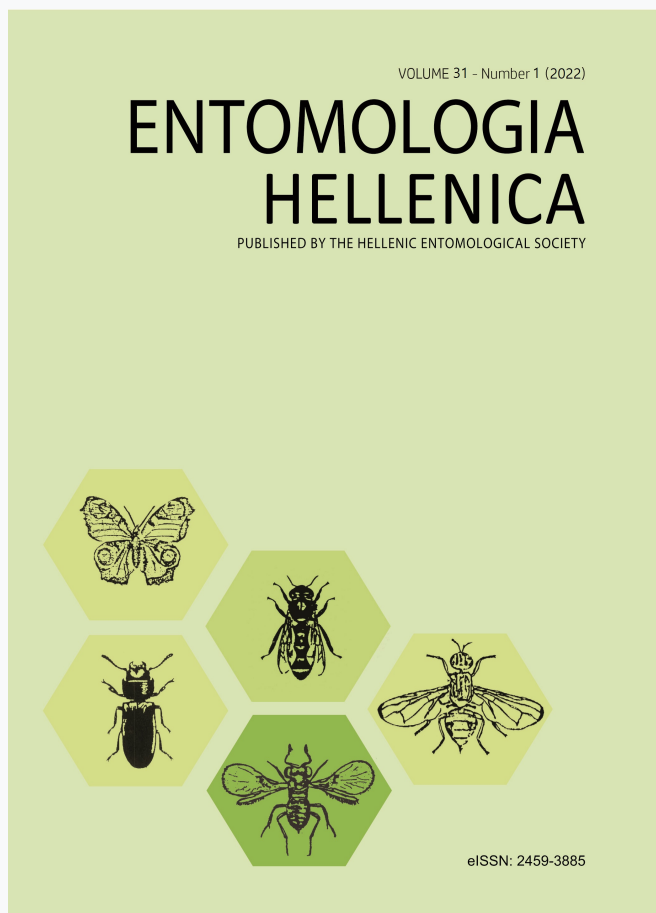


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Review of the occurrence of the oriental hornet *Vespa orientalis* Linnaeus, 1771 in the islands of Greece (Hymenoptera: Vespidae: Vespinae)

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A review of the oriental hornet *Vespa orientalis* (Hymenoptera: Vespidae: Vespinae) Linnaeus, 1771 distribution in the islands of Greece

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ABSTRACT

Records of *Vespa orientalis* Linnaeus, 1771 for 28 islands of Greece are given: in 18 islands (Agistri, Euboea, Folegandros, Kalamos, Kalymnos, Karpathos, Kos, Leros, Lefkada, Naxos, Nisyros, Paros, Patmos, Pserimos, Telendos, Tilos, Tinos, Sifnos), these occurrences are the first record of the species for them. The total number of Greek islands in which *V. orientalis* is known becomes 33.

KEY WORDS: distribution, faunistics, Greek islands, wasp.

Introduction

The genus *Vespa* Linnaeus, 1758 consists of 22 species of large eusocial wasps, most of which with a distribution restricted to Asia (Carpenter & Kojima 1997; Archer 2012; Perrard et al. 2013). In Europe only two species are native (Gusenleitner 2013), but during the recent years two alien species have been added in the continent (see Castro 2019; Laurino et al. 2019).

In Greece, the genus is represented by two species native in Europe: *Vespa crabro* Linnaeus, 1758 and *V. orientalis* Linnaeus, 1771 (Gusenleitner 2013). The latter species is originally distributed from southern Europe and northern Africa (up to the Horn of Africa in the south), across the Middle East to India, Nepal, central Asia and western China (Carpenter & Kojima, 1997; Četković, 2004; Archer, 2012). In the recent years it has been introduced in several countries—for a summary on the current non-native distribution see Zachí & Ruicănescu (2021), Gereyes et al. (2021),

Werenkraut et al. (2021) and Ceccolini (2021). A complete review of the distribution of *V. orientalis* in Greece was published by Četković (2004) who reported all known records from both literature sources and material examined by himself: in this work the occurrence of this hornet was reported from 15 islands, as well as from the mainland. This number appears to be a consequence of undersampling and seems to be quite inadequate to represent the real distribution of the species in the Greek islands, considering that this country has some thousands of islands of which about one hundred extend over areas of at least 5 km² (<https://www.statistics.gr>).

