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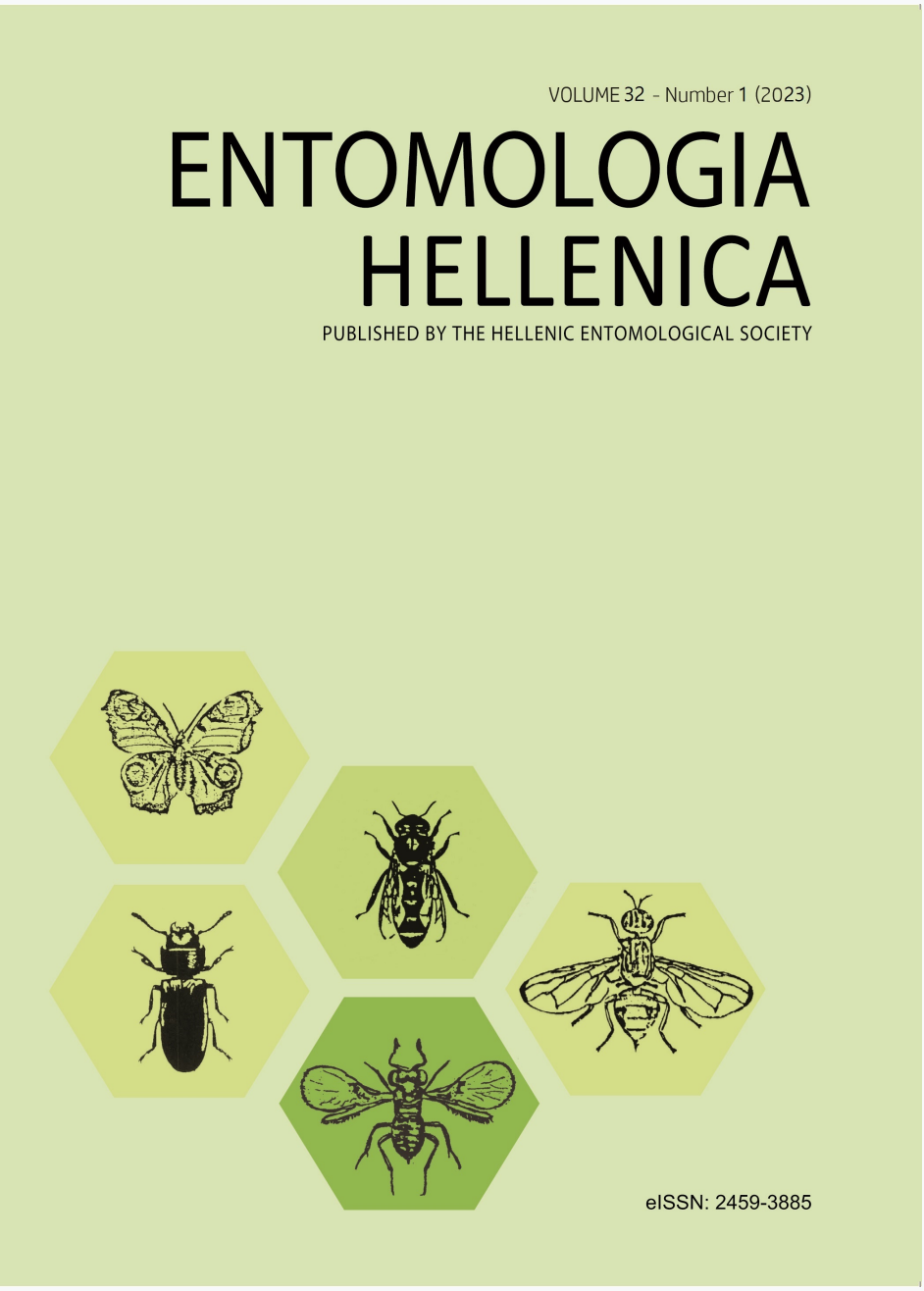

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Knowing no limits: First record of *Ozognathus cornutus* (Coleoptera: Ptinidae: Anobiinae) in Greece, including new host-plant records

EVANGELOS KOUTSOUKOS[1]*, JAKOVOS DEMETRIOU[1,2,3]

[1]*Department of Ecology and Systematics, Faculty of Biology, National and Kapodistrian University of Athens, 15784 Athens, Greece*

