

## Research article

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**A new species of the genus *Milesia* Latreille  
(Diptera: Syrphidae) from Crete**Sander BOT <sup>1,\*</sup>, Ximo MENGUAL <sup>2</sup>,  
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**Abstract.** *Milesia cretica* Bot & van Steenis sp. nov. is described from the Island of Crete, Greece. An identification key to all the European species of *Milesia* Latreille, 1804 is provided, together with DNA barcodes to distinguish the new species.

**Keywords.** Hover flies, flower flies, endemic, new species, DNA barcoding.

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**Introduction**

The genus *Milesia* Latreille, 1804 (Diptera: Syrphidae) consists of very large (13–35 mm) and conspicuous, colourful hover flies, which are perfect mimics of wasps. Currently, there are 77 described species of *Milesia* and its greatest diversity is reached in the Indomalayan Region (61). They are also known from the Palaearctic (6), Afrotropical (5) and Nearctic Regions (3), and two species occur in the northern part of the Neotropical Region (Hippa 1990; Thompson 2021). The larval biology of only a handful of species is known and their larvae are associated with wet detritus in rot holes, water-filled cavities in stumps and decaying stumps and heartwood of deciduous trees (Snow 1958; Maier 1982; Rotheray 1993; Skevington *et al.* 2019).

Hippa (1990) published a world revision of this genus. In this publication, *Milesia* was divided into 23 species groups, several new synonyms were reported, and 31 new species were described. Since this landmark publication, two additional new species have been described, both from China (Yang & Cheng 1993; He & Chu 1994).

In Europe, only two species of *Milesia* are known, namely *M. crabroniformis* (Fabricius, 1775) and *M. semiluctifera* (Villers, 1789). *Milesia crabroniformis* is the largest European hover fly and has a wide European distribution, from southern France to the island of Madeira and throughout the Mediterranean Basin including several Greek islands. Outside Europe, it can be found in North Africa, Turkey and Georgia (Mengual *et al.* 2020; Speight 2020; Vujić *et al.* 2020). *Milesia semiluctifera* occurs in Europe mainly in the Mediterranean Basin, outside Europe occurring further to the east, including the Middle East, the Caucasus and on eastward to as far as Turkmenistan (Mengual *et al.* 2020; Saab 2020; Speight 2020; Vujić *et al.* 2020). Here, we describe *Milesia cretica* Bot & van Steenis sp. nov. as the third species of *Milesia* occurring in Europe.

## Material and methods

### Field work

In 2021, between October 2<sup>nd</sup> and 23<sup>rd</sup>, a team of nine Dutch and Belgian entomologists, including the first and third authors, went to Crete to collect Syrphidae Latreille, 1802. Most field work took place between October 7<sup>th</sup> and October 17<sup>th</sup>. Daily, part of the island was systematically searched for suitable habitat, in particular for flowering *Hedera helix* L. (Araliaceae), a plant known to attract Syrphidae in autumn (Garbuzov & Ratnieks 2013; Morris & Ball 2019) including *Milesia*. Most sampling was done by hand with an entomological net. Some additional sampling was done by Malaise traps. In the present work, we report the sampling results regarding *M. cretica* sp. nov.; the collecting results related to other Syrphidae species and a more detailed description of the collecting trip will be presented in a separate publication (W. van Steenis *et al.* in prep).

### Taxonomic description

The adult terminology used follows Thompson (1999) except for some parts of the genitalia not described by Thompson where we follow Hippa (1990). All measurements are in millimetres and were taken using a reticule in a Leica® M165C microscope. Body length was measured from the anterior oral margin to the posterior end of the abdomen, in lateral view. Wing length was measured from the wing tip to the basicosta.

Figures 2–7 were made with a digital SLR camera. The camera setup consisted of a Canon 6D, Canon MPE-65 macro lens, a transmitter directing two flashes and a macro rail. As stacking software Helicon Focus (Kharkiv, Ukraine) was used. The photos were heavily edited using Adobe Photoshop (ver. 22.2.0); for instance, dust on the specimens, reflections from the flashes and the entomological pins were removed and the position of legs and wings was altered and often one side of the pair of wings or legs was copied to the other side and flipped.

