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Review of the genus *Pelecocera* Meigen, 1822 (Diptera, Syrphidae) in the Palaearctic with the description of a new species from Cyprus

With 11 figures, 1 table and an electronic supplementary information

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Abstract

The study of the hoverfly fauna of Cyprus resulted in the discovery of one new species to science, *Pelecocera hederae* van Eck spec. nov. In the present study, the new species is described in full and all other Palaearctic *Pelecocera* species are commented. As a result of this study, a revised identification key to the Palaearctic species of *Pelecocera* is presented. In addition, we performed a DNA barcoding analysis for the Palaearctic species of *Pelecocera*, including new DNA data and all the *Pelecocera* sequences publicly available. DNA barcoding supports the new species *Pelecocera hederae* van Eck spec. nov., as well as most of the Palaearctic species of this genus, with the exception of two pairs of taxa: *Pelecocera* (*Chamaesyrphus*) *japonica* (Shiraki, 1956) and *Pelecocera* (*Chamaesyrphus*) *lusitanica* (Mik, 1898), and *Pelecocera* (*Chamaesyrphus*) *pruinosomaculata* Strobl, 1906 and *Pelecocera* (*Chamaesyrphus*) *scaevoides* (Fallén, 1817).

Key words

Flower flies, hoverflies, *Pelecocera*, *Chamaesyrphus*, new species, Palaearctic, Cyprus, DNA barcoding

Taxonomic acts

Pelecocera hederae spec. nov. – urn:lsid:zoobank.org:act:6674C895-CB63-4379-BA8B-227F779481CF

Zusammenfassung

Die Untersuchung der Schwebfliegenfauna von Zypern führte zur Entdeckung einer neuen Art, *Pelecocera hederae* van Eck spec. nov. In der vorliegenden Studie wird die neue Art vollständig beschrieben und alle anderen paläarktischen *Pelecocera*-Arten kommentiert. Als Ergebnis der vorliegenden Studie wird ein überarbeiteter Bestimmungsschlüssel vorgestellt. Darüber hinaus führten wir eine DNA-Barcoding-Analyse für die paläarktische *Pelecocera*-Arten durch, einschließlich neuer DNA-Daten und aller öffentlich zugänglichen *Pelecocera*-Sequenzen. Das DNA-Barcoding unterstützt die neue Art *Pelecocera hederae* van Eck spec. nov. sowie die meisten paläarktischen Arten dieser Gattung, mit Ausnahme von zwei Taxapaaren: *Pelecocera* (*Chamaesyrphus*) *japonica* (Shiraki, 1956) und *Pelecocera* (*Chamaesyrphus*) *lusitanica* (Mik, 1898), und *Pelecocera* (*Chamaesyrphus*) *pruinosomaculata* Strobl, 1906 und *Pelecocera* (*Chamaesyrphus*) *scaevoides* (Fallén, 1817).

Introduction

The genus *Pelecocera* Meigen, 1822 (Diptera, Syrphidae) comprises small-sized flies, usually with an overall dark body colour, often parts of the body densely pruinose, and with or without tawny to yellow markings on the abdominal tergites. Although several records of flowers visited by adults appear in the literature (Speight 2020), the larval biology of these flies was completely unknown until very recently. Speight (2020) suggested that *Pelecocera* immatures were apparently phytophagous, but a recent discovery of larvae of *Pelecocera japonica* (Shiraki, 1956) on fungal fruit bodies suggests that they are mycophagous (Okada et al. 2021).

In the last decades, *Pelecocera* and *Chamaesyrphus* Mik, 1895 have either been treated as separate genera (Ståhls & Nyblom 2000; Doczkal 2002; Stubbs & Falk 2002; van Veen 2004; Hippa & Ståhls 2005; Mengual et al. 2015), or as subgenera within the genus *Pelecocera* (Thompson & Rotheray 1998; Ståhls et al. 2004; Bartsch et al. 2009). As a result, several species have been shifting from one taxon to the other, and back, in taxonomic literature. In the most recent phylogenetic study on the tribe Rhingiini, where they belong, *Pelecocera* and *Chamaesyrphus* were resolved as subgenera of *Pelecocera* based on molecular and morphological characters (Vujić et al. 2018). Formerly, the subgenus *Pelecocera* used to be divided into two species groups: the *tricincta*-group (slender and shiny species with a narrow frons: width of frons less than one eye width) and the *latifrons*-group (broader species, densely pruinose, with a broad frons: face broader than one eye width). However, since the study of Vujić et al. (2018) the species of the *latifrons*-group were moved to a new genus, *Pseudopelecocera* Vujić & Radenković in Vujić et al. 2018.

Pelecocera species are present in the Holarctic, with currently eight described valid species recorded from the Palaearctic Region, all but one also present in Europe (Peck 1988, Mengual et al. 2015, Speight 2020). Three valid species occur in the Nearctic Region (Evenhuis & Pape 2021), although new, undescribed Nearctic species of the subgenus *Chamaesyrphus* are known (F.C. Thompson pers. comm., 2020).

The aim of the present paper is to describe a recently discovered new species of *Pelecocera* (*Chamaesyrphus*) from Cyprus. This new species is described by the first author and it is supported by morphological and molecular characters. Moreover, an identification key is presented to all Palaearctic species within the genus *Pelecocera*.

Material and methods

Specimens of *Pelecocera* from Cyprus studied in this paper were mostly collected by hand netting. If other sampling techniques were used, they are specifically mentioned in the species accounts.

The examined material is preserved in the following collections referred to in the text by their acronyms, indicated between square brackets:

AET	André van Eck, Tilburg, The Netherlands, private collection
BMNH	British Museum of Natural History, London, United Kingdom, public collection
CML	Christodoulos Makris, Limassol, Cyprus, private collection
GPA	Gerard Pennards, Amersfoort, The Netherlands, private collection
FSUNS	Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia, public collection
JSA	Jeroen van Steenis, Amersfoort, The Netherlands, private collection
JTS	John T. Smit, Utrecht, The Netherlands, private collection
MLUH	Martin-Luther-Universität Halle-Wittenberg, Institut für Zoologie, Halle/Saale, Germany, public collection
NBC	Naturalis Biodiversity Center, Leiden, The Netherlands, public collection
NNKN	Natuurhistorisch Museum Brabant, Tilburg, The Netherlands, public collection
MSD	Martin Speight, Dublin, Ireland, private collection
MCT	Miguel Carles-Tolrá, Barcelona, Spain, private collection
WSB	Wouter van Steenis, Breukelen, The Netherlands, private collection
XLS:	Xavier Lair, Sournia, France, private collection
ZFMK	Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany, public collection

The Dutch database utility 'KLASSE' version 2.0.84 Unicode (www.klasse-info.nl) was employed by the first author to store and to interpret information on the examined specimens in this study.

For the holotype specimen the original label data have been given verbatim. Double quotation marks (" ") were used to indicate separate labels and a double slash (//) has been used to indicate separate lines within a label. Identification and location labels of other specimens are indicated in standard format. Square brackets are used to indicate information added by the authors.

Morphology: Morphological terminology follows Cumming & Wood (2017) and Hippa & Ståhls (2005). Terminology of the male genitalia follows Hippa & Ståhls (2005). Colour characters are described from dry mounted specimens.