Herein, new records of *V. orientalis* from several Greek islands are reported and an updated list of the islands of Greece in which the species is known is provided.

Materials and Methods

The examined material originates from the web platform iNaturalist (www.inaturalist.org).

Specimens of *Vespa orientalis* can easily be identified by photos because of the habitus of the species, which is well recognizable by its entirely largely reddish-brown colour with yellow markings on the face and the presence of a yellow band across the gaster (Archer 2012; Smith-Pardo et al. 2020).

For each site, the following information is given: locality, geographical coordinates, date, number of specimens, photo authority. For each locality, geographical coordinates are in decimal degrees (datum WGS84). Number of decimals varies according to the accuracy of the data. Uncertainty (abbreviated as un.) of the data (in metres) was indicated according to the point-radius method (Wieczorek et al. 2004). Each record was identified or confirmed by the author.

Material examined

Ionian Islands:

Cephalonia: Epar. Od. Argostoliou, 38.205341° N 20.488084° E (un. not recorded), 8.VIII.2021, 1 ex., photo by Mark Carter; near Skala, 38.085194° N 20.799897° E (un. = 22 m), 2.VII.2020, 1 ex., photo by “paulie_m_smith”.

Corfu: Old Fortress, 39.623417° N 19.929603° E (un. = 251 m), 3.X.2020, 1 ex., photo by “Sotiria Mb”.

Kalamos: near Kalamos, 38.631022° N 20.941387° E (un. = 5 m), 11.VII.2019, 1 ex., photo by “tikitu”

Lefkada: near Kariotes, 38.80303° N 20.72695° E (un. = 2 m), 2.IX.2019, 1 ex., photo by Nikolaos Papageorgiou; Kariotes, 38.796111° N 20.718158° E (un. = 24 m), 19.XI.2018, 1 ex., photo by Nikolaos Papageorgiou; Katouna, 38.782749° N 20.707281° (un. = 5 m), 24.VIII.2019, 1 ex., photo by “pieman”; Kallithea, 38.7047° N 20.709074° E (un. = 2 m), 10.VI.2019, 1 ex., photo by Nikolaos Papageorgiou; Vassiliki, 38.629353° N 20.608667° E (un.

= 91 m), 29.X.2021, 1 ex., photo by Alexandra Haritou.

Zakynthos: Laperda Beach, 37.856068° N 20.746983° E (un. not recorded), 2.VIII.2020, 1 ex., photo by “Vera Sz.”; Stasi Leoforiou, 37.718478° N 20.858282° E (un. = 190 m), 26.IX.2021, 1 ex., photo by Royce Cumming.

Saronic Islands:

Agistri: Dragonera Beach, 37.696955° N 23.33197° E (un. = 5 m), 7.VIII.2019, 1 ex., photo by Jonathan Riedel.

Euboea and surrounding islands

Euboea: near Petries, 38.410807° N 24.186692° E (un. = 526 m), 15.VIII.2019, 1 ex., photo by Mist Mask; idem, 38.410949° N 24.193677° E (un. = 24 m), 17.VI.2020, 1 ex., photo by Fabrizio Benedetti.

Aegean Islands:

Dodecanese

Folegandros: Karavostasis, 36.615377° N 24.949651° E (un. = 14 m), 22.VIII.2018, 1 ex., photo by Nick Leggatt.

Kalymnos: Emporeios, 37.04657° N 26.927795° E (un. = 24 m), 4.X.2021, 1 ex., photo by “spinyurchin”; between Emporeios and Church Saint Panormitis, 37.043622° N 26.944581° E (un. not recorded), 1.X.2021, 1 ex., photo by Calliope Hummer; near Arginontas Beach, 37.012499° N 26.974628° E (un. = 149 m), 4.VIII.2020, 1 ex., photo by Ioannis Gkourogiannis.