### Institutional abbreviations

At the end of each record the holding institution is indicated. The following acronyms are used to indicate entomological collections:

- AET = private collection of André van Eck, Tilburg, the Netherlands
- CNC = Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Canada
- FMT = private collection of Frank Van de Meutter, Tessenderlo, Belgium
- GPA = private collection of Gerard Pennards, Amersfoort, the Netherlands
- JSA = private collection of Jeroen van Steenis, Amersfoort, the Netherlands

- LEW = private collection of Leendert-Jan van der Ent, Wolfheze, the Netherlands  
MZW = private collection of Menno van Zuijlen, Wageningen, the Netherlands  
SBH = private collection of Sander Bot, Haren, the Netherlands  
USNM = Smithsonian National Museum of Natural History, Washington, USA  
WOA = private collection of Wout Opdekamp, Antwerpen, Belgium  
WSB = private collection of Wouter van Steenis, Breukelen, the Netherlands  
ZFMK = Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany

### DNA barcoding

The nucleotide sequence of the mitochondrial cytochrome *c* oxidase subunit I (COI) gene, also known as a DNA barcode (Hebert *et al.* 2003a, 2003b), was obtained from the holotype, and four paratypes of *M. cretica* sp. nov. One leg from the dry pinned specimens was used for DNA extraction. DNA was extracted following standard protocols of the commercially available DNeasy Blood & Tissue Kit (Qiagen). The COI barcode region was amplified using the forward primer LCO1-1490 (5'-GCTCAACAAATCATAAAGATATTGG-3'; Folmer *et al.* 1994) and the reverse primer COI-Dipt-2183R, also known as COI-780R (5'-CCAAAAAATCARAATARRTYTG-3'; Gibson *et al.* 2011). PCR amplification protocols were the same as described in Rozo-Lopez & Mengual (2015).

The PCR product was visualized on 1.5% agarose gels. PCR products were cleaned using the commercially available QIAquick PCR Purification Kit (Qiagen). Bi-directional sequencing reactions were carried out by Macrogen Inc. Chromatograms were edited in Geneious ver. 7.1.3 (Biomatters Ltd). All new sequences were submitted to GenBank via BOLD ([www.boldsystems.org](http://www.boldsystems.org)). GenBank accession numbers are listed for each sequenced specimen in the Paratypes section.

A distance-based Neighbor-Joining (NJ) analysis was done using the Jukes-Cantor Model as implemented in the software Geneious ver. 7.1.3, in which several published DNA barcode sequences were included from other species of *Milesia*. The DNA barcode of *Spilomyia manicata* (Rondani, 1865) (GenBank Accession number MN622074) was constrained as the root for the NJ tree. Bootstrap support values (BS) were estimated from 1000 replicates directly from Geneious ver. 7.1.3. The NJ tree was drawn with the aid of FigTree ver. 1.3.1 (Rambaut 2018) and Adobe Illustrator CS 5.1.

### Results

Class Insecta Linnaeus, 1758  
Order Diptera Linnaeus, 1758  
Family Syrphidae Latreille, 1802  
Subfamily Eristalinae Newman, 1834  
Genus *Milesia* Latreille, 1804

*Milesia cretica* Bot & van Steenis sp. nov.

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Figs 1–3, 7–8

### Differential diagnosis

*Milesia cretica* sp. nov. (Figs 2–3) belongs to the *Milesia crabroniformis* species group (see Remarks below), of which *M. crabroniformis* hitherto was the only member (Hippra 1990). It differs from *M. crabroniformis* (Fig. 4) as follows: vertex blackish caused by less dense pollinosity, completely yellow in *M. crabroniformis*; female frons medially with indistinct brown longitudinal vitta caused by the absence of pollinosity, completely yellow in *M. crabroniformis*; ground colour of the scutum is black except for a small rectangular orange brown part between the postalar calli, in *M. crabroniformis* the orange brown ground colour is much more extensive forming longitudinal vitta on the posterior part of the scutum; scutum with heavy yellow pollinose pattern on