A note about the view of male genitalia as used in the present paper: in natural position, *Pelecocera* genitalia are folded inward, visible in posterior and ventral view of the abdomen. In ventral view, the dorsal side of sternite 8 is visible (as in Figure 42B in Hippa & Ståhls 2005) as well as epandrium, surstyli and cerci. For study of the genitalia, this combination of structures is unfolded and the dorsal side becomes the dorsal view. How to look at the structures of the genitalia in this paper is based on these premises. Figure 43A in Hippa & Ståhls (2005) gives a lateral view on the genitalia, where the arrow to S9 points to the ventral view on the hypandrium, as employed in the present paper, i.e., the opposite side of hypandrium is called dorsal view in this paper. Similarly, the position of cercus is dorsally, the opposite side is called ventral view, as employed in the present paper.

To study the male genitalia, in the case of dry specimens, these were softened in a relaxing chamber and genitalia were dissected with an entomological pin. Genitalia were cleared either in a solution of water-diluted KOH pellets or lactic acid for 12–24 hours at room temperature. This was followed by brief immersion in acetic acid to neutralize the KOH, immersion in ethanol to remove the acid, and storage in micro vials containing glycerine, which are pinned with the source specimens. The male genitalia were examined and dissected in ethanol or in several drops of glycerine under the stereomicroscope. In one case dissected genitalia of a specimen kept in 70 % ethanol, are preserved in the same 2 mL microtube as the fly.

All measurements of external characters are in millimetres and were taken using a reticule in a Leica MZ6 microscope. Body length was measured in lateral view, from the anterior oral margin to the posterior end of the abdomen. Wing length was measured from the wing tip to the basicosta.

Illustrations were prepared with different hard- and software and, in some cases, drawn by hand. Genitalia of *Pelecocera hederae* spec. nov. were photographed using a Leica DM2500 LED binocular microscope, with a Leica MC170HD camera with DIC system attached. Software used for stacking is the Leica application suite v. 4.13.0 [build: 310]. Images of adults were made with a Canon EOS-R or Canon 6D camera, with MPE 65mm lens. Stacking of adults pictures was performed with Helicon Focus software. Adobe ® Photoshop CC v. 22.2.0 and Adobe ® Photoshop Lightroom v. 4.1 were also used for editing the final images. Line drawings were made from digital photos made with a Bresser MikroCam 3.1mP camera, with Bresser MikroCamLab II stacking software v. 4.7.15283.20190804, connected to a Leica MZ6 stereomicroscope. Measurements of genitalia are in millimetres and were performed with the help of stacking software.

We have examined specimens of all the Palaearctic species. The specimens of the new species from Cyprus were checked against several original descriptions when it turned out the species was unknown to the authors. These descriptions include *Chamaesyrphus apichaetus* Curran, 1923, *Chamaesyrphus japonicus* Shiraki, 1956, *Pelecocera escorialensis* Strobl in Čzerný & Strobl, 1909, *Syrphus trifasciatus* Preyssler, 1793 in Preyssler et al. (1793) [*nomen oblitum* for *Pelecocera lusitanica* (Mik, 1898)] and *Euceratomyia pergandei* Williston, 1884.

Molecular studies: The 5'-end of the mitochondrial cytochrome *c* oxidase subunit I (COI) gene, also known as DNA barcode (Hebert et al. 2003 a, b), was sequenced from several *Pelecocera* and *Pseudopelecocera* specimens, including four paratypes of *Pelecocera hederae* spec. nov. (Table 1). One or two legs from the dry pinned specimens or the ones in alcohol were 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-Dipt2183R, also known as COI-780R (5'-CCAAAAAATCARAATARRTGYTG-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-directionally sequencing reactions were carried out by Macrogen© Inc. Chromatograms were edited in Geneious 7.1.9 (Biomatters© Ltd). All new sequences were submitted to GenBank via BOLD (www.boldsystems.org). GenBank accession numbers are provided for each sequenced specimen (Table 1).

We performed a search with the terms '*Pelecocera*' and '*Chamaesyrphus*' in BOLD (https://www.boldsystems.org/index.php/Public_BINSearch?searchtype=records) to find publicly available DNA sequences for the genus *Pelecocera*. We retrieved 70 sequences from the Palaearctic with '*Pelecocera*' and none with '*Chamaesyrphus*', from which 49 were finally included in our molecular analysis with at least 500 bp. We also compiled six COI sequences of *Pelecocera* taxa from the German Barcode of Life (Geiger et al. 2016; http://www.bolgermany.de) and included these in our analysis. We included *Rhingia mecyana* Speiser, 1910 as outgroup and constrained

Chrysotoxum bicinctum (Linnaeus, 1758) as the root for our Neighbour-Joining (NJ) analysis.

In total, 83 COI sequences were aligned in Geneious 7.1.9 without gaps and we ran a distance based NJ analysis using the Jukes-Cantor Model as implemented in the same software. Bootstrap support values (BS) were estimated from 1,000 replicates directly from Geneious 7.1.9. Figure 9 was drawn with the aid of FigTree v.1.3.1 (Rambaut 2009) and Adobe ® Illustrator CS 5.1.

Results

Pelecocera (*Chamaesyrphus*) *hederae* van Eck spec. nov.

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Figures 1, 2, 3, 4

Pelecocera (*Chamaesyrphus*) spec. nov. in van Steenis et al. (2019): 141.

Diagnosis: With the relatively thin arista positioned dorsally, away from the apex of the postpedicel, this new species belongs to the subgenus *Chamaesyrphus* Mik. Morphologically the new taxon is very similar to *P. caledonica* (Collin, 1940) and *P. scaevoides* (Fallén, 1817). From both species it can be easily distinguished by its gently curved face below the antennae in both sexes, which is not projecting forwards (Figs 1E, 1J). Differs from all other species of the subgenus *Chamaesyrphus* by the shape of its face, the insertion point of the arista, being exactly in the middle of the upper margin of the postpedicel [arista placed more apically in all other species except *Pelecocera* Lair & Nève spec. nov. (*in litt.*), and *P. scaevoides*]; by a completely shiny lunule [only shared with *P. caledonica* and *Pelecocera* Lair & Nève spec. nov. (*in litt.*)]; and sternite 1 usually bare or at most with very few short white pile [longer and more numerous white pile in *Pelecocera* Lair & Nève spec. nov. (*in litt.*), *P. lusitanica* (Mik, 1898), *P. pruinosomaculata* Strobl, 1906 and *P. scaevoides*]. The male genitalia are clearly different from all other Palaearctic *Pelecocera* species.

Description: **Male** (Fig. 1A-E)
[based on the holotype ZFMK-DIP-00055258]
Size (N=1): Body length: 5.8 mm; wing length: 4.9 mm.
Head: Face concave below the antennae. Lower part of the face not projected forward, smoothly curved, in anterior view. Facial tubercle very shallow, almost lacking. Face strongly pollinose, mainly yellow with a narrowly visible, darkened median stripe under the pollinosity which does not reach the oral cavity. Clypeus broad (approx. as broad as long), yellowish, slightly pollinose. Lunule and vertical triangle entirely and clearly shiny, black. This in clear contrast with the heavily silvery pollinose frons. Vertical triangle very thinly punctuated. Frons black under the strong pollinosity, this black turns to greyish lateral to the antennal sockets and dorsal half of the face. Genae yellow. Vertex shiny black, only very slightly pollinose, occiput slightly pollinose, dull. Vertex a little bit broader than a posterior ocellus at the point where it meets the vertical triangle. Occiput, when viewed laterally, very narrow. Genae about as narrow as the thickness of metatars I. Paraface very narrow and yellow, with same pollinosity as lower face. All setae on the head silver to light yellow, except a few black setae on the ocellar triangle. Face without setae. Inner eye margins advancing at the junction of frons and ocellar triangle, equal to the distance between the two hind ocelli. *Antenna*: First antennal segment very short, brown dorsally, black ventrally. Second segment orange-red with black setae apically. Postpedicel large, orange (darker than the yellow face and coxae) but with dorsal margin and apical area black. Its surface very slightly, silvery pollinose. Its dorsal margin straight, apex making an approximately 90° angle with the apical margin. Apical margin about as long as dorsal margin, ventrally smoothly curved back to the basis of postpedicel. Arista black, setose, as long as diameter of postpedicel, its insertion point exactly in the middle of the upper margin of the postpedicel.

