

Supplementary information on *Zizeeria karsandra* (Lepidoptera: Lycaenidae) on Crete

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Abstract. For the first time spring and summer broods of *Zizeeria karsandra* (Moore, 1865) are documented from Crete. In March 2018, three or four specimens were found on waste ground near Matala, while in June the species was present in large numbers inside a greenhouse close to Kokkinos Pirgos. Genital preparations are presented, together with those of the sibling species *Z. karsandra* (Crete) and *Z. knysna* (Spain), thus confirming the taxonomic status of *Z. karsandra* in Crete.

Samenvatting. Voor de eerste keer werden in de lente en zomer legsels van *Zizeeria karsandra* (Moore, 1865) waargenomen in Kreta. In maart 2018 werden drie à vier exemplaren gevonden in een woestijn nabij Matala, terwijl in juni de soort in grote aantallen voorkwam in een serre dichtbij Kokkinos Pirgos. De genitaalpreparaten van de twee zustersoorten *Z. karsandra* (Kreta) en *Z. knysna* (Spanje) worden afgebeeld, waardoor de taxonomische status van *Z. karsandra* in Kreta bevestigd wordt.

Résumé. Pour la première fois, des pontes de *Zizeeria karsandra* (Moore, 1865) sont documentés en Crète. En mars 2018, trois à quatre spécimens ont été trouvés dans une terre en friche près de Matala, tandis qu'en juin l'espèce était présente en grand nombre dans une serre près de Kokkinos Pirgos. Des préparations génitales sont présentées pour les deux espèces apparentées *Z. karsandra* (Crète) et *Z. knysna* (Espagne), confirmant le statut taxonomique de *Z. karsandra* en Crète.

Key words. Lepidoptera – Lycaenidae – *Zizeeria karsandra* – Greece – Crete – faunistics.

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Introduction

In the countries surrounding the Mediterranean, the subtribe Zizeeriina is represented by two species: *Zizeeria karsandra* (Moore, 1865) and *Zizeeria knysna* (Trimen, 1862). According to Larsen (1986) the two species meet in Algeria. From here the distribution of the Afrotropical sister species *Z. knysna* extends southwards and to the west through Morocco, the Canary Islands and southern Portugal and Spain. Instead the distribution of the oriental *Z. karsandra* extends to the east, through Tunisia, Libya, Egypt, Israel, Jordan and Lebanon, with records but no recent ones, from the Mediterranean islands of Sicily, Crete, Cyprus and Rhodos. *Z. karsandra* is widely distributed in Cyprus (Makris 2003), while records from Crete lacked more specific location up to 2018 (Rowlings & Cuvelier 2018). Reliable separation of the two species requires examination of the male genitalia. As the work of Rowlings & Cuvelier (2018) did not include collected material, this left open questions on the taxonomic status, as well as unresolved questions on the relative abundance of spring and summer broods. Questions which the author attempts to address below.

Results

During 2018, several Danish lepidopterists visited Crete, on several occasions between late March and early October. Every visit included a search for *Z. karsandra* on the Messara plain, based on information from the Internet, located by Morten S. Mølgaard in September 2017 (<http://www.schmetterling-raupe.de/art/karsandra.htm>) and information passed on, from one expedition to the next.

On March 28th Christian Videnkjær, Allan Bornø Clausen and Martin Bjerg visited and surveyed presumably suitable localities for *Z. karsandra*. Here three to

four worn specimens of *Z. karsandra* were recorded at Matala (figs. 1–2). Also the area around the Port of Kokkinos Pirgos was investigated and here suitable host-



Fig. 1. *Z. karsandra* at/op Matala 28.iii.2018. © Martin Bjerg.



Fig. 2. Habitat of/van *Z. karsandra* at/op Matala, 28.iii.2018. Photo/Foto: Christian Videnkjær.



Fig. 3. The greenhouse and surroundings at Kokkinos Pargos 19.vi.2018. Photo © Arne Lykke Viborg.