both anterior and posterior part of scutum, in *M. crabroniformis* the yellow pollinosity is less extensive on the posterior part, making the orange brown ground colour pattern visible, creating a colour contrast between the yellow pollinose pattern on the anterior part and an orange brown ground colour pattern on the posterior part; on the medial part of the scutum two short yellow pollinose vittae depart as part of the anterior vittae into the posterior part, in *M. crabroniformis* these yellow pollinose vittae are absent; the anterior half of the scutellum is black, in *M. crabroniformis* the scutellum is usually all red or only with a small anterior portion black, anterior half seldom black; scutellum completely yellow pilose, at least one or a few black pili present in *M. crabroniformis*; in the male, pleura, coxae and trochanters largely black, on average with more yellow markings in *M. crabroniformis*. Legs are more extensively black marked but less extensively black pilose in *Milesia cretica* sp. nov.; metatibia medially with black markings and ventrally covered with black pile for some 25% of the length of the tibia in the male, in *M. crabroniformis* no black markings are present on metatibia, but black pile is more extensive, covering at least 40% of the length of the tibia; in the female, the metatibia is covered with black pile for some 10% of the length of the tibia, at least 30% in *M. crabroniformis*. *Milesia cretica* sp. nov. has the anterior half of the wing not clearly yellowish tinged and without subtle darker greyish subapical macula, the former character (clearly yellowish tinged) always present and the latter (subtle darker greyish subapical macula) usually present in *M. crabroniformis*. Terga 2–4 yellow and dark yellow with sharply demarcated black pattern in the new species, in *M. crabroniformis* colour pattern rather diffuse, extending from yellow to dark brown, without sharply demarcated black pattern. No diagnosable differences in male genitalia between the two species could be detected (Fig. 7).

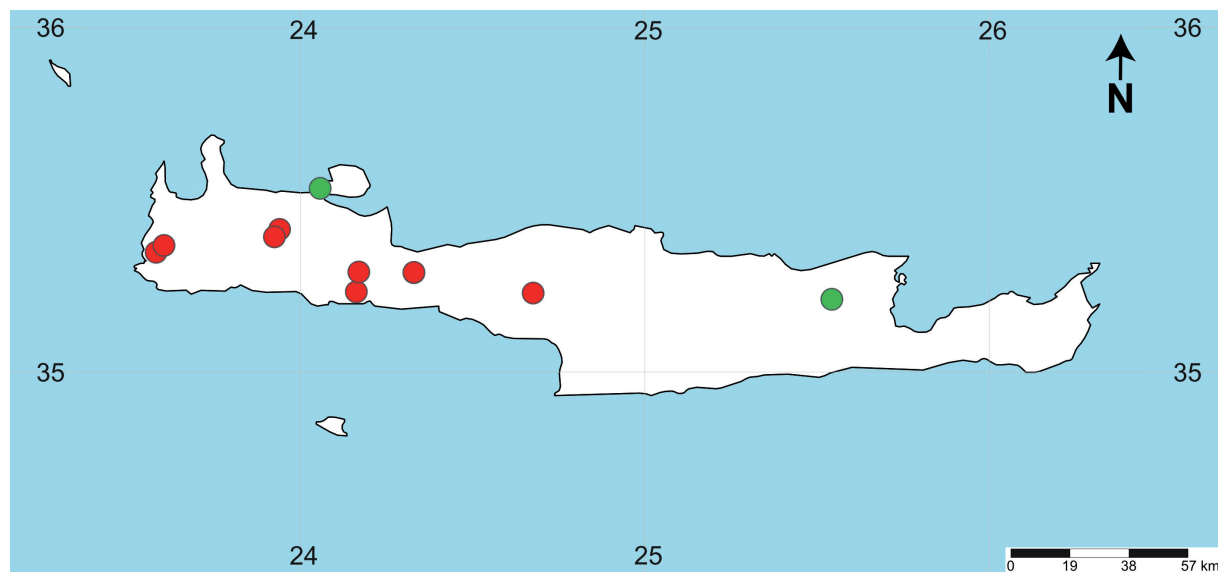
### Etymology

The species name is from the Latin ‘*creticus, cretica*’, meaning ‘Cretan’ and it refers to the type locality of this *Milesia*, the island of Crete.

### Type material

#### Holotype

GREECE • ♂; Crete, Chania, Imbros Gorge; 35°13'57.4" N, 24°09'46.1" E; alt. 554 m; 8 Oct. 2021; S. Bot leg.; ZFMK-DIP-00083005.



**Fig. 1.** Locations on Crete, Greece where *Milesia cretica* Bot & van Steenis sp. nov. was observed (green circles) or collected (red circles).