[2]*Joint Services Health Unit Cyprus, BFC RAF Akrotiri BFPO 57, Akrotiri, Cyprus*

[3]*Enalia Physis Environmental Research Centre, Akropoleos 2, Aglantzia, Nicosia, Cyprus*

ABSTRACT

Ozognathus cornutus (LeConte, 1859), a species native to the Nearctic zoogeographical realm, has gradually spread throughout Europe and the Mediterranean region becoming alien. The species has been associated with at least 41 host-plant species and has been detected in both man-made and natural habitats. Nevertheless, no phytosanitary measures have been applied or adverse impacts on native biodiversity recorded. In this publication, *O. cornutus* is recorded in Greece from Rhodes Island, constituting the first record of this alien species to the country. In addition, examination of material from Cyprus and Greece unveils four new host-plants for the species, *Asphodelus ramosus*, *Schinus terebinthifolia*, *Schinus molle* and *Vachellia farnessiana*.

KEY WORDS: Alien species, biological invasions, Eastern Mediterranean, *Schinus terebinthifolia*, *Schinus molle*, *Vachellia farnessiana*.

Introduction

During the last centuries, introduction and spread of alien species have been facilitated by globalization and international trade (Hulme 2009; Seebens 2019). Approximately 14,000 alien species have been identified in Europe, a large percentage of which accounts for insects (EASIN 2022). A total of 469 alien insect species have been identified in Greece, including ten species of the family Ptinidae (Demetriou et al. 2021). Among them, the subfamily Anobiinae is represented by three stored-product pests, namely: *Lasioderma serricorne* (Fabricius, 1792) (Levinson and Buchelos 1988; Buchelos and Athanassiou 1993), *Stegobium paniceum* (Linnaeus, 1758) (Buchelos and Athanassiou 1993) and *Nicobium castaneum* (Olivier 1790) (Denux and Zagatti 2010).

Originally native to the Nearctic zoogeographical realm *Ozognathus cornutus* (LeConte, 1859) (Coleoptera: Ptinidae: Anobiinae) has been unintentionally introduced and gradually invaded Europe and the Mediterranean region. Its current distribution in the region includes: Cyprus (Demetriou et al. 2022), France (Allemand et al. 2008), Germany (Allemand et al. 2008), Gibraltar (GONHS 2017), Israel (Miłkowski 2019), Italy (including Sardinia and Sicily) (Cusimano et al. 2015; Sidoti et al. 2016; Bazzato et al. 2021; Cerasa and Lo Verde 2021; Lo Cascio et al. 2022), Latvia (Telnov et al. 2016), Malta (Zahradník and Mifsud 2005), Portugal (Madeira) (Zahradník and Mifsud 2005), Spain (including Canary Islands)

*Corresponding author: vag18000@gmail.com

(Bercedo et al. 2005; Viñolas 2017; Trócoli et al. 2020), Switzerland (Germann and Schmidt 2017), Tunisia (Zahradník and Mifsud 2005) and the United Kingdom (Stenhouse 2017).

The ecology of *O. cornutus* still remains largely unknown (Stenhouse 2017; Miłkowski 2019). Nevertheless, it has been associated with at least 41 host-plant species (Bazzato et al. 2021; Cerasa and Lo Verde 2021; Demetriou et al. 2022). In addition, the species is known to feed on decaying plant tissues such as dried fruit, wood shavings, galls formed on plant-foliage or stems, as well as fecal matter in galleries constructed by wood-boring insects (Cerasa and Lo Verde 2021). Regarding its ecological associations with other insects, this saproxylophagous insect has been detected in conspicuous galls of various Diptera (Cecidomyiidae), Hymenoptera (Cynipidae) and Lepidoptera (Gelechiidae) as well as galleries of Coleoptera (Cerambycidae), laying its eggs inside the gall inducer's larval chambers (White 1974; Sidoti et al. 2016; Viñolas 2017; Miłkowski 2019; Trócoli et al. 2020; Cerasa and Lo Verde 2021).