Thorax: Postpronotum yellow, strongly pollinose. Mesonotum dorsally as brightly shiny as the vertical triangle, except for the following areas which are strongly pollinose: postpronotum and sharply defined border of it, notopleuron, postalar callus and the narrow connection between the latter two. Mesonotum dorsally just moderately punctuated, pale pilose. Pilosity of equal length, short, semi-erect to erect. Laterally and ventrally, the mesonotum is covered with thick, silvery, pollinosity (microtrichose), which is practically covering the black shiny ground colour. Anterior anepisternum with a few longer pile, hardly visible. Postpronotum with short white pile. Posterior anepisternum, anterior anepimeron and meron loosely covered with medium long white pile. Katepisternum with long white pile dorsally and ventrally, with broad area void of pile. One seta on left posterior anepisternum present (yellow), notopleural seta absent, one supra alar seta present (black). These bristles are quite weak. Postalar calli with very weak yellow setae. Scutellum tapering, appearing rather triangular, subapically with two longer bristles, one black and one yellow, placed sub-apically. Plumula white. *Legs*: Legs completely yellow, including coxae, except for the following parts: metafemur with yellow basal half, black ring at top half and yellow at apex; tibia and tarsomeres of leg III almost completely darkened, leaving only the bases of tibia and ventral side of tarsomeres yellowish; tarsal segments 3–5 of fore and mid legs slightly darkened. All pile white, except on the tarsomeres where is a mix of white pile and black setae. Stronger black bristles appear ventrally on the apex of tibia 2 and its first four tarsal segments. Pulvilli yellow,

tarsal claws bi-coloured with white basis and dark top half. Femora shiny, tibiae and tarsomeres slightly pollinose. *Wings*: Halters white-yellow. Alula white, as is the hair fringe of it. Wings completely microtrichose. Wing venation black, except at the very basis of the wing where the venation is dark yellow. Stigma dark grey.

Abdomen: Abdominal tergites shiny, especially at their lateral margins, dorsal surface only slightly pollinose. Extreme posterior margins of tergites 2–4 yellow. Tergite 1 black dorsally, and a whitish-yellow macula laterally, this macula covered with white pollinosity. Posterior margin black. Tergite 2 black, slightly longer than broad, with broadly separated paired yellow maculae, rectangular but antero-laterally reaching its margins. Anterior margin black, except where the yellow spots reach its margins. Length of yellow spot about half of length of tergite. Tergite 3 black, slightly broader than long, with yellow trapezium shaped maculae which are narrowly connected at the anterior margin of the tergite. Their inner margins twice as long as their lateral margins. Inner margins of the spots slightly V-shaped, lateral margins reaching the tergite's lateral margins. Anteriorly the spots connect with the anterior margin of the tergite. Length of the spots half of the length of the tergite. Tergite 4 same as tergite 3, as long as broad at its anterior margin, with similar yellow maculae as tergite 3, but the spots are slightly shorter than the ones on tergite 3 occupying less than half of the length of tergite 4. Tergites 5–8 yellow, with short black pile mixed with some white pile. Pile on tergites short, semi-erect to adpressed dorsally, mainly black but on the yellow maculae mainly white. Tergites laterally with longer white pile. Sternites yellow, moderately shiny, moderately pollinose with short semi-erect white pile on sternites 2–4. Sternite 1 practically bare (two pile). Sternite 8 with mixed short pale and black pile.

Male terminalia: Terminalia were dissected, photographed and drawn from a paratype specimen (ZFMK-DIP-55257) which was stored in 70 % ethanol (Figs 2A–F, 4A–C). Genitalia from two more paratype specimens (ZFMK-DIP-55262 and ZFMK-DIP-00055275), were dissected for comparison. ***Minis***: broad and compact (Figs 2B, 4C) (rather slender in all other species of ***Pelecocera***). ***Surstylus***: clearly shorter in length than epandrium (Fig. 4A, 4B) (equal in length or longer in all other species of ***Pelecocera***); in lateral view, extended anteriorly (Fig. 4A) (not extended anteriorly in all other ***Pelecocera*** species).

Female (Fig. 1F–J)
Description based on female paratype ZFMK-DIP-00055259. In most characters similar to the male holotype, except for the following:

Size (N=1): Body length: 7.5 mm; wing length: 6.4 mm.

Head: Face densely pollinose as in male, but with an oval undusted and shiny tubercle in its lower portion. Postpedicel smaller, more rounded apically and ventrally, red with black dorsal margin, arista as long as or a little longer than all antennal segments together. Frons with a narrow but clearly pollinose transverse band above lunule, contrasting and straight bordered with the shiny black dorsal area of the frons and frontal triangle. Inner eye margins straight, moderately tapering dorsally. Face as wide as an eye at the level of the antennal sockets.

Thorax: As in the male, except for the lacking setae on posterior anepisternum and notopleuron. Supra alar seta black on one side, yellow on the other. Postalar calli idem. Scutellum with one pair of black setae.

Abdomen: The abdominal orange coloured maculae on tergites 3–4 more widely separated than in the male. Maculae trapezium shaped, inner margins shorter than lateral margins. Lateral margins of the maculae on tergite 3 only reach lateral margin of tergite at their antero-lateral corners. Maculae on tergite 4 subtriangular with convex inner margins and reaching lateral margins of tergite. Tergite 5 with small yellow maculae similar in shape as those on tergite 4. As in the male, anteriorly the spots connect with the anterior margin of the respective tergites 3–5.

Variability: Variability exists in the colouration and size of the maculae on the abdominal tergites, which can sometimes be vaguely visible, in other cases they can be larger or even broadly connected, especially on T4, thus forming a band with a triangular incision at its hind margin. Larger maculae are usually more brightly yellow, and can reach the lateral margins of the tergites at their full length, especially in females. Size, colour and number of setae on scutum are variable, but generally these setae appear very weak. The number of scutellar setae varies from one to three pairs, usually black but can be partly or all of them yellow. Anterior anepisternum may have very weak, or no pile at all. The face can be more or less pollinose, particularly in females (e.g. compare Figs 1H, 3).

Etymology: *Pelecocera hederae* spec. nov. is named after the plant genus *Hedera* L. (ivy), as it seems to live in close relationship with it. Most specimens were collected on flowers of *Hedera*, which might be their main food source. Both genus name and epithet are derived from Greek, epithet Latinised, meaning: on *Hedera*.

Material studied: HOLOTYPE: 1 ♂, "CYPRUS, Limassol // Prodromos (Troodos) // UTM 36S 485.2 3865.4 [34.92980°N 32.84160°E] // 3.XI.2016 A.v.Eck // on Hedera", "ZFMK // DIP 00055258" [col. ZFMK].