Fig. 3. De serre en omgeving van Kokkinos Pargos 19.vi.2018. Foto © Arne Lykke Viborg.



Fig. 4. The habitat of *Z. karsandra* in the greenhouse at Kokkinos Pargos 19.vi.2018. Photo © Arne Lykke Viborg.

Fig. 4. De habitat van *Z. karsandra* in de serre te Kokkinos Pargos 19.vi.2018. Foto © Arne Lykke Viborg.

plants were recorded, but the search for adults was negative. At Matala, *Medicago marina* was observed as resting place and nectar source and an undetermined species of *Trifolium* with furry seed heads was observed as a resting place. The following plant species were also searched for resting specimens at Matala: a large species of *Medicago* perhaps *M. sativa*, a small *Melilotus* species perhaps *M. indica*, a species of clover reminiscent of *Trifolium resupinatum* and a small *Polygonum* (?) species. At the harbour of Kokkinos Pargos, a single example of *Tribulus terrestris* and different low growing unknown species of Fabaceae were searched.

Based on the condition of the butterflies at Matala, it seems reasonable to assume that the first brood of *Z. karsandra* is on the wing from early March, as suggested by Pamperis (Rowlings & Cuvelier 2018).

On June 18th and 19th, the author, accompanied by his wife, searched for *Z. karsandra* at the Messara plain first on the 18th at Kokkinos Pargos in the afternoon, just after a thunderstorm. As the sun reappeared, the search focused along the margins of the road connecting Kokkinos Pargos and Timpaki. During the next 30 minutes five or six *Z. karsandra* were observed. The majority were

observed at the end of a greenhouse, where there was a patch of moist earth. In the same area, single specimens of *Carcharodus alceae* (Esper, 1780), *Gegenes nostrodamus* (Fabricius, 1793) and *Gegenes pumilio* (Hoffmannsegg, 1804) were found. Identification of the *Gegenes* specimens was based purely on external morphology.

On June 19th, along the road from Kalamaki towards Kokkinos Pargos, four or five stops were made to look for *Z. karsandra* at habitats presumed to be suitable. This included areas close to a dried up streambed and open areas close to olive groves and orchards. Mid-June, the green herbaceous vegetation was almost entirely restricted to *Capparis*-species. The earth was dry and hard, and all these stops proved negative. Then an area with greenhouses was reached between Kokkinos Pargos and Timpaki. There was nothing found along the road margins, but then the author's wife found a few *Z. karsandra*. Once more it was at the end of a greenhouse where water had been spilled. Subsequently the neighbouring area alongside the greenhouse was searched, even though it seemed inhospitable for butterflies, as the ground was very dry and lacked green vegetation. The greenhouse appeared to have a one-metre-wide opening along the sides to allow ventilation. Through this opening it was clearly visible that the ground of the greenhouse was covered by 30–40 cm high green weeds (fig. 3–4). A closer look inside the greenhouse revealed several *Z. karsandra* flying inside or just above the vegetation. The greenhouse appeared to be water melon cultivation, but in the midst and almost covered by a diverse herbaceous vegetation. During the next 30 minutes at least 60 specimens of *Z. karsandra* were observed in an area of less than 200 square meters. The female/male ratio was approximately 1/1.5. While a high proportion of the females were fresh, most of the males were worn, indicating they had been on the wing for at least a week.

On October 3rd 2018 the same greenhouse was visited by Torben Friis-Larsen, and during 15 minutes he collected two females and five males of *Z. karsandra*, all fresh.

Genital preparations

Genital preparations were made of a male *Z. karsandra* and a male *Z. knysna* from Gran Canaria. In Higgins (1975) the genitalia of *Z. knysna* and *Z. karsandra* are figured. The description states that the valve apex is pointed in *Z. knysna*, while it is almost rectangular in shape in *Z. karsandra*. This corresponds well to the genital preparations shown in figs. 5–6.