Karpathos: 35.575949° N 27.14014° E (un. = 526 m), 15.VII.2021, 1 ex. (Fig. 2), photo by Benoit Segerer.

Kos: Tigaki, 36.883858° N 27.179944° E (un. = 977 m), 17.XII.2019, 1 ex., photo by Harrys Reisis; Igrotos - Akti Psalidiou, 36.885837° N 27.340292° E (un. not recorded), 5.X.2019, 1 ex., photo by Almut Martens; near Agios Fokas Beach,

36.859731° N 27.34821° E (un. = 2 m), 7.VII.2020, 1 ex., photo by “mnauky”; near Chapel St John Perigialiti, 36.832264° N 27.06107° E (un. = 8 m), 23.IX.2019, 1 ex., photo by “manroth”; Kardámaina, 36.774457° N 27.133121° E (un. = 35 m), 16.VIII.2019, 1 ex., photo by “anlias”; Kefalos, 36.744239° N 26.967029° E (un. = 77 m), 1.V.2021, 1 ex., photo by “expatp”.



FIG. 1: Specimen of *Vespa orientalis* from Karpathos Island (photo by Benoît Segerer).

Leros: Agia Marina, 37.149375° N 26.86138° E (un. = 10 m), 11.IX.2021, 1 ex., photo by Chrystèle Bréat.

Lesbos: Mithymna, 39.368931° N 26.168726° E (un. = 4 m), 20.VIII.2021, 1 ex., photo by Savvas Zafeiriou; near Skala Kallonis, 39.202462° N 26.16703° E (un. = 1650 m), 17.V.2006, 1 ex., photo by Paul Cools; Skala Kallonis, 39.207571° N 26.203773° E (un. = 65 m), 1 ex., 3.VII.2019, photo by “hassel”; Pírgi Thermis, 39.175626° N 26.504504° E (un. = 8 m), 21.VII.2021, 1 ex., photo by Savvas Zafeiriou; idem, 39.175336° N 26.503779° E (un. = 31 m), 19.VIII.2019, 1 ex., photo by Savvas Zafeiriou; idem, 39.17567° N 26.502881° E (un. = 31 m), 13.VIII.2019, 1 ex., photo by Savvas Zafeiriou; idem, 39.173344° N 26.503018° E (un. = 644 m), 18.VIII.2018, 1 ex., photo by Savvas Zafeiriou; idem, 39.172557° N 26.504195° E (un. = 15 m), 19.V.2020, 1 ex., photo by Savvas Zafeiriou.

Milos: Agathia Beach, 36.72726° N 24.341413° E (un. = 4 m), 27.VIII.2018, 1 ex., photo by “g-natural”.

Naxos: surroundings of Chalki, 37.064632° N 25.482313° E (un. = 5850 m), 30.IX.2021, 1 ex., photo by “dementieva”; Kastraki, 37.005159° N 25.397018° E (un. = 5 m), 12.VIII.2020, 1 ex., photo by “georgedros”; Pyrgaki Beach, 36.977015° N 25.396956° E (un. = 9 m), 10.IX.2018, 1 ex., photo by Nick Leggatt.

Nisyros: Emporios, 36.603213° N 27.177195° E (un. not recorded), 23.VIII.2019, 1 ex. (Fig. 3), photo by Giorgos Nikolakakis; near Stefanos Crater, 36.579618° N 27.167563° E (un. not recorded), 28.IX.2019, 1 ex., photo by Almut Martens.



FIG. 2: Specimen of *Vespa orientalis* from Nisyros Island (photo by Giorgos Nikolakakis).

Paros: Paros Park near Monastery of St. John’s of Deti, 37.146605° N 25.224112° E (un. = 22 m), 20.VII.2021, 1 ex., photo by “mammal”; Naousa, 37.120594° N 25.230848° E (un. = 2 m), 1.VII.2019, 1 ex., photo by “mammal”; Parikia, 37.085643° N 25.148832° E (un. = 1350 m), 6.X.2020, 1 ex., photo by Micha Baum.

