mass emergence.

As agreed, we arrived in the morning of the following day and, indeed, *Q. hellenicus* was everywhere by the millions, many of them crawling on the ground and on the monastery walls, and the remainder on the wing; in fact the air was full of flying *Q. hellenicus*.



Figs 1-4: Oros Pantokratoras: (1) west slope (above); (2) north wall of monastery on summit (lower left); (3) yard on the north side of monastery (mid-right); (4) north slope of Pantokrator below summit (lower right).



Figs 5-6: Monastery on summit of Oros Pantokratoras on 1 June, 2017: northwestern monastery wall with numerous specimens of *Quedius hellenicus*.

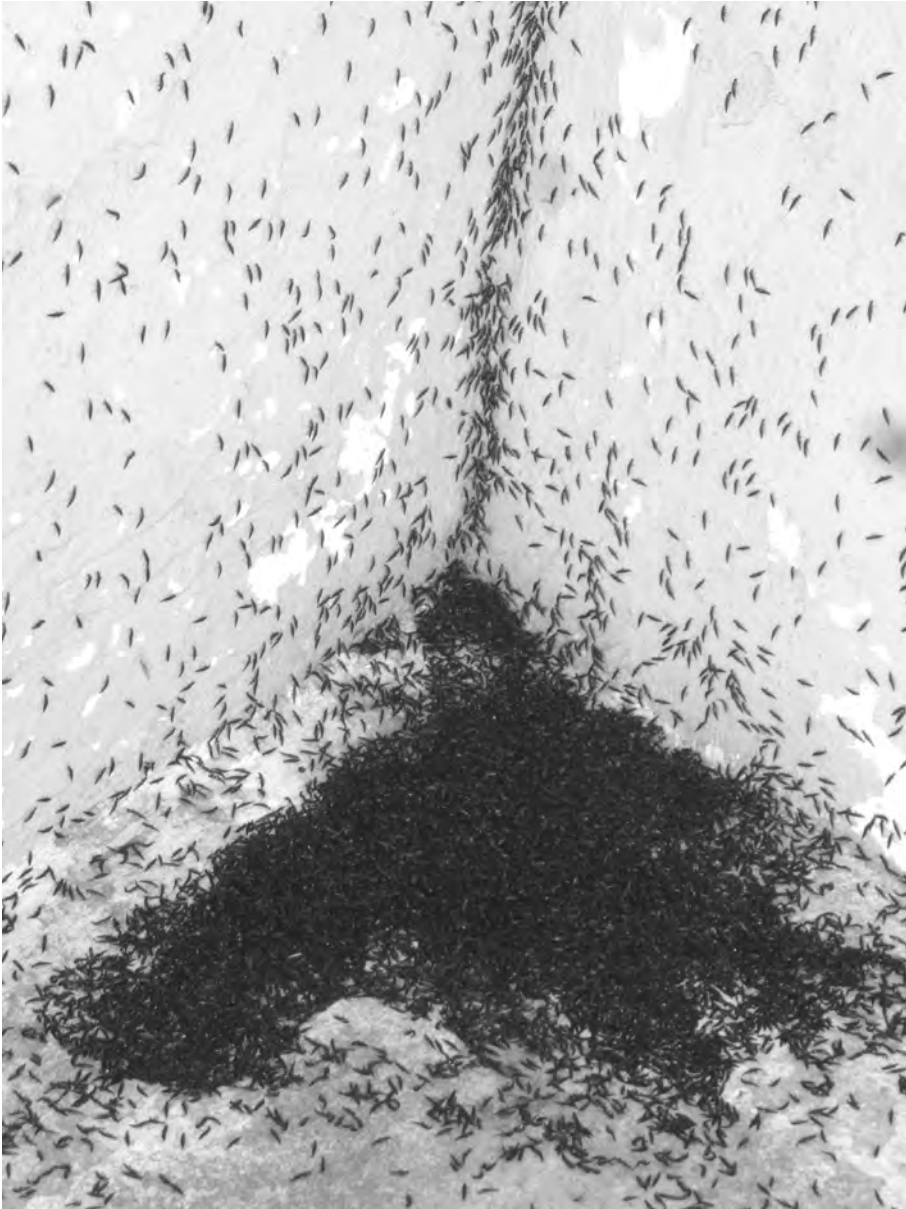


Fig. 7: Monastery on summit of Oros Pantokratoras on 1 June, 2017: north wall with thousands of specimens of *Quedius hellenicus*.