PARATYPES: CYPRUS: 1 ♂, Nicosia, Platania Forest Station, 34.94890°N 32.92790°E, 28.x.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055257 [col. AET; in 70 % ethanol; genitalia dissected for description and photography]; 1 ♂, 1 ♀, Nicosia, Platania Forest Station, 34.94890°N 32.92790°E, 28.x.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055267 (♂) and ZFMK-DIP-00055268 (♀) [col. JSA]; 3 ♂♂, Nicosia, Platania Forest Station, 34.94890°N 32.92790°E, 28.x.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055274, ZFMK-DIP-00055275 [genitalia dissected for description], and ZFMK-DIP-00055276 [col. AET]; 1 ♂, Nicosia, Platania Forest Station, 34.94890°N 32.92790°E, 28.x.2016, on *Hedera*, leg. A. v. Eck [col. MSD; in 70 % ethanol]; 1 ♂, Limassol, Prodromos (Troodos), 34.92980°N 32.84160°E, 29.x.2016, on *Hedera*, leg. C. Makris, ZFMK-DIP-00055269 [col. XLS]; 1 ♂, 1 ♀, Limassol, Prodromos (Troodos), 34.92980°N 32.84160°E, 29.x.2016, on *Hedera*, leg. C. Makris, ZFMK-DIP-00055277 (♂) and ZFMK-DIP-00055278 (♀) [col. CML]; 5 ♀♀, Limassol, Prodromos (Troodos), 34.92980°N 32.84160°E, 29.x.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055280, ZFMK-DIP-00055281, ZFMK-DIP-00055282, ZFMK-DIP-00055283 and ZFMK-DIP-00055284 [col. AET]; 1 ♂, 1 ♀, Limassol, Platres (in village), 34.88970°N 32.85990°E, 3.xi.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00082340 (♂) and ZFMK-DIP-00082341 (♀) [col. ZFMK]; 1 ♂ paratype 4A, Limassol, Platres (in village), 34.88970°N 32.85990°E, 3.xi.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055271 [col. NBC]; 1 ♂ paratype 4B, Limassol, Platres, Trooditissa, 34.91356°N 32.84303°E, 3.xi.2016, +1300 m, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055272 [col. AET]; 1 ♀ paratype 4D, Limassol, Platres, Trooditissa, 34.91356°N 32.84303°E, 3.xi.2016, 1300 m a.s.l., on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055273 [col. NBC]; 6 ♀♀, Limassol, Platres, Trooditissa, 34.91356°N 32.84303°E, 3.xi.2016, 1300 m a.s.l., on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055279, ZFMK-DIP-00055285, ZFMK-DIP-00055286, ZFMK-DIP-00055287, ZFMK-DIP-00055288 and ZFMK-DIP-00055289 [col. AET]; 1 ♀, Limassol, Platres, Trooditissa, 34.91356°N 32.84303°E, 3.xi.2016, 1300 m a.s.l., on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055270 [col. XLS]; 2 ♀♀, Limassol, Platres, Trooditissa, 34.91356°N 32.84303°E, 3.xi.2016, 1300 m a.s.l., on *Hedera*, leg. A. v. Eck [col. MSD; in 90 % ethanol]; 1 ♂, Limassol, Prodromos (Troodos), 34.92980°N 32.84160°E, 3.xi.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055290 [col. AET]; 1 ♀, Limassol, Prodromos (Troodos), 34.92980°N 32.84160°E, 3.xi.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055291 [col. GPA]; 1 ♂, Limassol, Prodromos (Troodos), on *Hedera*, 34.92980°N 32.84160°E, 3.xi.2016, leg. A. v. Eck, ZFMK-DIP-00055262 [col. ZFMK; dry pinned; genitalia dissected and stored in micro-tube on the same pin]; 1 ♀, Limassol, Saittas, river valley, 34.87478°N 32.91496°E, 6.xi.2016, on *Hedera*, leg. C. Makris, ZFMK-DIP-00055292 [col. AET]; 1 ♀, Limassol, Saittas, river valley, 34.87478°N 32.91496°E, 6.xi.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055293 [col. FSUNS]; 2 ♀♀, Limassol, Saittas, river valley, 34.87478°N 32.91496°E, 6.xi.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055294 and ZFMK-DIP-00055295 [col. AET]; 1 ♀ paraype 4C, Limassol, Amiantos, river valley, 34.91388°N 32.94268°E, 7.xi.2016, on *Alnus orientalis*, leg. A. v. Eck, ZFMK-DIP-00055259 [col. ZFMK]; 5 ♀♀, Limassol, Amiantos, river valley, 34.91388°N 32.94268°E, 7.xi.2016, on *Alnus orientalis*, leg. A. v. Eck, ZFMK-DIP-00055298, ZFMK-DIP-00055299, ZFMK-DIP-00055300, ZFMK-DIP-00055301 and ZFMK-DIP-00055302 [col. AET; in 96 % ethanol]; 2 ♀♀, Limassol, Amiantos, river valley, 34.91388°N 32.94268°E, 7.xi.2016, on *Alnus orientalis*, leg. A. v. Eck, ZFMK-DIP00055296 and ZFMK-DIP-00055297 [col. AET]; 2 ♀♀, Limassol, Saittas, river valley, 34.87478°N 32.91496°E, 7.xi.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00055263 and ZFMK-DIP-00055264 [col. ZFMK]; 1 ♂, 1 ♀, Limassol, Saittas, river valley, 34.87478°N 32.91496°E, 7.xi.2016, on *Hedera*, leg. A. v. Eck, ZFMK-DIP-00082342 (♂) and ZFMK-DIP-00082343 (♀) [col. ZFMK]; 1 ♂, 1 ♀, Limassol, Platres, along rd E804, 1355 m a.s.l., Malaise trap over *Hedera helix*, 34.93166°N 32.83861°E, 09-13.x.2017, leg. J. & W. van Steenis, ZFMK-DIP-00055265 (♂) and ZFMK-DIP-00055266 (♀), [col. JSA]; 1 ♂, 1 ♀, Limassol, Platres, along rd E804, 1355 m a.s.l., Malaise trap over *Hedera helix*, 34.93166°N 32.83861°E, 09-13.x.2017, leg. J. & W. van Steenis, ZFMK-DIP-00027881 (♂) and ZFMK-DIP-00027882 (♀), [col. JSA]; 3 ♂♂, 1 ♀, Limassol, Platres, along rd E804, 1352 m a.s.l., on *Hedera helix*, 34.93175°N 32.84728°E, 09.x.2017, leg. X. Mengual, ZFMK-DIP-00028163, ZFMK-DIP-00028164 (♂) and ZFMK-DIP-00028165 (♀), ZFMK-DIP-00027873 (♂ in alcohol) [col. ZFMK]; 1 ♂, 2 ♀♀, Limassol, Platres, along rd E804, 1352 m a.s.l., on *Hedera helix*, 34.93175°N 32.84728°E, 09.x.2017, leg. W. van Steenis, wvs07057 (♂), wvs07055 and wvs07056 (♀♀) [col. WSB];
3 ♂♂, Limassol, Platres, along rd E804, 1352 m a.s.l., on *Hedera helix*, 34.93175°N 32.84728°E, 13.x.2017, leg. X. Mengual, ZFMK-DIP-00028166, ZFMK-DIP-00028167, ZFMK-DIP-00028168 [col. ZFMK].

Ecology: The adult flies were found feeding on flowering *Hedera pastuchovii* subsp. *cypria* (McAll.) Hand (Fig. 5), usually within the forests or at forest edges. Adult flies were also found feeding on male catkins of *Alnus orientalis* Decne. in a half open area along a stream. Larval niche is unknown.