Patmos: northern part of the island, 37.36662° N 26.575962° E (un. = 5 m), 17.VIII.2021, 1 ex., photo by “elisareddavid”.

Pserimos: Avlakia, 36.934553° N 27.13725° E (un. = 407 m), 29.VII.2020, 1 ex., photo by Ioannes Marnierakis.

Rhodes: Rhodes city, Nihori, 36.446896° N 28.226871° E (un. not recorded), 18.IX.2021, 1 ex., photo by “robayne”; idem, Monte Smith, 36.44144° N 28.220266° E (un. = 2 m), 30.VI.2020, 1 ex., photo by Eleftherios Katsillis; idem, 36.439472° N 28.217107° E (un. not recorded), 1.V.2021, 1 ex., photo by Eleftherios Katsillis; idem, Rodini Park, 36.426833° N 28.219918° E (un. = 124 m), 16.VI.2020, 1 ex., photo by Eleftherios Katsillis; Theologos, 36.38583° N 28.033966° E (un. not recorded), 22.IX.2021, 1 ex., photo by “Jochen”; near Kathara Bay, 36.320842° N 28.203558° E (un. = 5 m), 17.VIII.2019, 1 ex., photo by “elliott8on”; Kolympia, 36.259847° N 28.162959° E (un. = 30 m), 22.VIII.2017, 1 ex., photo by “d7p”; idem, 36.253392° N 28.1713° E (un. not recorded), 22.VIII.2021, 1 ex., photo by Žygimantas Valiuška; idem, 36.249925° N 28.169163° E (un. = 20 m), 4.X.2020, 1 ex., photo by “rickyn”; near Seven Springs Waterfall, 36.254247° N 28.115785° E (un. = 4 m), 28.VIII.2019, 1 ex., photo by Stefano Aguzzi; near Agia Agathi Monastery, 36.173412° N 28.098864° E (un. not recorded), 5.X.2021, 1 ex., photo by “petroc”; Limni Fragmatos Gadoura, 36.168563° N 27.970317° E (un. not recorded), 29.VIII.2021, 1 ex., photo by Giacomo Assandri; idem, 36.157498° N 27.997815° E (un. not recorded), 27.VIII.2021, 1 ex., photo by Giacomo Assandri; Lindos, 36.091814° N 28.088476° E (un. = 178 m), 13.VIII.2020, 1 ex., photo by “tamma”; idem, 36.088272° N 28.087898° E (un. not recorded), 11.VII.2021, 1 ex., photo by “cozza_dt”.

Samos: near Paleo Karlovasi, 37.785912° N 26.686138° E (un. = 10 m), 3.XI.2021, 1 ex., photo by “deleuze”; Kokkari, 37.77322° N 26.879496° E (un. = 598 m), 26.VII.2019, at least 4 exx., photo by “ellavg”; near Kampos Marathokampos, 37.716602° N 26.654806°

E (un. = 243 m), 7.X.2021, 1 ex., photo by “phup”; Ormos Marathokampos, 37.710462° N 26.704823° E (un. = 116 m), 10.VIII.2021, 1 ex., photo by “vydysh”.

Serifos: Moni Taxiarchon, 37.19182° N 24.509175° E (un. = 10 m), 4.IX.2021, 1 ex., photo by “naturaliste”.

Sifnos: Exambela, 36.974124° N 24.731714° E (un. = 172 m), 22.X.2010, 2 adults and 1 larva (Fig. 1), photo by Kim Moore.



FIG. 3: Adults and larva of *Vespa orientalis* from Sifnos Island (photo by Kim Moore).

Telendos: Telendos village, 36.99817° N 26.92092° E (un. = 10 m), 12.IX.2018, 1 ex., photo by “libertyruth”.

The Cyclades

Tilos: Livadia, 36.415111° N 27.384746° E (un. = 10 m), 3.IX.2016, 1 ex., photo by Magne Flåten.

Tinos: Volax, 37.592318° N 25.178175° E (un. = 337 m), 3.VIII.2021, 1 ex., photo by Ioannis Gkourogianis.