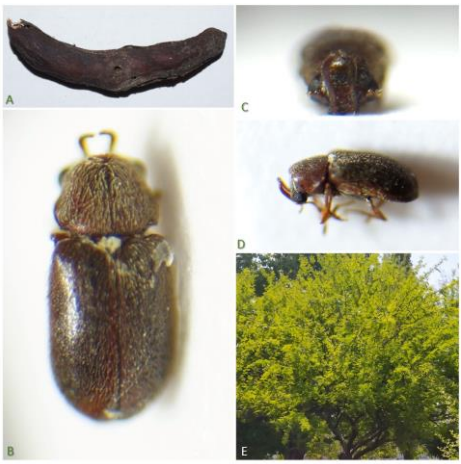

FIG. 1: Pod of *Vachellia farnesiana* (L.) Wight et Arn., infested by *Pseudopachymerina spinipes* (Erichson, 1834) (A). Habitus of *Ozognathus cornutus* (LeConte, 1859), collected from Rhodes Island, Greece (B), frontal view of *O. cornutus* (C), lateral view (D), *V. farnesiana* individual from Rhodes. Photographed by: Evangelos Koutsoukos.

Herein, *O. cornutus* is detected in the island of Rhodes (Dodecanese) constituting the first record of this alien species in Greece. In addition, examination of reared material from Cyprus and Greece allows to add four new host-plants for the species.

Materials and Methods

Material examined:

Asphodelus ramosus L. seeds, *Schinus terebinthifolia* Raddi, *Schinus molle* L. fruits and *Vachellia farnesiana* (L.) Wight et Arn. pods were collected and stored dry in sealed polyethylene bags or containers until emergence of adults. Specimens reared were subsequently stored in 70º ethanol and then card mounted and examined under a stereomicroscope for morphological examination. Identification was performed following diagnostic remarks of Zahradník and Mifsud (2005) and Stenhouse (2017). Additional individuals of *A. ramosus*, *S. molle* and *V. farnessiana* were sampled in various locations in Greece, in order to investigate further presence of *O. cornutus.*

Locations:

GREECE: Dodecanese, Rhodes, Rhodes city, 23.vi.2022, alt. 15 m, 36.4308º N, 28.2296º E, 2 males, 1 female, lgt. et coll. E. Koutsoukos, reared from *Vachellia farnessiana* (L.) Wight et Arn. pods.

CYPRUS: Limassol, Kato Polemidia, iii.-viii.2022, alt. 30 m, 34.675556º N, 32.998611º E, 30 spec., lgt. et coll. J. Demetriou, reared from *Schinus molle* L. fruit.; Limassol, Kato Polemidia, 26.iii.2022, alt. 34 m, 34.678056º N, 33.005556º E, 4 females, 1 male, lgt. et coll. E. Koutsoukos, reared from *Schinus*

terebinthifolia Raddi fruit.; Larnaca, Larnaca airport env., 26.iii.2022, alt. 10 m, 34.85º N, 33.6º E, 2 males, lgt. et coll. E. Koutsoukos, reared from *Schinus molle* L. fruit. Paphos, Chloraka, Melanos, 17.viii.2022, alt. 90 m, 34.79083º N, 32.41278º E, 2 females, 2 males, lgt. et coll. J. Demetriou, reared from *Asphodelus ramosus* L. fruit.

Results and Discussion

The newly presented record of *O. cornutus* alongside previously omitted *Ernobius mollis* (Linnaeus, 1758), *Mezium affine* Boieldieu, 1856 and *Trigonogenius globolus* Solier, 1849 (Zahradník 2015; EASIN 2022), raise the number of alien and cryptogenic Ptinidae of Greece to 14. Upon examination of reared material from Cyprus and Greece, *A. ramosus*, *S. terebinthifolia*, *S. molle* and *V. farnessiana* are recorded for the first time as host-plants for *O. cornutus.*

The species is presumed to be associated with gall-inducers of the family Megastigmidae collected from the aforementioned Anacardiaceae species (summarized in Roques and Skrzypczyńska 2003), phytophagous Eurytomidae developing in *A. ramosus* seed capsules (Delvare et al. 2019) as well as *Pseudopachymerina spinipes* (Erichson, 1834) developing in *V. farnessiana* pods. No specimens of *O. cornutus* were obtained from *A. ramosus*, *S. molle* and *V. farnesiana* samples collected across different localities throughout Greece (Attica, Crete). Nevertheless, given the wide host range of the species, its distribution in Greece is expected to be much wider.