### Paratypes

GREECE • 1 ♀; Crete, Chania, Ammoudari; 16 Jun. 1971; W. Gross leg.; ZFMK-DIP-00061225 • 1 ♂; Crete, Rethymno, Monastiraki; 35°13'44.4" N, 24°40'33.6" E; alt. 305 m; 6 Oct. 2021; M. van Zuijen leg.; MZW, MPZ015125 • 5 ♂♂; same collection data as for holotype; SBH, ZFMK-DIP-00083001, ZFMK-DIP-00083002 • 1 ♂; same collection data as for holotype; AET • 4 ♂♂; same collection data as for holotype; W. van Steenis leg.; WSB, wvs11055 to wvs11058 • 1 ♂; Crete, Chania, Karanos; 35°23'31.2" N, 23°55'30.0" E; alt. 580 m; 8 Oct. 2021; F. Van de Meutter leg.; FMT • 1 ♀; same collection data as for preceding; ZFMK-DIP-00082510 • 1 ♂; same collection data as for preceding; W. Opdekamp leg.; WOA • 1 ♂, 1 ♀; Crete, Chania, Askordalos; 35°24'50.4" N, 23°56'24.0" E; alt. 280 m; 8 Oct. 2021; F. Van de Meutter leg.; FMT • 1 ♀; Crete, Chania, Plokamania, valley; 35°20'50.3" N, 23°34'53.8" E; alt. 200 m; 8 Oct. 2021; L.J. van der Ent leg.; LEW, LJE100052 • 2 ♂♂, 3 ♀♀; same collection data as for holotype; 9 Oct. 2021; J. van Steenis leg.; JSA, 2021-001.025 to 2021-001.029 • 2 ♂♂, 1 ♀; same collection data as for holotype; 9 Oct. 2021; M. van Zuijen leg.; MZW, MPZ014979, MPZ014977, MPZ014990 • 1 ♀; Crete, Chania, Askordalos; 35°24'49.3" N, 23°56'24.0" E; alt. 285 m; 9 Oct. 2021; S. Bot leg.; SBH • 1 ♂; Crete, Chania, near Vathi; 35°22'01.9" N, 23°36'16.9" E; alt. 550 m; 9 Oct. 2021; W. Opdekamp leg.; WOA • 3 ♂♂, 5 ♀♀; same collection data as for holotype; 10 Oct. 2021; F. Van de Meutter leg.; FMT • 1 ♀; same collection data as for holotype; 10 Oct. 2021; F. Van de Meutter leg.; CNC • 1 ♂, 3 ♀♀; same collection data as for holotype; 10 Oct. 2021; W. Opdekamp leg.; WOA • 2 ♂♂; same collection data as for holotype; 11 Oct. 2021; L.J. van der Ent leg.; LEW, LJE100152, LJE100153 • 1 ♀; same collection data as for holotype; 11 Oct. 2021; L.J. van der Ent leg.; LEW, LJE100151 • 1 ♂;



**Fig. 2.** *Milesia cretica* Bot & van Steenis sp. nov. ♂, (SBH), habitus dorsal. Collected on Crete, Imbros Gorge, 17 October 2017, leg. and coll. S. Bot.

Crete, Rethymno, near Argyroupoli; 35°17'17.2" N, 24°19'47.6" E; alt. 135 m; 11 Oct. 2021; M. van Zuijlen leg.; MZW, MPZ015018 • 1 ♀; same collection data as for preceding; 13 Oct. 2021; S. Bot leg.; SBH • 1 ♀; same collection data as for preceding; ZFMK-DIP-00083000 • 1 ♂; same collection data as for preceding; ZFMK-DIP-00083006 • 1 ♂; same collection data as for preceding; CNC • 1 ♂; same collection data as for preceding; USNM • 3 ♂♂, 2 ♀♀; same collection data as for preceding; F. Van de Meutter leg.; FMT • 1 ♂, 1 ♀; Crete, Rethymno, Monastiraki; 35°13'44.4" N, 24°40'33.6" E; alt. 850 m; 17 Oct. 2021; J. van Steenis leg.; JSA, 2021-001.295, 2021-001.296 • 1 ♀; same collection data as for preceding; M. van Zuijlen leg.; MZW, MPZ015125 • 4 ♂♂, 1 ♀; same collection data as for holotype; 22 Oct. 2021; G. Pennards leg.; GPA.

### Type locality

GREECE: Crete, Chania, Imbros Gorge; 35°13'57.4" N, 24°09'46.1" E; alt. 554 m.

### Description

#### Male

LENGTH (N = 9). Body: 20–24 mm; wing: 15–17 mm.

HEAD. Face yellow; yellow pollinose; laterally yellow-pilose; in lateral profile nearly rectangular; shallowly concave; slightly tuberculate ventrally. Gena brownish black; shiny. Frons yellow; yellow pollinose; dorsally with long yellow pile. Vertical triangle with long yellow pile; yellow pollinose; black except yellow anterior of ocellar triangle. Occiput heavily yellow pollinose. Antenna yellow brown;



**Fig. 3.** *Milesia cretica* Bot & van Steenis sp. nov., paratype, ♀ (SBH), habitus dorsal. Collected on Crete, near Lakkoi, 9 October 2021, leg. and coll. S. Bot.

basoflagellomere round, as long as broad or slightly longer than broad; arista with short semi-erect pile on basal part. Eye bare.

