Zizeeria karsandra (Lepidoptera: Lycaenidae) recorded from Crete (Greece): observations, distribution and habitats

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Abstract. *Zizeeria karsandra* (Moore, 1865) is formally documented with location details from the Greek island of Crete for the first time. This resolves a history of rumours, assertions and doubts of its presence on Crete and more widely in Greece. The butterfly was found easily but in low numbers over a five-day period in mid-October 2017. It was confirmed from a total of eleven locations across the lower Messara plain (Heraklion province, southern Crete). Provisional limits of its range are provided. The use of dry waste ground in urban habitats is reported. Further searches of suitable habitats in Crete and other Mediterranean islands would lead to a better knowledge of the distribution, phenology and ecology of this discrete and easily overlooked species.

Samenvatting. De aanwezigheid van *Zizeeria karsandra* (Moore, 1865) wordt formeel gedocumenteerd voor het Grieks eiland, Kreta met gedetailleerde plaatsgegevens. Dit brengt een einde aan een geschiedenis van geruchten, beweringen en twijfels over het voorkomen van de soort in Kreta of breder in Griekenland. De vlinder werd vlot gevonden in lage aantallen gedurende een periode van vijf dagen medio oktober 2017. Er is bevestiging van in totaal elf plaatsen verspreid over het lagere deel van de Messara vlakte (provincie Heraklion, zuiden van Kreta). De voorlopige limieten van de verspreiding worden gegeven. Het voorkomen op droge, niet gecultiveerde terreinen in urbaan gebied wordt gedocumenteerd. Verder onderzoek naar geschikte biotopen in Kreta en andere eilanden in de Middellandse Zee kan leiden tot een betere kennis van de verspreiding, fenologie en ecologie van deze onopvallende en vaak over het hoofd geziene soort.

Résumé. La présence de *Zizeeria karsandra* (Moore, 1865) est documentée formellement pour la première fois de la Crête, Grèce, avec des données précises des sites. Les doutes et rumeurs sur sa présence en Crête et plus largement en Grèce sont ainsi levés. Le papillon a été trouvé sans peine mais en petit nombre sur une période de cinq jours en mi-octobre 2017. Onze sites ont été confirmés à travers la basse plaine de Messara (province d'Héraklion, sud de la Crête). Les limites provisoires de répartition sont présentées. L'exploitation de terrains vagues secs dans les zones urbaines est documentée. Des recherches supplémentaires des biotopes adaptés en Crète et dans d'autres iles Méditerranéennes mèneront à une meilleure connaissance de la distribution, de la phénologie et de l'écologie de cette espèce discrète et facilement ignorée.

Keywords: Lepidoptera – Lycaenidae – *Zizeeria karsandra* – Greece – Crete – distribution – habitat – faunistics.

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Introduction

There are few documented records of *Zizeeria karsandra* (Moore, 1865) from the island of Crete and of these, detailed data have been mostly lacking. This is surprising considering that Crete is a frequent destination for lepidopterists, attracted by the high level of endemism on the island. Some doubts have been expressed about its presence at all on the island (Anastassiu 2010) due to this lack of formally documented evidence, negative results from targeted surveys and its absence from nearby Turkey (Hesselbarth *et al*. 1995). There is only one other published record from Greece, from Rhodes in 1958 (Olivier 1993). Its absence on the Dodecanese islands, located roughly between Crete and mainland Turkey, is confirmed by Cuvelier *et al*. (2012). Pamperis (1997, 2009) has consistently reported its presence on Crete albeit while withholding detailed location information. He published photos with legends CRE, Chania, 0 m, 28.x.1994 (Pamperis 2009) and on his website: 5.xi.2010 and 28.x.2012. Two independent references were found on the Internet during 2017, including location data on www.lepiforum.de: "Straße bei Matala" (street in Matala) and on www.gbif.org with coordinates pointing to the nearby town of Voroi. All photographic sources found at the time of RM's visit related to October and November. RM visited southern Crete to search for *Z. karsandra* between 16th and 20th October 2017 during a family holiday based in Matala. This is probably the optimum time to search for *Z. karsandra*.