Any adverse impact of *O. cornutus* to native biodiversity is hard to assess, given our lack of knowledge concerning its ecological networks both within its native and invaded range (Cerasa and Lo Verde 2021). Nevertheless, the species could cause minor socio-economic damages since it has been reported to damage heritage works (Manachini 2015). In Greece and Cyprus, all reported host-plants, except for *A. ramosus*, have been mainly planted as ornamental foliage within urban sites. However, this newly found association may implicate further integration into plant-insect interactions and native species interrelationships throughout Cyprus and Greece. Further research regarding the ecology of this species and any putative adverse impact to gall inducing insects in its invaded range are encouraged.

Acknowledgments

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**Corresponding author: vag18000@gmail.com*

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Πρώτη καταγραφή του *Ozognathus cornutus* (Coleoptera: Ptinidae: Anobiinae) στην Ελλάδα, με νέες καταγραφές φυτών-ξενιστών

Ε. ΚΟΥΤΣΟΥΚΟΣ[1]* ΚΑΙ Ι. ΔΗΜΗΤΡΙΟΥ[1,2,3]

[1]*Τομέας Οικολογίας και Ταξινομικής, Τμήμα Βιολογίας, Εθνικό και Καποδιστρικό Πανεπιστήμιο Αθηνών 15784, Αθήνα, Ελλάδα*
[2]*Joint Services Health Unit Cyprus, BFC RAF Akrotiri, BFPO 57, Ακρωτήρι, Κύπρος*
[3]*Ενάλια Φύσις Περιβαλλοντικό Κέντρο Ερευνών, Ακροπόλεως 2, Αγλαντζιά 2102, Λευκωσία, Κύπρος*

ΠΕΡΙΛΗΨΗ

Το *Ozognathus cornutus* (LeConte, 1859), είναι ένα είδος με καταγωγή από τη Νεαρκτική, και έχει σταδιακά εξαπλωθεί στην Ευρώπη και τη Μεσόγειο, ως ξενικό. Το είδος αυτό σχετίζεται με τουλάχιστον 41 είδη φυτών – ξενιστών, και έχει εντοπιστεί τόσο σε ανθρωπογενή όσο και φυσικά οικοσυστήματα. Παρόλα αυτά, δεν έχουν θεσπιστεί φυτο-υγειονομικά μέτρα σχετικά με το είδος αυτό, ενώ παράλληλα δεν έχουν καταγραφεί οι πιθανές του επιπτώσεις στη ντόπια βιοποικιλότητα. Στην εργασία αυτή, το *O. cornutus* καταγράφεται για την Ελλάδα από το νησί της Ρόδου, αποτελώντας έτσι την πρώτη αναφορά του ξενικού αυτού είδους για την χώρα. Επιπρόσθετα, εξέταση υλικού από την Κύπρο και την Ελλάδα αποκαλύπτει συνολικά τέσσερα νέα είδη φυτών – ξενιστών για το είδος αυτό, και συγκεκριμένα τα *Asphodelus ramosus*, *Schinus terebinthifolia*, *S. molle* and *Vachellia farnessiana*.

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First record of the Bright Bush-Cricket *Poecilimon inflatus lyciae* (Orthoptera: Tettigoniidae) from Greece

C. KAZILAS[1*], K. KALAENTZIS[1,2], P. DRAKOPOULOS[3], L. WILLEMSE[1]

[1]Naturalis Biodiversity Center, PO Box 9517, 2300 RA Leiden, The Netherlands
[2]Hydrobiological Station of Rhodes, Hellenic Centre for Marine Research, Cos Street, 85100 Rhodes, Greece
[3]Anthimou Gazi 7, 26331 Patra, Greece

ABSTRACT

The Bright Bush-Cricket, *Poecilimon inflatus lyciae* is reported for the first time from Greece in the island of Kastellorizo (Dodecanese). The study contributes to the knowledge of the biodiversity of Kastellorizo archipelago, which remains widely understudied.

KEY WORDS: Barbitistini, entomofauna, Kastellorizo, Phaneropterinae.