**THORAX.** Scutum black; posteriorly between postalar calli with rectangular part orange brown; scutum with extensive thick yellow pollinose striped pattern (Fig. 2); with erect yellow pile except fascia of black pile between wings. Postpronotum yellow; with yellow pollinosity and yellow pile. Postalar callus yellow; covered in yellow pollinosity and yellow pile with anteriorly one or a few black pili. Scutellum with anterior half black, posterior half reddish; yellow pilose; ventral scutellar fringe yellow. Posterior spiracle opened only on dorsal part. Proepisternum yellow; yellow pilose. Posterior anepisternum and dorsal part of katepisternum with large yellowish pollinose macula, remainder of katepisternum, anterior anepisternum and metasternum black. Halter yellow except base blackish. Calypter whitish with yellow posterior margin; ventral calypter with long yellow pile on posterior margin; dorsal calypter with short brown pile.

**WING.** Wing including alula entirely microtrichose except cell cup bare on very base and narrow vitta along anterior margin in basal half. Very base of wing and first and second costal cells slightly tinged yellow, rest of wing hyaline

**LEGS.** Coxae and trochanters with black and dark yellow pattern. Profemur orange; with yellow pile; with basoventral area black and weakly depressed, covered with black setulae. Mesofemur orange; ventrally with black vitta; slightly ventrally flattened; with black pile at and around ventrally flattened



**Fig. 4.** *Milesia crabroniformis* (Fabricius, 1775), ♂, (SBH), habitus dorsal. Collected in France, Midi-Pyrénées, 4 August 2010, leg. and coll. S. Bot.

area, otherwise with yellow pile. Metafemur orange; with vague incomplete black ring at one third from base; ventrally with black pile, dorsally with yellow pile; ventrally at three-quarter of its length from base with well-developed spina. Pro- and mesotibia yellow; with yellow pile. Metatibia yellow; with indistinct black markings in the medial part; with yellow pile, but medio-ventrally and posterolateral with black pile, largely coinciding with black colour, covering some 25% of length of tibia. Tarsi largely dark red.

**ABDOMEN.** Surface of terga semi dull with shiny posterior part of tergum 4. Tergum 1 black. Terga 2, 3 and 4 largely yellow anteriorly; dark yellow posteriorly; with sharply demarcated black pattern (Fig. 2). Tergum 1 with mainly black pile. Terga 2 and 3 anteriorly with yellow pile; medial black vitta and anterior part with black pile. Tergum 4 with yellow pile. Terga 7 and 8 yellow; yellow pilose. Sternum 1 black. Sterna 2 and 3 whitish-yellow; with large triangular black macula. Sternum 4 largely black; anteriorly narrowly yellow. Sterna 1–4 with long erect mainly yellow pile. Genitalia (Fig. 7): Surstyli symmetrical; broad at base, horizontally elongate; with narrow pointed apicodorsal lobe and broad apicoventral lobe. Hypandrium symmetrical; ventrally mixed black and yellow pilose. Superior lobes apically with one to two spinae; position and number can differ intraspecifically between right and left superior lobes. Aedeagus symmetrical; with paired apico-dorsal lobe, ventral margin of each lobe continues as an elevated carina along the posterior margin of aedeagus.

#### **Female**

LENGTH (N = 6). Body: 17–20 mm; wing: 15–17 mm.



**Fig. 5.** *Milesia semiluctifera* (Villers, 1798), ♂, (SBH), habitus dorsal. Collected in Greece, Lesbos, 14 September 2019, leg. and coll. S. Bot.



Similar to male except for normal sexual dimorphism and as follows: frons medially with indistinct brown longitudinal vitta caused by absence of pollinosity; femora and metatibia completely orange, without black markings; profemur with more extensive black pile; ventral black pile on metatibia covering some 10% of length of tibia.

### Ecology

All collected specimens were visiting flowering *Hedera helix* (Fig. 8). The localities of the *H. helix* differed, ranging from dry river beds with old *Platanus* trees to gardens, gorges and edges of groves. A female was flushed from a deep crevice with decaying wood at 0.5 m height in a *Platanus orientalis* L. Afterwards, it hovered some time with its extended ovipositor curled under the abdomen in front of this crevice before flying off. A male was seen hovering around a *Castanea sativa* Mill. tree as if it were defending a territory. This suggests that *M. cretica* sp. nov. uses *P. orientalis* and possibly also *C. sativa* as its breeding habitat.