Z. karsandra is a lowland species, so I decided to focus my search on the Messara plain (Fig. 1). The plain runs east to west, flanked by hills to the south and mountains to the north. It is roughly 10 km wide at sea-level in the west, rising to roughly 300 m approximately 35 km to the east. Olive groves dominate land use, with numerous plastic greenhouses in the NW. around Timpaki. During our stay, *Z. karsandra* was found to be widespread in the lower region of the Messara plain. Time allowed only one day of dedicated research to establish the range. I searched from NW. of Timpaki and along the main road eastwards to Asimi. Time did not permit the investigation of the area west of Chania, indicated on the distribution map for *Z. karsandra* in Pamperis 2009. The aim of this paper is to document my observations of *Z. karsandra* during my visit.

Methods

Literature suggests the species can be found in naturally damp areas such as water courses. In October there is almost no natural fresh water at low levels on the Messara plain. Experience with the closely similar *Z. knysna* from Spain suggested human habitations, watered gardens and other human related damp areas should be considered in any search. Makris (2003) reports all these habitats are used on Cyprus. During my very first walk into

Matala I found *Z. karsandra* at the edge of dry dusty waste ground close to human habitation (Fig. 4). This strongly correlated to similar habitat requirements of *Z. knysna* so I prioritised searching these locations over (very) dry natural water courses. A net was not used, and no insects were captured. Photographs were taken of butterflies in natural conditions and habitats.

Observations

The map (Fig. 2) shows the locations surveyed. The presence or absence of *Z. karsandra* is recorded. Details of the locations and results are given in Table 1. Internet and literature references are also shown.

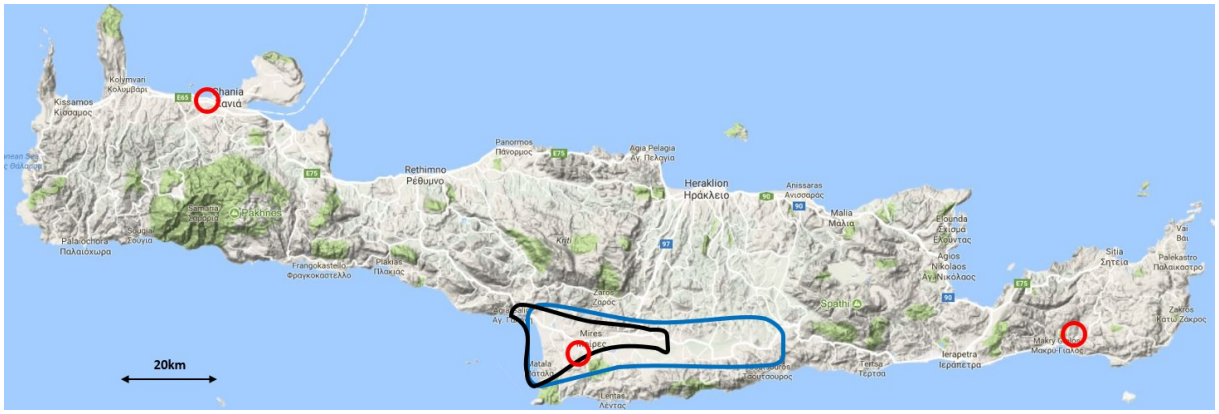

Fig. 1. Map of Crete showing the Messara plain (blue), distribution of *Z. karsandra* confirmed between 16 and 20th October 2017 (black) and literature references (red). Map data © Google.