Cretan islands

Crete: Kissamos, 35.48424° N 23.57867° E (un. = 92 m), 11.IX.2021, 1 ex., photo by “lasmalla”; near Maléme airport, 35.528938° N 23.825171° E (un. = 31 m), 8.IX.2018, 1 ex., photo by John Cree; near Gouverneto Monastery, 35.57216° N 24.133874° E (un. = 977 m), 2.XII.2020, at least 3 exx., photo by “fotis-samaritakis”;

Souda, 35.466868° N 24.115777° E (un. = 24 m), 1.IX.2021, 1 ex, photo by “dirkey”; Gavalohori, 35.424256° N 24.215506° E (un. not recorded), 9.VIII.2021, 1 ex, photo by Haydn Fox; Kryonerida, 35.359987° N 24.210125° E (un. = 4 m), 25.VIII.2021, 1 ex., photo by “danp7”; Georgioupoli, 35.362798° N 24.257562° E (un. = 4 m), 4.X.2021, 1 ex., photo by “wormsy”; near Georgioupoli, 35.3548° N 24.284431° E (un. = 15 m), 29.IX.2021, 1 ex., photo by “wormsy”; Kournas Lake, 35.334658° N 24.276715° E (un. = 7 m), 9.VIII.2020, 1 ex., photo by “clemoune”; idem, 35.332163° N 24.279988° E (un. = 145 m), 28.VII.2021, 1 ex., photo by rkjakobsen”; idem, 35.331434° N 24.276198° E (un. = 725 m), 4.IX.2019, 1 ex., photo by Alistair Puddifer; Agios Georgios, 35.295037° N 24.456555° E (un. = 5 m), 17.X.2020, 1 ex., photo by “sbibby117”; near Halevi Monastery, 35.344898° N 24.508403° E (un. not recorded), 1.IX.2021, 1 ex., photo by “felixf”; Vlichada, 35.396256° N 24.785499° E (un. not recorded), 25.X.2008, 1 ex, photo by Sandy Rae; Chersonissos, 35.2179° N 25.421487° E (un. = 3 m), 13.VII.2021, 1 ex., photo by Markus Döring; Plaka Beach, 35.301567° N 25.726912° E (un. not recorded), 23.VII.2018, 1 ex., photo by “eoa”; Pissidos, 35.204051° N 25.715043° E (un. = 581 m), 7.IX.2019, 1 ex., photo by “jukkajarvi”; near Kritsa, 35.16993° N 25.643743° E (un. not recorded), 6.X.2020, 1 ex., photo by Felicia Seichter; Kritsa, 35.156113° N 25.64302° E (un. = 12 m), 21.IX.2021, 1 ex., photo by “fuerchtegott”; Melisses, 35.119085° N 25.88209° E (un. not recorded), 29.IX.2020, 1 ex., photo by “fuerchtegott”; Richtis Gorge, 35.182881° N 25.986864° E (un. = 1800 m), 2.IX.2021, 1 ex., photo by Marina Roth; Piskokefalo, 35.182932° N 26.088463° E (un. = 298 m), 16.VIII.2021, 1 ex., photo by “arkim”; Hidden church, 35.208572° N 26.198578° E (un. not recorded), 17.VIII.2020, 1 ex., photo by “arkim”; near Zakros Gorge, 35.099888° N 26.242462° E (un. not recorded),