Distribution: Cyprus: Troodos Mountains (~550–1450 m a.s.l.).

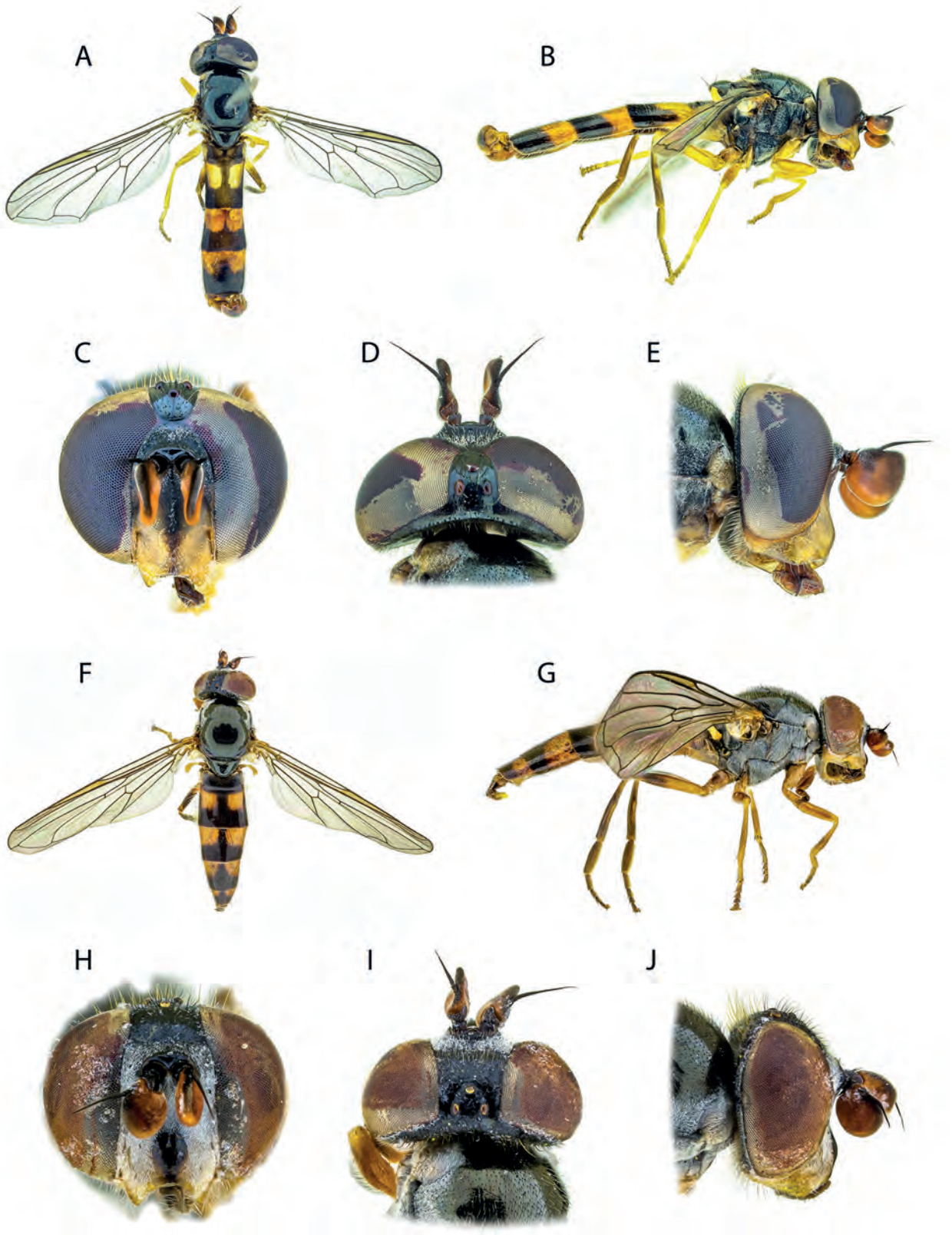

Fig. 1A-J: **A–E**: *Pelecocera hederae* spec. nov., male holotype, body length 5.8 mm: **A**: habitus dorsal view; **B**: habitus lateral view; **C**: head, anterior view; **D**: head, dorsal view; **E**: head, lateral view. – **F–J**: *Pelecocera hederae* spec. nov., female paratype ZFMK-DIP-00055259, body length 7.5 mm: **F**: habitus, dorsal view (pin digitally removed); **G**: habitus, lateral view; **H**: head, anterior view; **I**: head, dorsal view; **J**: head, lateral view.

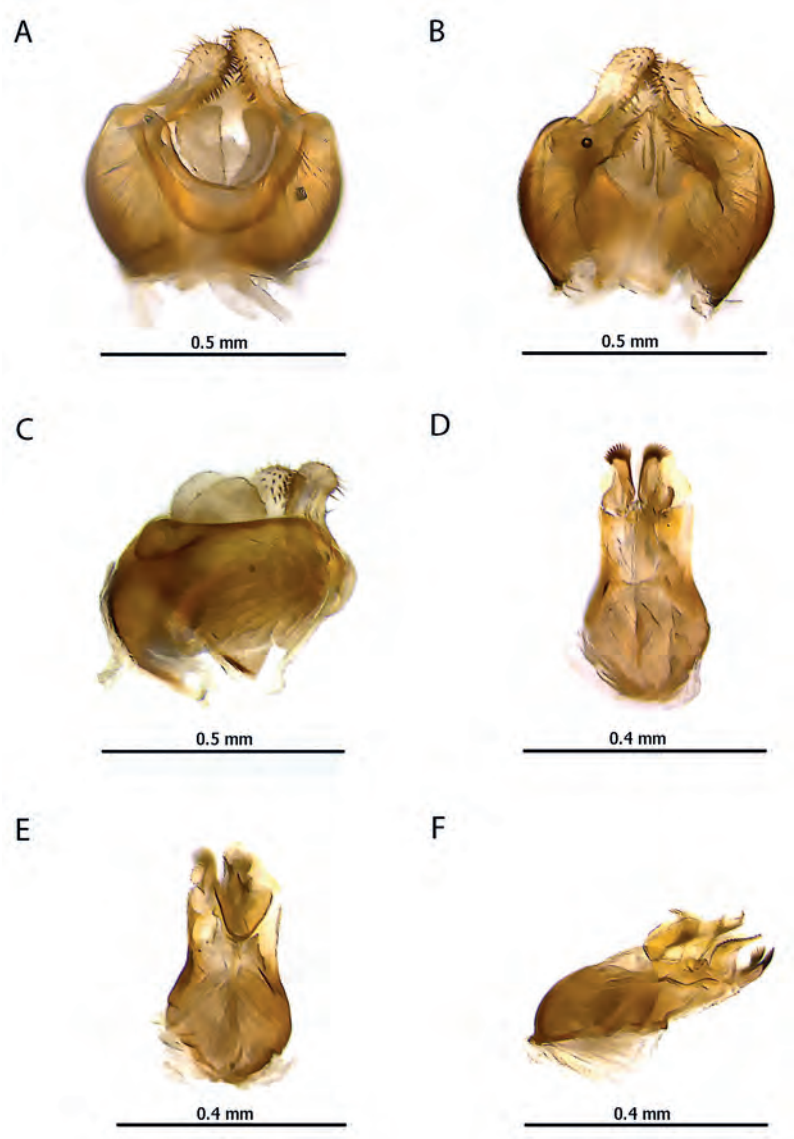

Fig. 2A–F: *Pelecocera hederae* spec. nov., male paratype (ZFMK-DIP-55257), genitalia: **A**: epandrium, cerci and surstyli, dorsal view; **B**: epandrium, surstyli and minis, ventral view; **C**: epandrium, cerci and surstyli, lateral view; **D**: hypandrium, dorsal view; **E**: hypandrium, ventral view; **F**: hypandrium, lateral view.