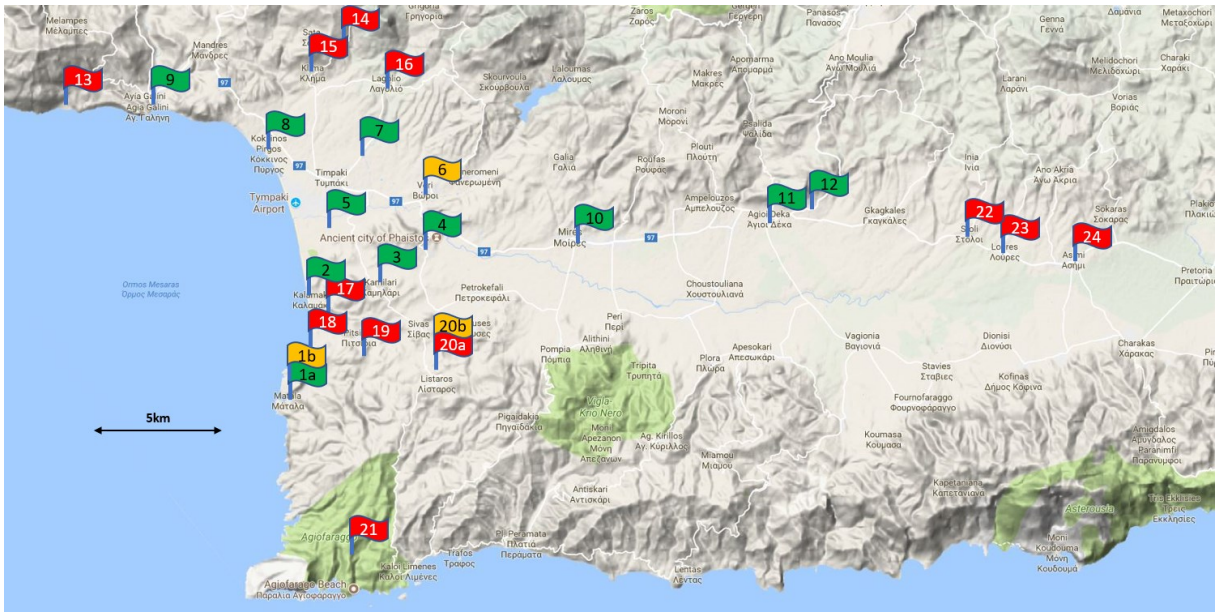

Fig 2. Map showing sites visited in the search for *Z. karsandra* on the Messara plain. Green flag: *Z. karsandra* present; Red flag: *Z. karsandra* not found; Yellow flag: Internet and literature references. Site details are given in table 1. Map data © Google

Table 1. Details of locations surveyed for *Z. karsandra*, with results and a description of each site. Refer to flags in Fig 2.

Site details: flag number, locality, altitude, coordinates (decimal coordinates)	***Z. karsandra* Numbers seen + dates**	**Locality description and comments**
1a – Matala, 5 m 34.99N 24.75E	Daily sightings 5 or 10♂ 1 or 2♀ 16–20.x.2017	Habitat: fig 4. Several locations in urban situations behind the town. Bare hard dry dusty waste ground close to irrigated gardens. In one instance, a single male was found flying along a dusty road about 200m from any green vegetation.
1b – Matala, 5m 34.99N E24.75E	Internet reference	Internet reference lepiforum.de: “Straße bei Matala” (street in Matala)
2 – Kalamaki, 5m 35.03N 24.76E	2♂ 18.x.2017	Habitat: fig 7. Urban. Dry dusty waste ground with sparse green plants. Brief survey to confirm presence.
3 – Kalimari, 90m 35.03N 24.79E	1♂ 19.x.2017	Urban. Dry dusty waste ground with sparse green plants. Brief survey to confirm presence.