The butterflies are shown in figs. 7–10. According to Larsen (1986), the eyes of *Z. knysna* should be naked, while those of *Z. karsandra* should be hairy. This character which is not at all obvious in the depicted specimens, in which the eyes of both species appear naked.

Discussion

Based on the present information, the first generation of *Z. karsandra* flies in Crete in March and in low numbers.



Fig. 5. Genital preparation of *Z. knysna*. Puerto Rico, Gran Canaria, Spain. 7.iii.1993. Leg. Flemming Vilhelmsen. Photo © Mikkel Høegh Post.
Fig. 6. Genital preparation of *Z. karsandra*. Kokkinos Pargos, Crete, Greece. 19.vi.2018. Leg. Arne Lykke Viborg. Photo © Mikkel Høegh Post.

Fig. 5. Genitaalpreparaat van *Z. knysna*. Puerto Rico, Gran Canaria, Spanje. 7.iii.1993. Leg. Flemming Vilhelmsen. Foto © Mikkel Høegh Post.
 Fig. 6. Genitaalpreparaat van *Z. karsandra*. Kokkinos Pargos, Kreta, Griekenland. 19.vi.2018. Leg. Arne Lykke Viborg. Foto © Mikkel Høegh Post.



Fig. 7. Underside *Z. knysna*. Puerto Rico, Gran Canaria, Spain. 7.iii.1993. Leg. Flemming Vilhelmsen. Photo © Mikkel Høegh Post.
Fig. 8. Underside *Z. karsandra*. Kokkinos Pargos, Crete, Greece. 19.vi.2018. Leg. Arne Lykke Viborg. Photo © Mikkel Høegh Post.
Fig. 9. Upperside *Z. knysna*. Puerto Rico, Gran Canaria, Spain. 7.iii.1993. Leg. Flemming Vilhelmsen. Photo © Mikkel Høegh Post.
Fig. 10. Upperside *Z. karsandra*. Kokkinos Pargos, Crete, Greece. 19.vi.2018. Leg. Arne Lykke Viborg. Photo © Mikkel Høegh Post.

Fig. 7. Onderkant *Z. knysna*. Puerto Rico, Gran Canaria, Spanje. 7.iii.1993. Leg. Flemming Vilhelmsen. Foto © Mikkel Høegh Post.
 Fig. 8. Onderkant *Z. karsandra*. Kokkinos Pargos, Kreta, Griekenland. 19.vi.2018. Leg. Arne Lykke Viborg. Foto © Mikkel Høegh Post.
 Fig. 9. Bovenkant *Z. knysna*. Puerto Rico, Gran Canaria, Spanje. 7.iii.1993. Leg. Flemming Vilhelmsen. Foto © Mikkel Høegh Post.
 Fig. 10. Bovenkant *Z. karsandra*. Kokkinos Pargos, Kreta, Griekenland. 19.vi.2018. Leg. Arne Lykke Viborg. Foto © Mikkel Høegh Post.

The next recorded generation is from mid-June, while the last generation seems to fly in September–October. It seems reasonable that there might be a generation between the recorded spring and summer broods, and again between the recorded summer and autumn broods.

It is the author's guess that population density peaks during the different summer broods, and that a great majority of the butterflies during spring and early summer

retreats to open greenhouses which are grown organically. Here, inside or between greenhouses, the species has optimal conditions with fresh green larval host plants, and here Larsen (1986) description applies: "*Z. karsandra* is a very sedentary species, and its populations may inhabit localities of a few square metres. It is usually associated with moist patches where various Leguminosae (Fabaceae) grow." When the growth and

watering in the greenhouses ends during summer, the vegetation in the greenhouses dies out and this probably forces *Z. karsandra* to disperse. Here, as described by Rowlings & Cuvelier (2018), they colonise waste ground close to human habitation where water has been spilled or where irrigation takes place. The relative scarcity of females in autumn reported by Rowlings and Cuvelier (2018), might be because the males disperses more readily than the females, or it may reflect that the date was at the start of that generation when males are normally more common than females.

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