### Distribution

The species is only known from the island of Crete, Greece and is presumed to be a Cretan endemic. During the field work, *Milesia cretica* sp. nov. was collected from seven locations; all specimens were collected by hand with an entomological net. On the website iNaturalist under catalogue number 67354454 another observation was found: <https://www.inaturalist.org/observations/67354454>. All known localities are visualized in Figure 1.



**Fig. 6.** *Milesia virginiensis* (Drury, 1773), ♂, (SBH), habitus dorsal. Collected in the USA, South Carolina, 3 September 2018, leg. and coll. S. Bot.



### DNA barcode analysis

A total of 54 COI sequences for different species of *Milesia* were analysed, including our five sequences of *M. cretica* sp. nov. (Fig. 9). The NJ tree depicts well-defined, genetically divergent clusters that reflect morphological species with high bootstrap support values (BS > 92). Our analysis recovered the *Milesia crabroniformis* group (BS = 99.5), our new species (BS = 100) and *M. crabroniformis* (BS = 100) with high support.

From the newly obtained COI sequences for *M. cretica* sp. nov., the sequence ON059134 (paratype ZFMK-DIP-00083002) differs 0.152% from the other four sequences, which are identical. COI barcodes of *M. cretica* sp. nov. differ more than 2% from the sequences of *M. crabroniformis* (2.13–2.66%), while the intraspecific variability in the latter taxon is less than 1% (0.0–0.68%) among the studied European specimens. In general, the intraspecific divergence among the COI sequences from the studied species is always lower than 1%, except for *M. virginiensis* (Drury, 1773) whose COI sequences differ 0.46–1.52%.

### Remarks

In overall appearance, *M. cretica* sp. nov. is remarkably similar to the Nearctic species *Milesia virginiensis* (Fig. 6), sharing the black and yellow pattern on terga 2, 3 and 4. This is unexpected since *M. virginiensis* occurs in a different realm and belongs to a different species group (Hippa 1990). The



**Fig. 7.** *Milesia cretica* Bot & van Steenis sp. nov. (SBH), male genitalia in lateral view. Collected on Crete, Imbros Gorge, 17 October 2017, leg. and coll. S. Bot. Abbreviations: a = aedeagus; s = surstylus; sl = superior lobe. Scale bar = 1 mm.

*Milesia crabroniformis* group differs from the *Milesia virginiensis* group by, for example, slightly tuberculate face; alula and cell r completely microtrichose; profemur with flattened basoventral area; and male genitalia very different (Hippra 1990).

*Milesia cretica* sp. nov. belongs to the *crabroniformis* species group as defined by Hippra (1990). The following morphological characters are shared by *M. cretica* sp. nov. with the *crabroniformis* species group: bare anterior anepisternum; bare pleura at ventral end of posterior spiracle; face not strongly produced; proboscis normal and with short labella; cell  $r_1$  closed; alula and posterior part of cell br completely microtrichose; posterior spiracle open only on dorsal part; male profemur with a wide basoventral depressed area; and female abdominal tergum 5 medially submembranous and laterally compressed. Still, *M. cretica* sp. nov. does not key satisfactorily to any of the species groups in Hippra's (1990) key. This is because it has a partly black vertex and partly black terga compared to *M. crabroniformis*, and thus, not all characters univocally key out to the *M. crabroniformis* group in couplets 15 and 16. When disregarding the colouration, but maintaining the structural characters, *M. cretica* sp. nov. keys out in the *M. crabroniformis* species group in Hippra's (1990) key:

- 15. Posterior spiracle medially widely open (Hippra 1990: fig. 13f) ..... *M. semiluctifera* group
  - Posterior spiracle open only on dorsal part (Hippra 1990: fig. 30e) ..... 16
- 16. Male profemur without a large basoventral depressed area, female abdominal tergum 5 uniformly sclerotized and rigid, not laterally compressed (Hippra 1990: 62) ..... *M. undulata* group
  - Male profemur with a wide basoventral depressed area, female abdominal tergum 5 medially submembranous and laterally compressed (Hippra 1990: 58) ..... *M. crabroniformis* group