Site details: flag number, locality, altitude, coordinates (decimal coordinates)	*Z. karsandra* Numbers seen + dates	Locality description and comments
4 – Agios Ioannis, 50m 35.05N 24.81E	1♂ 17.x.2017	Nectaring at dry dusty roadside wasteland with abundant flowering *Heliotropium europaeum*. Brief survey to confirm presence. Just below the ancient Minoan palace of Phaistos.
5 – Kalamaki (north), 15m 35.04N 24.77E	1♂ 18.x.2017	Intensively farmed area, extensive irrigation and plastic green houses. Perhaps surprisingly only a single male was found here in this habitat superficially like many of the urban habitats in it was found.
6 – Voroi, 60m 35.07N 24.81E	Internet reference	The village was not visited. The grid reference given on the Internet reference gbif.org shows an urban site amongst houses, similar in nature to many places the butterfly was found.
7 – Timpaki (north), 50m 35.09N 24.78E	2♂ 1♀ 19.x.2017	Habitat: fig 5. Agricultural. Strip of damp ground beside plastic greenhouse in otherwise dry dusty terrain and olive groves. With diverse green plants.
8 – Kokinos Pirgos, 0m 35 09N 24.73E	5♂ 2♀ 19.x.2017	Habitat: fig 3. Urban situation. Strip of damp ground at base of steep slope with houses and drain run offs. Butterflies were nectaring on a few flowers of variety of plants with a marked preference for the flowers of *Tribulus terrestis*.
9 – Agia Galini, 5m 35.10N 24.69E	1♀ 19.x.2017 Absent 20.x.2017	Urban. Dry dusty waste ground with sparse green plants. The only site in steep hilly country. Possibly the extreme western end of the distribution just beyond the Messara plain. Nectaring on *Dittrichia viscosa*.
10 – Mires, 70m 35.05N 24.88E	1♂ 19.x.2017	Urban. Dry dusty waste ground with sparse green plants. Brief survey to confirm presence.
11 – Agio Deka, 150m 35.06N 24.96E	2♂ 19.x.2017	Habitat: fig 8. Urban. Dry dusty waste ground with sparse green plants. Brief survey to confirm presence.
12 – Agio Deka NE, 200m 35.06N 24.98E	1♂ 19.x.2017	Habitat: fig 9. Urban. Dry dusty waste ground with sparse green plants. Brief survey to confirm presence.
13 – Agios Georgios, 15m 35.10N 24.65E	Not found 20.x.2017	Hills and cliffs, no flat open ground, limited human presence. Site appeared unsuitable.
14 – Below Vathiako, 430m, 35.14N 24.75E	Not found 19.x.2017	The highest site surveyed. No suitable habitat.
15 – Klima, 100m 35.11N 24.76E	Not found 19.x.2017	No suitable habitat found.
16 – Lagoli, 140m 35.10N 24.79E	Not found 19.x.2017	Urban. Habitat appeared suitable.
17 – Kalamaki olive grove, 30m, 35.03N 24.77E	Not found 18.x.2017	Habitat: fig 11. Irrigated olive groves with plentiful *Oxalis* and some other low plants in flower.
18 – Kommos, 0m 35.01N 24.76E	Not found 20.x.2017	Very dry coastal site, no human habitation or agriculture: no damp places.
19 – Kalimari olive grove, 70m, 35.02N 24.80E	Not found 19.x.2017	Habitat: fig 12. Irrigated olive groves with plentiful *Oxalis* and some other low plants in flower.
20a – Listaros, 170m 35.00N 24.82E	Not found 17.x.2017	Hot dry grassy gulley in hills, lacking dry flat dusty ground. Habitat appeared unsuitable.
20b – Listaros, 170m 35.00N 24.82E	Bereut 1955	As 20a. This is probably the area referred to as “Listovounos” by Beuret.
21 – Agio Farago gorge, 30m, 34.93N 24.78E	Not found 17.x.2017	Hot dry river bed and gorge. Almost no low plants in flower. Habitat appeared unsuitable.
22 – Stoli, 260m 35.05N 25.05E	Not found 19.x.2017	Urban. Dry dusty waste ground with sparse green plants. Habitat appeared suitable. Possibly above altitude limit.
23 – Loures, 260m 35.05N 25.06E	Not found 19.x.2017	Urban. Dry dusty waste ground with sparse green plants. Habitat appeared suitable. Possibly above altitude limit.
24 – Asimi, 280m 35.04N 25.09E	Not found 19.x.2017	Urban. 3 sites in the town were visited, all dry dusty waste ground with sparse green plants. Habitats appeared suitable. Possibly above altitude limit.