Fig. 3: *Pelecocera hederae* spec. nov., female paratype (ZFMK-DIP-00055273): head, anterior view.

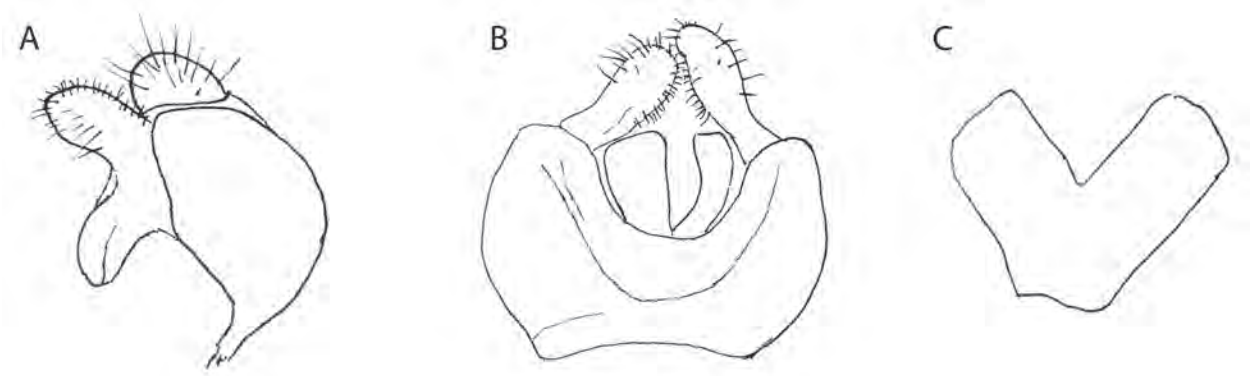

Fig. 4: Male genitalia of *Pelecocera hederae* spec. nov., paratype (ZFMK-DIP-00055257). **A**: Epandrium cerci and surstyli, lateral view; **B**: Epandrium, cerci and surstyli, dorsal view; **C**: Minis.

Other species examined: The following, mostly unpublished, specimens were examined in order to provide an updated identification key to the Palaearctic species of *Pelecocera*, belonging to the subgenera *Chamaesyrphus* and *Pelecocera*.

Pelecocera (*Chamaesyrphus*) *caledonica* (Collin, 1940)

Original description: *Chamaesyrphus caledonicus* Collin, 1940: 157.

Material examined: ANDORRA: 1 ♀, Andorra, Camping Font des Ferrosins [42.591°N 1.668°E], 1800–1900 m a.s.l., 30.vii.1995, leg. B. Wakkie [col. WSB]. FINLAND: 1 ♂, 1 ♀, Helsinki, Kallahdenniemi, 16.viii.2004, leg. J. Kahanpää [col. GPA]. NORWAY: 1 ♀, Geiranger, Grotli, 15.vii.1988, 1000 m a.s.l., leg. M. v. Steenis [col. NBC]; 1 ♀, Geiranger, Grotli, 15.vii.1988, 1000 m a.s.l., leg. H. v. Steenis [col. WSB]. PORTUGAL: 1 ♂, Porto, Valongo, Campo, 41.17667°N 8.48138°W, 11.x.2010, leg. R. Andrade [col. AET; genitalia dissected for analysis]; 1 ♀, Braga, Barcelos, Gilmonde, 41.51058°N 8.64649°W, 26.x.2013, leg. R. Andrade [col. AET]. RUSSIA: 1 ♀, St-Petersburg, Luga, Yaschera [59.15N 29.91E], 21.viii.1958, leg. Stackelberg [col. NBC]; 1 ♂, St-Petersburg, Luga, Yaschera [59.15N 29.91E], 13.viii.1964, leg. Stackelberg [col. NBC]. SPAIN: 1 ♂, Granada, Sierra Nevada, Trevélez, 1550 m, 36.99634°N 3.26410°W, 22.x.2001, leg. J.T. Smit [col. JTS]; 3 ♀♀, Granada, Sierra Nevada, Mecina Bombarón, 36.99654°N 3.15171°W, 1190 m a.s.l., 23.x.2001, leg. J.T. Smit [col. JTS]. SWEDEN: 1 ♀, Hälsingland, Edsbyn, Eggåssen, burned forest, [61.38333°N 15.81666°E], viii.1997, malaise trap, leg. L.O. Wikars [col. JSA].

Fig. 5: *Pelecocera hederae* spec. nov. female (on the right), feeding on nectar produced by *Hedera pastuchovii* subspecies *cypria,* 28.x.2016, Prodromos, Cyprus. Photo: Christodoulos Makris.

Pelecocera (*Chamaesyrphus*) *japonica* (Shiraki, 1956)

Original description: *Chamaesyrphus japonicus* Shiraki, 1956: 3.

Material examined: JAPAN: 2 ♂♂, 2 ♀♀, Ehime prefecture, Imabari City, Shishima Gahara beach, 34.017°N 133.048°E, 7.iv.2014, leg. K. Ichige, Det. K. Ichige 2020 (as *Chamaesyrphus japonicus* Shiraki, 1956), ZFMK-DIP-00055303, ZFMK-DIP-0055304 (♂♂) and ZFMK-DIP-00055305, ZFMK-DIP-00055306 (♀♀) [coll. ZFMK]; 1 ♂, 1 ♀, Ehime prefecture, Imabari City, Shishima Gahara beach, 34.017°N 133.048°E, 7.iv.2014, leg. K. Ichige, Det. K. Ichige 2020 (as *Chamaesyrphus japonicus* Shiraki, 1956), ZFMK-DIP00055307 (♂) and 00055308 (♀) [coll. AET].

Remarks: Originally described from a female specimen (Shiraki 1956). Only recently, the male was described by Katsura (2004). Ichige (2014) published a short key including *P. scaevoides*, the only other *Pelecocera* species recorded nearby Japan, from the Russian Far East region, from two localities on Sakhalin Island, which is close to Hokkaido, Japan (Mutin & Barkalov 1997). Taira (2002), Katsura (2004), Ichige (2014) and Ohishi & Shinogi (2017) provided photos of adults as well as habitat photos. The male genitalia were illustrated by Katsura (2004). These two species are currently the only taxa known to occur in the region. *Pelecocera japonica* has not been recorded outside Japan. The holotype specimen of *Chamaesyrphus japonicus* could be studied via photographs (images of the holotype are at HTTPS://www.naro.affrc.go.jp/org/niaes/type/dbdiptera/c_japonicus.html). After examination of the six specimens of *P. japonica* kindly sent to us by K. Ichige, we did not find any external morphological character or male genitalia feature to distinguish *P. japonica* from *Pelecocera pruinosomaculata*, but our DNA barcoding analysis clustered *P. japonica* with *P. lusitanica* with low support (BS=82.2).

Pelecocera (*Chamaesyrphus*) *lusitanica* (Mik, 1898)

Original description: *Chamaesyrphus lusitanicus* Mik, 1898: 143.