3.VIII.2021, 1 ex., photo by “hanaemori”; near Agiou Georgiou church, 35.1188° N 26.074806° E (un. not recorded), 29.VIII.2020, 1 ex., photo by “arkim”; near Handras, 35.08595° N 26.107231° E (un. not recorded), 26.VIII.2020, 1 ex., photo by “arkim”; Epar Od Kato Choriou – Sitias, 35.055294° N 25.908852° E (un. = 488 m), 17.IX.2017, 1 ex., photo by Steve Daniels; Schinokapsala, 35.052753° N 25.881606° E (un. not recorded), 24.VIII.2021, 1 ex., photo by “arkim”; near Timiou Stavrou church, 35.06328° N 25.848323° E (un. = 321 m), 13.X.2016, 1 ex., photo by Steve Daniels; Ferma, 35.017749° N 25.856795° E (un. = 15 m), 20.IX.2017, 1 ex., photo by Steve Daniels; Kalamafka, 35.075644° N 25.655486° E (un. = 1580 m), 11.IX.2020, 1 ex., photo by Josef Wirth; near Panagia Selakaniotissa, 35.089177° N 25.541505° E (un. not recorded), 4.X.2020, 1 ex., photo by Felicia Seichter; near Zaros, 35.1243° N 24.9123° E (un. not recorded), 10.X.2015, 1 ex., photo by “djhiker”; near Ampelouzos, 35.063107° N 24.947212° E (un. = 10 m), 16.VII.2019, 1 ex., photo by Emily Dent; Kouzes, 35.01761° N 24.830345° E (un. = 33 m), 4.X.2018, 1 ex., photo by “Katrin”; Lentas, 34.930275° N 24.924791° E (un. not recorded), 7.X.2019, 1 ex, photo by Davide Berton; near Frati, 35.2032° N 24.4881° E (un. not recorded), 6.X.2015, 1 ex, photo by “djhiker”; Kato Moni Preveli, 35.170559° N 24.465981° E (un. not recorded), 25.IX.2019, 1 ex, photo by Davide Berton; near Kleidisi Beach, 35.174616° N 24.415306° E (un. not recorded), 10.VIII.2009, 1 ex., photo by Pavel Trhoň; Kokkina Chorafia, 35.174751° N 24.413519° E (un. not recorded), 22.IX.2021, 1 ex., photo by “peterse”; near Greleskas Observatory, 35.317717° N 23.841426° E (un. not recorded), 15.V.2017, 1 ex., photo by Pascal Dubois; near Koustogerako, 35.280925° N 23.82141° E (un. = 828 m), 7.X.2021, 1 ex., photo by “matpfalz”; Sougia, 35.249112° N 23.81162° E (un. = 96 m), 16.IX.2021, 1 ex., photo by “daxkifa”; Pelekanos, 35.23463° N

23.688736° E (un. = 23 m), 20.IX.2021, 1 ex., photo by Julian Kokott; Elafonisi (island), 35.268862° N 23.533225° E (un. = 5 m), 27.IX.2019, 1 ex., photo by “elenor”; Epar. Od. Kastelliou – Kefaliou, 35.358031° N 23.562308° E (un. = 95 m), 13.IX.2021, 1 ex., photo by “lasmalla”.

Gavdos: 34.839272° N 24.089732° E (un. = 6450 m), 5.VII.2020, 1 ex., photo by Alexandros Quartarone.

The list of the Greek islands in which *V. orientalis* is known is reported in Table 1.

TABLE 1. List of the islands (in alphabetical order) in which *Vespa orientalis* is known. Islands marked with an asterisk are reported for the first time in the present work. Only references with original data are quoted.

Island	References
Agistri*	Present work
Cephalonia	Giordani Soika 1953; Ćetković 2004; Present work
Chios	Alfken et al. 1934
Corfu	Giordani Soika 1953; Present work
Crete	Giordani Soika 1953; Blüthgen & Gusenleitner 1970; Ćetković 2004; Present work
Euboea*	Present work
Folegandros*	Present work
Gavdos	Ćetković 2004; Present work
Ikaria	Alfken et al. 1934; Giordani Soika 1953
Kalamos*	Present work
Kalymnos*	Present work
Karpathos*	Present work
Kos*	Present work
Leros*	Present work
Lesbos	Alfken et al. 1934; Ćetković 2004; Present work
Lefkada*	Present work
Milos	Alfken et al. 1934; Present work
Naxos*	Present work
Nisyros*	Present work
Ophidhousa	Giordani Soika 1953
Paros*	Present work
Patmos*	Present work
Pserimos*	Present work
Rhodes	Giordani Soika 1953; Erlandsson 1974; Ćetković 2004; Present work
Telendos*	Present work
Thasos	Atanassov 1942; Ćetković 2004
Tilos*	Present work
Tinos*	Present work
Samos	Alfken et al. 1934; Giordani Soika 1953; Present work
Serifos	Alfken et al. 1934; Present work
Sifnos*	Present work
Siros	Giordani Soika 1953
Zakynthos	Giordani Soika 1953; Present work