Introduction

Poecilimon Fischer, 1853 is one of the largest genera within the Tettigoniidae, with a total of 145 species currently described (Cigliano et al. 2022). Bush-crickets belonging to this genus are distributed across the Palearctic, from Italy, central and southeastern Europe to central Asia (Bey-Bienko 1954). The Aegean region forms the core of the genus range; Greece in particular, is at the forefront of *Poecilimon* diversity in Europe, with 45 representatives recorded across the country (Willemse et al., 2018; Lemonnier-Darcemont & Daremont, 2020).

Based on molecular, morphological and bioacoustic criteria, two subgenera and 17 species groups are distinguished within *Poecilimon*, with many taxa still requiring allocation to a group (Cigliano et al. 2022). One of the species groups is the *Poecilimon jonicus* group which includes species sharing similarities in morphology and song structure (Heller 1984, 1988, 2004). Recently the evolution within this group and its correlation to paleogeographic events was studied by Borissov et al. (2020). The molecular phylogenetic analyses of the above study confirmed the composition of the group, indicated a robust phylogeny and revealed links between the evolution of this group and paleogeographical events of the Aegean. The *Poecilimon jonicus* group currently encompasses 11 species, including taxa transferred from the former *Poecilimon inflatus* group, which no longer exists (Kaya et al., 2018; Borissov et al., 2020). In Greece, six species of the *P. jonicus* group are present: *P. cretensis* Werner, 1903 from Crete and some of the Cyclades islands, *P. erimanthos* Willemse & Heller, 1992 from the area around Mt. Erymanthos in the Peloponnese, *P. jonicus* (Fieber, 1853) from the western mainland and some Ionian islands, *P. laevissimus* (Fischer, 1853) from the western Peloponnese, some Ionian islands and a few fragmented areas in Central Greece, *P. tessellatus* (Fischer, 1853) from the Peloponnese, and *P.*

**Corresponding author: ckazilas@gmail.com*

werneri Ramme, 1993 from the southwestern edge of the Greek mainland and northwestern Peloponnese (Fig. 1).

Except for *P. superbus*, which is restricted to Italy, the other four species belonging to the *P. jonicus* group (*P. antalyaensis*, *P. inflatus*, *P. isopterus* and *P. martinae*), occur in southwestern Anatolia. Here we report *P. inflatus* for the first time from Kastellorizo, one of the islands of the Dodecanese, in Greece.

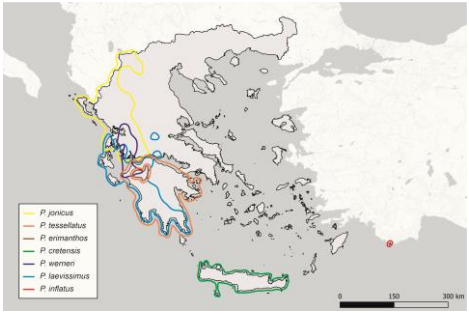

FIG. 1: Distribution of the members of the *Poecilimon jonicus* group in Greece. The range of *P. inflatus lyciae*, which is herein reported from the country for the first time, is shown in red.

Materials and Methods

On May 4th, 2017, two individuals of *Poecilimon* sp. were recorded and photographed near the settlement of Megisti in Kastellorizo, in an area covered with typical Mediterranean low-lying shrubs (phrygana), but no specimen was collected at the time. A few years later, on May 27th, 2022, the island was surveyed again, and three *Poecilimon* individuals were collected from Palaiokastro. Once again, the specimens were found in an area covered with phrygana. Afterwards, all collected specimens and photographic material were identified based on the determination key by Kaya et al. (2018) and were deposited in the collection of Naturalis Biodiversity Center (RMNH).

Results

The three collected specimens and the two previously photographed individuals were identified as *P. inflatus lyciae*. The diagnostic characters used for distinguishing *P. inflatus lyciae* from its allies are the following: the number of stridulatory teeth is higher than 100; the male cerci are almost straight; the female subgenital plate has a widely rounded posterior margin; and the male paraproct is almost straight at the posterior margin (Fig. 2, Kaya et al. 2018).