Material examined: BELGIUM: 1 ♂, Sourbrodt, 30-6-1991, leg. J.F. Reichwein [col. NNKN]. NETHERLANDS: 1 ♀, Bergen, 13.ix.1954, leg. V.S. an der Goot [col. NBC]; 1 ♂, Bergen, 7.ix.1958, leg. V.S. van der Goot [col. NBC]; 1 ♀, Otterlo, 4.ix.1968, leg. B. van Aartsen [col. NBC]; 1 ♀, Drunense Duinen, 51.64702°N 5.11990°E, 9.ix.2006, leg. AET [col. AET]; 3 ♂♂, 1 ♀, Brunssumerheide, 50.92000°N 5.97000°E, 20.viii.2016, leg. A. van Eck & M. Oosthoek [col. AET]. PORTUGAL: 2 ♂♂, Algarve, E. of Quarteira, [37.06°N 8.10°W], 22.iv.1985, leg. J.A.W. Lucas [col. NBC]; 2 ♀♀, Algarve, E. of Quarteira, [37.06°N 8.10°W], 24.iv.1985, leg. J.A.W. Lucas [col. NBC]; 3 ♂♂, 6 ♀♀, Algarve, Vilamoura, 26.iv.1985, leg. J.A.W. Lucas [col. NBC]; 1 ♂, Algarve, Vilamoura, 27.iv.1985, leg. J.A.W. Lucas [col. NBC]; 1 ♀, Algarve, N. of Quarteira, [37.06°N 8.10°W], 27.iv.1985, leg. J.A.W. Lucas [col. NBC]; 3 ♀♀, Algarve, N. of Quarteira, [37.06°N 8.10°W], 28.iv.1985, leg. J.A.W. Lucas [col. NBC]; 1 ♀, Algarve, E. of Quarteira, 29.iv.1985, [37.06°N 8.10°W], leg. J.A.W. Lucas [col. NBC]; 1 ♂, 5 ♀♀, Aveiro, São Jacinto, 40.67273°N 8.61545°W, 19.iv.2012, leg. AET [col. AET]; 1 ♀, Faro, 41.53°N 8.75°W, 8.ii.2013, leg. V. Jacinto [col. AET]; 1 ♂, 1 ♀, Caldas da Rainha, Salir do Porto, 39.474°N 9.157°W, 1.xi.2013, leg. R. Andrade [col. AET]; 1 ♂, Porto, Vila do Conde, Mindelo, 41.32052°N 8.73541°W, 17.i.2017, leg. R. Andrade [col. AET; genitalia dissected for analysis]; 1 ♀, Braga, Barcelos, Gilmonde, 41.51194°N 8.64916°W, 12.iii.2019, leg. R. Andrade [col. AET]. SPAIN: 1 ♀, Huelva, Coto Doñana, Matalascañas, dunes east of village, 36.59°N 6.32°W 11.iv.2002, leg. W. van Steenis & E.M. Bakker [col. JSA].

Remarks: Mengual et al. (2015) synonymized this species with *Pelecocera lugubris* Perris, 1839. We prefer to keep the name *P. lusitanica* here as Mengual et al. (2015) did not study material from France, from where *P. lugubris* was described, and there is neither a single COI sequence of *P. lusitanica* from mainland France (which would be conspecific with *P. lugubris*) nor from Portugal (the type locality of *P. lusitanica* is Sintra, Portugal).

Pelecocera (*Chamaesyrphus*) *nigricornis* (Santos Abreu, 1924)

Original description: *Chamaesyrphus nigricornis* Santos Abreu, 1924: 79.

Material examined: SPAIN: 1 ♂, 2 ♀♀, Canary Islands, La Palma, along LP-4, pine forest, on *Foeniculum vulgare* Mill., 28.73538°N 17.82534°W, 1900 m a.s.l., 31.x.2017, leg. X. Mengual [col. AET; male genitalia dissected for analysis]; plus all the specimens published in Burt & Mengual (2018).

Remarks: Flower visits have been reported on *Foeniculum vulgare* Mill. (Burt & Mengual 2018) and *Ageratina riparia* (Regel) R.M. King & H. Rob. (Asteraceae) (Source: OBSERVATION.ORG, accessed 16.ii.2021).

Pelecocera (*Chamaesyrphus*) *pruinosomaculata* Strobl, 1906

Original description: *Pelecocera pruinosomaculata* Strobl, 1906: 326.

Material examined: CYPRUS: 4 ♂♂, 8 ♀♀, Pafos, Akamas, Neo Chorio, 35.02627°N 32.35049°E, 200 m a.s.l., 8.ii.2016, 11 specimens on *Lecokia cretica* (Lam.)

DC. (Apiaceae) and 1 ♀ on Brassicaceae, leg. A. v. Eck [3 ♂♂ & 7 ♀♀ col. AET; genitalia of one male dissected for analysis] [1 ♂ ZFMK-DIP-00055311 and 1 ♀ ZFMK-DIP-0000310, col. ZFMK]; 1 ♀, Nicosia, Kakopetria, river valley, 34.97469°N 32.91320°E, 3.xi.2016, on *Polygonum equisetiforme* Sibth. & Sm., leg. A. v. Eck, ZFMK-DIP-00055312 [col. ZFMK]; 1 ♀, Nicosia, Kakopetria, river valley, 34.97469°N 32.91320°E, 3.xi.2016, leg. A. v. Eck, ZFMK-DIP-00082362 [col. ZFMK]; 2 ♂♂, Limassol, Saittas, river valley, 34.87478°N 32.91496°E, 6.xi.2016, on *Hedera* L., leg. A. v. Eck [col. AET]; 1 ♂, Limassol, Saittas, river valley, 34.87478°N 32.91496°E, 6.xi.2016, on *Hedera* L., leg. A. v. Eck, ZFMK-DIP-00082361 [col. ZFMK]; 1 ♂, Larnaca, Delikipos, 34.916°N 33.362°E, iii.2018, leg. C. Makris [col. AET]; 1 ♂, Limassol, Pera Pedi, 34.85990°N 32.88970°E, 700 m a.s.l., 25.iii.2018, on *Smyrnium* L., leg. A. v. Eck [col. AET; genitalia dissected for analysis] (Fig. 6); 1 ♂, Limassol, Pera Pedi, 34.85990°N 32.88970°E, 700 m a.s.l., 26.iii.2018, on *Smyrnium*, leg. A. v. Eck [col. AET]; 1 ♂, Kyrenia, Bellapais, 35.30°N 33.35°E, 5.iii.2019, on flowers of *Zosima absinthiifolia* (Vent.) Link, leg. A. v. Eck [col. AET]; 1 ♂, Limassol, Pera Pedi, old grape plantation, 34.86578°N 32.84886°E, 881 m a.s.l., Malaise trap, 8–12.x.2017, leg. X. Mengual, ZFMK-DIP-00027919 [col. ZFMK]. FRANCE: 1 ♂, Corsica, St Pietro di Venaco, 24.iv.1978, 700 m a.s.l., maquis with streams, leg. A.E. Stubbs, [col. BMNH]; 1 ♀, Pyrenees-Oriental, Eyne, 1-14.vii.1983, 1600 m a.s.l., leg. C.J. Zwakhals [col. NBC]. ITALY: 1 ♂, 1 ♀, Calabria, Paestum, 16.ix.1976, on yellow crucifer flowers, dune scrub, leg. M.C.D. Speight [col. AET]; 1 ♀, Abruzzo l'Aquila, Fontecchio, 670 m a.s.l., 4.v.2018, leg. G.W.A. Pennards, ZFMK-DIP-00055309 [col. GPA]; PORTUGAL: 1 ♀, Porto, Vila do Conde, Mindelo, 41.32416°N 8.73325°W, 30.x.2016, leg. R. Andrade [col. AET]. SPAIN: 1 ♀, Malaga, Istan, 3.iv.1972, 500–600 m a.s.l., leg. V.S. van der Goot & J.A.W. Lucas [col. NBC]; 2 ♂♂, Catalonia, Vilassar de Dalt, 41.517°N 2.348°E, 9–15.iv.1995, Malaise trap, leg. J.L. Jara [col. MCT]; 3 ♂♂, Catalonia, Vilassar de Dalt, 41.517°N 2.348°E, 23–29.iv.1995, Malaise trap, leg. J.L. Jara [col. AET & MCT]; 3 ♂♂, Catalonia, Vilassar de Dalt, 41.517°N 2.348°E, 7–13.v.1995, Malaise trap, leg. J.L. Jara [col. AET]; 3 ♂♂, Catalonia, Vilassar de Dalt, 41.517°N 2.348°E, 21–27.v.1995, Malaise trap, leg. J.L. Jara [col. MCT]; 2 ♂♂, Catalonia, Vilassar de Dalt, 41.517°N 2.348°E, 4–10.vi.1995, Malaise trap, leg. J.L. Jara [col. MCT]; 3 ♂♂, Catalonia, Vilassar de Dalt, 41.517°N 2.348°E, 27.viii–2.ix.1995, Malaise trap, leg. J.L. Jara [col. AET & MCT]; 2 ♂♂, Catalonia, Vilassar de Dalt, 41.517°N 2.348°E, 24–30.ix.1995, Malaise trap, leg. J.L. Jara [col. AET]; 1 ♂, Catalonia, Vilassar de Dalt, 41.517°N 2.348°E, 8–14.x.1995, Malaise trap, leg. J.L. Jara [col. MCT]. TURKEY: 1 ♀, Side, sand-dune, 36.75400°N 31.45600°E, 26.iii.2007, leg. N. Vikhrev [col. GPA]; 1 ♀, Side, sand-dune, 36.75400°N 31.45600°E, 22.ii.2008, leg. N. Vikhrev [col. GPA].