Most of the tourists going for a stroll around the monastery were partly scared, partly annoyed, only few were actually interested in this phenomenon. After scooping a few thousand specimens of *Q. hellenicus* into vials in a matter of seconds (we could have filled buckets in no time), we screened the area for other beetles emerging from the

mountain. Only two species, a carabid (*Leistus* sp.) and a cholevid (*Choleva cisteloides cisteloides* (FRÖLICH, 1799)), were found in larger numbers (> 200 specimens each). The following staphylinids were collected from the walls and stairs of the monastery: *Anotylus nitidulus* (GRAVENHORST, 1802) (1 ex.), *Stenus aceris* STEPHENS, 1833 (6 exs.), *S. parciior* BERNHAUER, 1929 (3 exs.), *Ocypus* sp. (1 ex.), *Quedius boops* (GRAVENHORST, 1802) (1 ex.), *Q. nivicola* KIESENWETTER, 1858 (1 ex.), *Parabolitobius inclinans* GRAVENHORST, 1806 (1 ex.), *Falagrioma thoracica* (STEPHENS, 1832) (3 exs.), *Atheta trinotata* (KRAATZ, 1856) (1 ex.), and *Aleochara funebris* WOLLASTON, 1864 (1 ex.).



Figs 8: Monastery on summit of Oros Pantokratoras on 1 June, 2017: close-up of northwest wall.

Dimitris informed us that he observed this mass emergence every year, usually at the end of May or in the beginning of June, when temperatures rose to approximately 30 °C, and that it lasted for approximately ten days. The beetles would start crawling up the outside walls of the monastery (Fig. 2) in the morning and be swarming and crawling all over the place until the afternoon. On some days, there would be about five times as many beetles as what we were observing in 2017, so many that the monastery walls were completely covered with these insects. His observations were confirmed by a local employee working at the monastery who, among other things, was in charge of keeping the monastery clean.

Conclusions

The above observations confirm my earlier hypothesis that *Q. hellenicus* and probably also the other species of the *Q. coloratus* group live and reproduce in the MSS stratum or similar subterranean habitats. Judging from the visible output on the summit of Oros

Pantokratoras, this mountain alone probably hosts a population of billions of individuals of *Q. hellenicus*. Considering that this species is predatory, it can be concluded that the fauna in the superficial subterranean habitat must be enormously rich, at least as far as quantity is concerned. Adults of *Q. hellenicus* emerge from this habitat in spring, when the conditions are optimal for dispersal by flight. This also explains why the beetles particularly crawl up to, and emerge from, the summit of the mountain and why this species, which had been collected from the leaf litter layer only on rare occasions, was sifted in relatively large numbers from upper soil layers on Oros Pantokratoras.

The observations on Mount Pantokratoras suggest that *Q. hellenicus* and other representatives of the *Q. coloratus* group may be common in the limestone regions of the East Mediterranean, where suitable subterranean habitats are probably widespread. The same may also apply to *Q. nivicola*, which appears to have a similar life history (ASSING 2016). Recording these species should be fairly easy by visiting the summits of calcareous mountains during the respective dispersal periods.

Acknowledgement

The phenomenon presented in this paper would have escaped our notice, had it not been for Dimitris Kolovos' confidence, determination, and tenacity.

Zusammenfassung

Im Frühjahr 2017 wurde auf der griechischen Insel Korfu ein massenhaftes Erscheinen von *Quedius hellenicus* ASSING, 2017 beobachtet. Ein derartiges Ausbreitungsphänomen war bisher von keiner anderen Art der Gattung bekannt. Die Beobachtungen bestätigen, dass *Q. hellenicus*, wie vermutlich auch andere Arten der *Q. coloratus*-Gruppe, ein subterrane Habitat bewohnt.

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