#### Key to species of *Milesia* occurring in Europe

- 1. Terga 2 and 3 black with pair of yellow rectangular maculae anteriorly (Fig. 5); clypeus black .....  
..... *M. semiluctifera* (Villers, 1798)
  - Terga 2 and 3 with rather diffuse colour pattern, mainly dark brown, red or yellow, if black is present, it is in the form of well demarcated black vittae (Figs 2–4); clypeus yellow-brown ..... 2
- 2. Terga 2 and 3 without well-demarcated black pattern (Fig. 4); yellow pollinosity on scutum is less extensive on posterior part, creating a colour contrast between yellow pollinose pattern on anterior part and orange brown ground colour pattern on posterior part; base and anterior part of wing yellow, creating colour contrast with slightly infuscated remainder of wing .....  
..... *M. crabroniformis* (Fabricius, 1775)
  - Terga 2 and 3 with well-demarcated black pattern (Figs 2–3); scutum with heavy yellow pollinose pattern on both anterior and posterior part; base of wing only slightly yellow, wing appearing all hyaline, without colour contrast ..... *M. cretica* Bot & van Steenis sp. nov.

#### Discussion

The two European species, *M. crabroniformis* and *M. semiluctifera*, have several synonyms all of which could hypothetically involve our new species. None of the synonyms were described from Crete, the type locality of the new species. No type material has been studied, however, the descriptions and type localities leave no doubt about the identity of these species as discussed below.

Fabricius' (1775) description of the holotype of *Syrphus crabroniformis*, translated from Latin, is: "abdomen yellow; first and second segment with brown tip". This description fits our concept of *M. crabroniformis* well and excludes *M. cretica* sp. nov. Further, the holotype of *M. crabroniformis* was collected on the island of Madeira, Portugal, which is far from Crete. Moreover, all records of *M. crabroniformis* from Madeira we assessed were true *M. crabroniformis* (Smit *et al.* 2004;



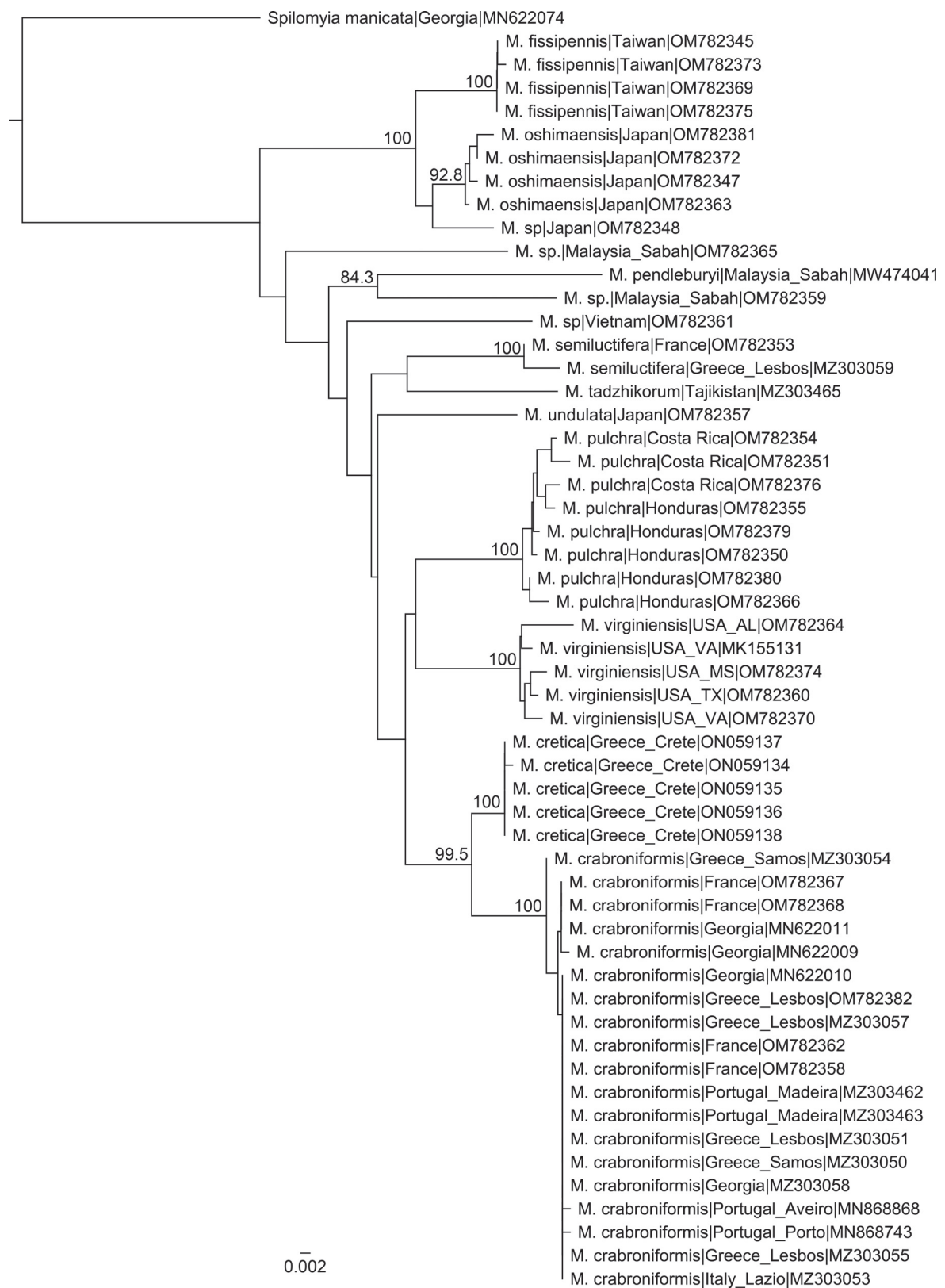
www.observation.org) and the two barcoded specimens from Madeira cluster with all other European specimens identified as *M. crabroniformis* (Fig. 9).