Behaviour

The butterfly is small and discrete. It could be easily overlooked, particularly by the casual observer. It flies rapidly and erratically, rarely higher than 20 cm above the ground or low vegetation. It has a more direct flight across very dry bare dusty places (Figs 3–9). It settles low down on green and dried vegetation and small stones, usually keeping wings closed even early in the morning when temperatures are at their daily minimum. In late October it would fly from about 09.00 to 16.30 h and was most active between 10.00 and 15.00 h.

Fig. 3. Kokinos Pirgos, a site with permanent damp run off from the light blue building and dry dusty waste land. Female *Z. karsandra* present, site 8, 19.x.2017.

Fig. 4. Matala, damp run off from watering of a hotel lawn and dry dusty waste land. Female *Z. karsandra* present, site 1a, 16.x.2017.

Fig. 5. Timpaki (2 km north), run off from irrigated plastic greenhouses, with variety of low plants, site 7, 19.x.2017.

Fig. 6. Mires, urban, dry dusty waste ground with *Heliotropium europaeum* in the foreground, site 10, 19.x.2017.

Fig. 7. Kalamaki, urban dry dusty waste ground with sparse vegetation, site 2, 18.x.2017.

Fig. 8. Agio Deka, urban dry dusty waste ground with sparse vegetation, site 11, 19.x.2017. All © M. Rowlings.

Fig. 9. Agio Deka, dry dusty waste ground with sparse vegetation, site 12, 19.x.2017.

Fig. 10. Matala, *Zizeeria karsandra* ♀ on cultivated tomato flower, dd. 16x.2017.

Figs 11–12. Kalamaki and Kamilari – irrigated olive groves with extensive tracts of abundant *Oxalis* and some other low plants dominate the Messara plain. *Z. karsandra* was not found in these locations, sites 17 and 19, 18.x.2017. All © M. Rowlings.

Both sexes are attracted to flowers for nectar. *Heliotropium europaeum* (Figs 13, 24) is widespread and common at low levels throughout the region and is often exploited by *Z. karsandra* as the only nectar source available in many places. Other plants used by *Z. karsandra* where they were available included *Tribulus terrestis* (Figs 17–18), *Dittrichia viscosa* (Figs 15–16) and cultivated tomato (Fig. 10).

Relatively few females were seen. No eggs were found, and no egg laying was observed. Pamperis (1997, 2009) reports the use of *Oxalis* spec. for egg laying on Crete. I did not find *Oxalis* spec. from the three places where females were found during the visit, however the plant can be very

small and could be overlooked, Pamperis (pers. comm.). *Oxalis* was however quite abundant in several of the agricultural areas (Figs 11–12) where it grows around the bases of irrigated olive trees with other low plants. This widespread and very common habitat would seem suitable for *Z. karsandra*, but the absence of the butterfly puts in question the regular use of *Oxalis* spec. as a larval food plant, at least at this time of the year. Unsympathetic farming practices in these agricultural areas may explain its apparent absence.

Makris (2003) refers to the use of *Tribulus terrestris*, *Amaranthus blitum*, *Trifolium fragiferum*, *Glinus lotoides* and *Polygonum equisetiforme* on Cyprus. At Kokinos Pirgos (Figs 17–18) both males and females were nectaring avidly on the only example of *Tribulus terrestis* I found. At this site the plant may be important for both adults and larvae. Tennent (1996) refers to *Melilotus indica* and *Medicago sativa* in N. Africa. Similar plants were present in Crete, but as most plants were not flowering, species level identification was not possible. Many other larval food plants are reported across its vast range, which extends across Asia to Australia, so it is highly likely that it is also polyphagous on Crete.

Fig. 13. Matala. *Zizeeria karsandra* ♀ on *Heliotropium europaeum*, site 1a, 16.x.2017.

Fig. 14. Matala. *Zizeeria karsandra* ♂ on dry vegetation, site 1a, 18.x.2017.