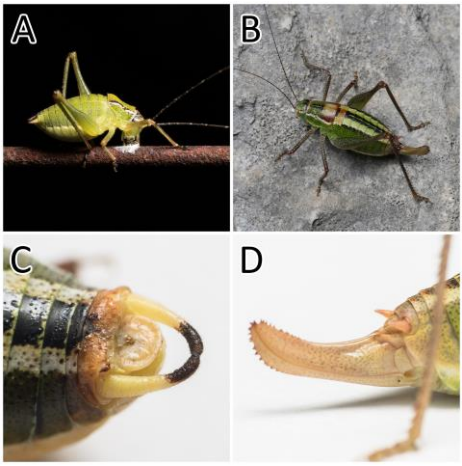

FIG. 2: Individuals of *P. inflatus lyciae* found in Kastellorizo, Greece. Depicted are a last instar juvenile male (A) and a female (B) specimen found on 4 May 2017, as well as close-ups of the male cerci (C) and the female ovipositor (D) from two specimens collected on 27 May 2022. Photos by K. Kalaentzis.

Poecilimon inflatus lyciae

Kaya & Çiplak, 2018

GREECE – Dodecanese, Kastellorizo: Kastellorizo (Megisti); N 36.146526˚, E 29.591032˚; 4.V.2017, K. Kalaentzis & C. Kazilas obs.; 1♂ 1♀; direct sighting (Fig. 2A, 2B); Palaiokastro; N 36.1482859˚, E 29.5769310˚; 27.V.2022, P. Drakopoulos

leg.; 2♂ 1♀(RMNH). Material has been deposited in the collection of Naturalis Biodiversity Center (RMNH).

Discussion

The discovery of *P. inflatus lyciae* on Kastellorizo raises the number of *P. jonicus* species group representatives in Greece to seven, and the overall number of *Poecilimon* species in the country to 46.

Despite the fact that the description of *P. inflatus* took place over 100 years ago (Brunner von Wattenwyl 1891), there is still limited to zero information on the ecology or biology of this taxon. The majority of the current studies involving this group of species focuses on the phylogenetic relationships and the resolution of their taxonomic status (Kaya et al. 2012, Sevgili et al. 2018, Kociński et al. 2021, Borissov et al., 2021, 2023). Besides a clear understanding of the taxonomy, a better understanding of feeding habits, habitat and biology of *Poecilimon* representatives is equally important to gain further knowledge that may aid future conservation efforts.

Kastellorizo, along with its surrounding islets, constitutes the easternmost part of Greece. The flora and fauna of this island is characterized heavily by Anatolian elements, compared to the rest of Greece. Past studies have indicated that the Kastellorizo archipelago hosts an astonishingly high number of invertebrate (Mylonas et al. 2019) and vertebrate organisms (Kalaentzis et al. 2018a) in proportion to its area and has contributed to the documentation of species new to the country (Kalaentzis et al. 2018a, Strachinis et al. 2018), as well as the discovery of known taxa with unique phenotypes (Kalaentzis et al. 2018b, Kazilas et al. 2018). Unless more effort is directed towards additional surveys to study the rich biodiversity of this archipelago, it will evidently remain understudied.

Acknowledgments

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**Corresponding author: ckazilas@gmail.com*

Πρώτη καταγραφή του είδους *Poecilimon inflatus lyciae* (Orthoptera: Tettigoniidae) στην Ελλάδα

Χ. ΚΑΖΙΛΑΣ[1]*, Κ. ΚΑΛΑΕΝΤΖΗΣ[1,2], Π. ΔΡΑΚΟΠΟΥΛΟΣ[3], L. WILLEMSE[1]

[1]Naturalis Biodiversity Center, PO Box 9517, 2300 RA Leiden, The Netherlands
[2]Υδροβιολογικός Σταθμός Ρόδου, Ελληνικό Κέντρο Θαλάσσιων Ερευνών, Οδός Κω, 85100 Ρόδος, Ελλάδα
[3] Ανθίμου Γαζή 7, 26331 Πάτρα, Ελλάδα

ΠΕΡΙΛΗΨΗ

Σε αυτή την εργασία παρουσιάζουμε την πρώτη καταγραφή του είδους *Poecilimon inflatus lyciae* στην Ελλάδα, (Δωδεκάνησα). Η παρούσα μελέτη συμβάλλει στη διεύρυνση των γνώσεων σχετικά με τη βιοποικιλότητα των νησιών του Αρχιπέλαγους του Καστελλόριζου, η οποία παραμένει σε μεγάλο βαθμό ανεξερεύνητη.

**Corresponding author: ckazilas@gmail.com*