*Syrphus gigas* Rossi, 1790, described from Italy, was listed as synonym of *M. crabroniformis* by Peck (1988) but it was omitted by Hippha (1990). The synonym by Peck (1988) is accepted here. The description and figure of Rossi's *Syrphus gigas* (1790: 283, tab. x, fig. 11) leaves no doubt about its synonymy with *M. crabroniformis*. *Milesia gigas* Macquart, 1834, a junior homonym of *Syrphus gigas*, was renamed as *Milesia gigantea* Hippha, 1990 and is an Oriental species not occurring in Europe. The taxonomic status of another junior homonym, *Milesia gigas* Guérin-Ménéville, 1834 [as *Milesia gigas* Querin, 1834 in Hippha (1990)], was left unresolved by Hippha (1990: 109), but he stated that the synonymy of this taxon with *M. gigantea* is very unlikely.

The type locality of *Musca semiluctifera* Villers, 1798 is southern France and its description clearly depicts the species as interpreted here. For *M. semiluctifera* the following two synonyms are given by Peck (1988) and Hippha (1990): *Syrphus splendidus* Rossi, 1790 and *Eristalis fulvimanus* Fabricius, 1805, both with Italy as the type locality. The descriptions of *Syrphus splendidus* “antennae black, bare; thorax with vittae and maculae; abdomen with 3 pairs of yellow maculae” and the figure (Rossi 1790: tab. x, fig. 10) clearly depict *M. semiluctifera*. The description of *Eristalis fulvimanus*: “antennae black; thorax with yellow maculae and abdomen with yellow interrupted fascia” also applies to *M. semiluctifera*.



**Fig. 8.** Type locality of *Milesia cretica* Bot & van Steenis sp. nov. with flowering *Hedera helix* L.: Imbros Gorge, Crete, Greece, October 8, 2021 (photo Sander Bot).



**Fig. 9.** Neighbour-Joining tree using the 658 bp COI sequences. Numbers at nodes indicate the bootstrap support values above 80. Each specimen name has the morphological identification, the country of origin and the GenBank Accession Number.



*Milesia cretica* sp. nov. is so far only known from Crete. The recently published *Atlas of the Hoverflies of Greece* (Vujić *et al.* 2020) also reports the closely related *M. crabroniformis* from Crete, which is based on a field observation made by A. Ssymank (A. Vujić pers. com.). One individual was caught with a hand net, but escaped before it could be collected, so it remains unknown whether it concerned the true *M. crabroniformis* or the new species *M. cretica* sp. nov. (A. Ssymank pers. com.). It is hard to prove that *M. crabroniformis* does not occur on Crete but the absence of records suggests that it is not present there. During the field trip, we collected many specimens of *M. cretica* sp. nov. and none of *M. crabroniformis*, which is also known to fly in autumn and is also a frequent visitor of flowering *Hedera helix* (Speight 2020; van Steenis *et al.* 2021).

This is the fourth species of endemic syrphid discovered on Crete, the others being *Brachyopa vernalis* van Steenis & van Steenis, 2014, *Merodon atricapillatus* Šašić, Ačanski & Vujić in Šašić Zorić *et al.*, 2018, and *Merodon medium* Vujić, Likov & Radenković in Vujić *et al.*, 2020 (see Vujić *et al.* 2020).

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