Figs 15–16. Agia Galini. Two images of the same *Zizeeria karsandra* ♀ nectaring on *Dittrichia viscosa*, site 9, 19.x.2017.

Figs 17–18. Kokinos Pirgos. *Zizeeria karsandra* feeding on *Tribulus terrestris*, a larval foodplant reportedly used in Cyprus by Makris 2003, site 8, 19.x.2017.

Figs 19–20. Matala, *Zizeeria karsandra* ♂, site 1a, 20.x.2017.

Fig. 21. Kalamaki, *Zizeeria karsandra* ♂, site 2, 18.x.2017 All © M. Rowlings.

Discussion

Data indicate the butterfly flies from early spring, February in N. Africa and March in Cyprus (Makris 2003, Tenant 1996). Numbers increase during the year, peaking in the autumn. Pamperis (pers. comm.) has searched for the butterfly in April at known sites on Crete, but failed to find it. He speculates that the first brood may fly in March on the island. Phenology and abundance is likely to be seasonally variable.

Given the ease with which new locations were found in October 2017 it is surprising more details have not been published previously. Possible explanations for this could be the timing of the visit, being much later than most lepidopterists visit in the search here for spring and summer endemics. Additionally, the lower Messara plain is rather “unattractive” to lepidopterists, being low, flat, highly cultivated and relatively densely populated.

The butterfly is very small and discrete and is easily overlooked, although not as small or inconspicuous as the more widely reported *Chilades trochylus* (Freyer, 1845). Nevertheless, a small amount of detailed location information has appeared recently on the Internet for *Z karsandra* from the Messara region. This proved invaluable as a starting point for the current survey.

All the records are between sea level and 200 m. The butterfly was not found in suitable habitats at 260 and 280 m in Stoli, Loures and Asimi, just 10 km east Agio where it was found a short time earlier on the same day. In N. Africa it can be found at up to 1500 m (Tennent 1996), and on Cyprus it can reach 550 m (Makris 2003). Given suitable habitats, it may therefore be expected at higher levels on Crete.

In contrast to the high-density populations recorded on Cyprus and in N. Africa (Makris 2003, Tennent 1996) it was found only at low density on Crete. Males were widespread across the area in villages and towns which may suggest dispersal behaviour.

Fig. 22. Matala, *Zizeeria karsandra* ♀, site 1a, 20.x.2017.

Fig. 23. Matala, *Zizeeria karsandra* ♀, site 1a, 16.x.2017.

Fig. 24. Agios Ioannis, *Zizeeria karsandra* ♂ on Heliotropium europaeum, site 4, 17.x.2017.

Figs 25–26. Matala, *Zizeeria karsandra* ♂, site 1a, 16.x.2017.

Fig. 27. Matala, *Zizeeria karsandra* ♂, site 1a, 17.x.2017.

Fig. 28. Kamilari, *Zizeeria karsandra* ♂, site 3, 18.x.2017.

Figs 29–30. Matala, *Zizeeria karsandra* ♂, site 1a, 18.x.2017. All © M. Rowlings.

Conclusion

Z. karsandra is widespread and easily found in hot dry dusty urban situations in the lower Messara plain (Heraklion province, southern Crete). It was encountered at 11 different locations in an area of about 10 km × 20 km over a 5-day period from 16th to 20th October 2017. Most of these sites were found during a single day of dedicated searching. It seems likely that the species is overlooked, probably due to low abundance in spring and summer broods and to the perceived low quality of its urban habitats.

Further work would be desirable to document the existence and relative abundance of spring and summer broods. An explanation of the widespread occurrence of males but relative scarcity of females should be investigated, as should the ecology and foodplants. Examination of male genitalia and DNA may also be useful to confirm the taxonomic status of *Z. karsandra* in Crete.

It is hoped that the data in this paper will encourage and enable further research for this species across Crete and possibly also on other Mediterranean islands including those with sparse records: Sicily, Malta and Rhodes.

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