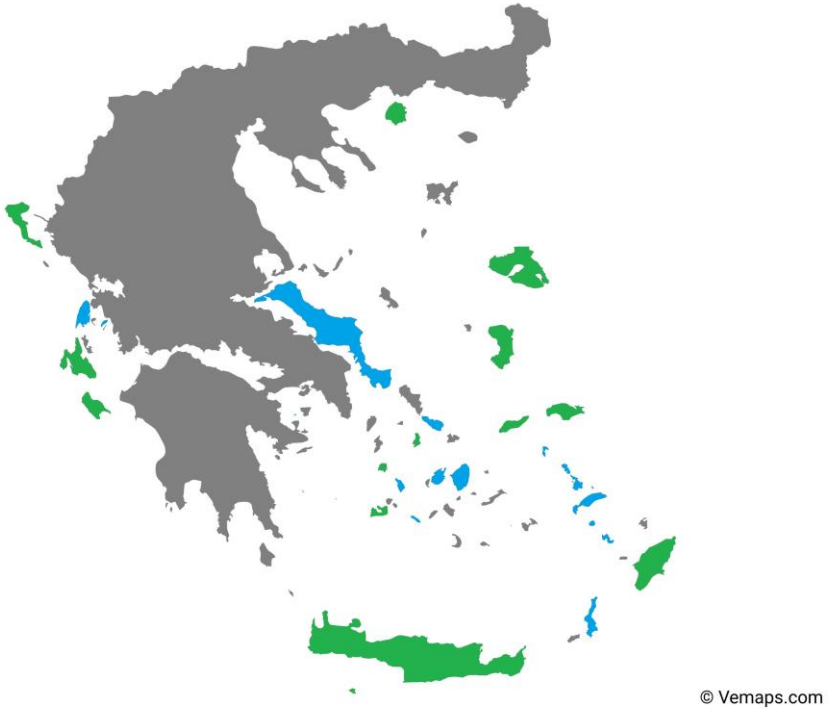


FIG. 4: Updated distribution of *Vespa orientalis* in the islands of Greece. Green colored: islands where the species was already documented in literature; blue colored: islands where the species is recorded for the first time through the present work (original map: © Vemaps.com).

Conclusions

With the present work, the occurrence of *Vespa orientalis* in 28 Greek islands is documented. This includes first records for 18 islands. Currently, also considering references sources, the number of islands of Greece in which *V. orientalis* is documented is 33, as summarized in Fig. 4 and Table 1. Therefore, the knowledge of *V. orientalis* distribution in insular Greece is now more than doubled (from 15 to 33 islands). Further research might show even more widespread presence of this highly successful overseas colonizer.

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Ανασκόπηση της παρουσίας της σφήκας *Vespa orientalis* Linnaeus, 1771 (Hymenoptera: Vespidae: Vespinae) στα νησιά της Ελλάδας

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ΠΕΡΙΛΗΨΗ

Στην παρούσα εργασία δίνονται καταγραφές της παρουσίας του είδους *Vespa orientalis* Linnaeus, 1771 από 28 νησιά της Ελλάδας, στα 18 από τα οποία (Αγκίστρι, Εύβοια, Φολέγανδρος, Κάλαμος, Κάλυμνος, Κάρπαθος, Κως, Λέρος, Λευκάδα, Νάξος, Νίσυρος, Πάρος, Πάτμος, Τελένδος, Ψέριμος, Τήνος, Σίφνος), τα περιστατικά αυτά αποτελούν πρώτες καταγραφές για την τοποθεσία. Ο συνολικός αριθμός των ελληνικών νησιών στα οποία είναι πλέον καταγεγραμμένη η παρουσία του *V. orientalis* ανέρχεται στα 33.