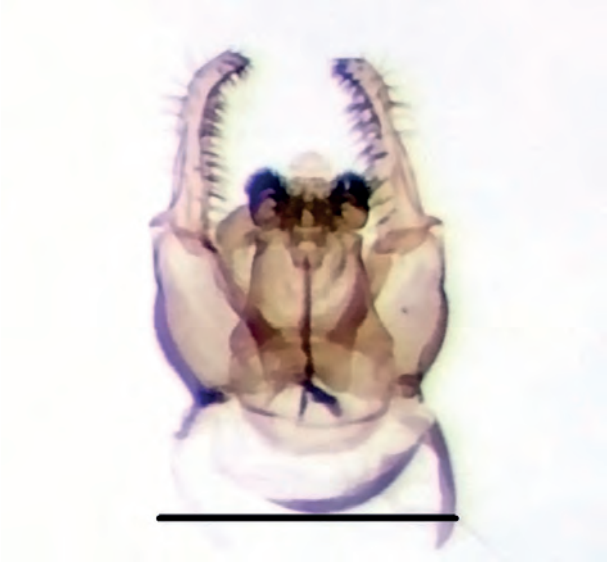

Fig. 6: *Pelecocera pruinosomaculata*, male Cyprus, 25.iii.2018, genitalia complex, ventral view (scale bar = 0,4 mm)

Remarks: New species for the Portuguese mainland. This taxon is most variable among females. The pollinosity of lunule and frons is rather variable, even among specimens collected at the same locality and date. Figs 7 and 8 give an impression of this variability. Care must be taken using this feature in the key presented below.

Pelecocera (*Chamaesyrphus*) *scaevoides* (Fallén, 1817)

Original description: *Rhingia scaevoides* Fallén, 1817: 35.

Material examined: AUSTRIA: 1 ♂, Tirol, Imst, Hochimst, roadside along skipiste, 47.24166°N 10.72777°E, 1000 m a.s.l., 9.vii.2001, leg. J. & W. van Steenis & B. Achterkamp [col. JSA; genitalia dissected for analysis; head lost]. FRANCE: 1 ♂, Pyrenees-Oriental, Eyne, 1600 m a.s.l., [42.47277°N 2.08000°E], 1–14.vii.1983, leg. C.J. Zwakhals [col. NBC]; 1 ♂, 2 ♀♀, Gorges de la Caranca, 31.viii.2003, leg. Pennards [col. GPA]; 1 ♀, Languedoc-Rousillon, Vernet les Bains, Col de Mantet, 42.48055°N 2.31472°E, 1765 m a.s.l., 17.viii.2014, leg. J. van Steenis [col. JSA]. GERMANY: 2 ♂♂, Hamern, 30.viii.72 [1872], [leg. v. Röder?; col. MLUH]. ITALY: 1 ♂, Bozen, 15.vi.73 [1873], [leg. v. Röder?; col. MLUH]; 1 ♂, Bolzano, Sarntal, 1250 m a.s.l., 12.vi.1977, leg. C.J. Zwakhals [col. NBC]. LEBANON: 1 ♀, Brummana, [33.8°N 35.5°E], 1899 [missing head; leg. Schmedeknecht?; col. MLUH]. MONGOLIA: 1 ♀, Bulgan, Teshig sum, Teshigiyn davaa, 50.1°N 102.7°E, 9.vii.2017, 1400 m a.s.l., leg. AET, ZFMK-DIP-00055239 [col. AET]. NETHERLANDS: 1 ♀, Venlo, 25.vii.1982, leg. B. van Aartsen [col. NBC]. RUSSIA: 1 ♀, Magadan, Malkachan river, road in taiga forest, 59°51'N 154°12'E, Malaise trap, leg. M. van Steenis [col. JSA]. SWEDEN: 1 ♂, Uppland, Uppsala, Linnés Hammarby, garden in wood, RN 6634-1610, 13.vi.1996,

leg. J. van Steenis [col. JSA]; 1 ♀, Uppland, Uppsala, Fiby urskog, RN 6641.4-1586.6, Malaise trap, 27.v.-23.vi.1997, leg. J. van Steenis [col. JSA]; 1 ♂, Uppland, Funbo, Fjällnora, Stornoret, RN 6635-1618, 31.v.1998, leg. J. van Steenis [col. JSA]. SWITZERLAND: 1 ♀, St. Moritz, Morteratsch, 1900 m a.s.l., [46.49833°N 9.83916°E], 26.vii.1960, leg. H.J.P. Lambeck [col. NBC]. TURKEY: 8 ♂♂, Kars, 8 km W. of Sarikaniş, 2000 m a.s.l., 6.vii.1986, leg. J.A.W. Lucas [col. NBC]; 2 ♀♀, Palandöken Mts, 24.vi.1996, 2300 m a.s.l., leg. W. Hurkmans [col. NBC]. UNITED KINGDOM: 1 ♀, Scotland, Highland, Culrain, Carbisdale Castle, [57.916°N 4.400°W], 31.vii.2011, leg. J. van Steenis [col. JSA].

Remarks: New species for Lebanon and for Mongolia.

Pelecocera (*Chamaesyrphus*) Lair & Nève spec. nov. (*in litt.*)

Material examined: SPAIN: 1 ♀, Malaga, Istan, 500–600 m a.s.l., 5.iv.1972, leg. V.S. van der Goot & J.A.W. Lucas [col. NBC]. FRANCE: 1 ♂ PARATYPE, Sournia F-66, Chemin de Roquebert, Garrigue à buis et thym (calcaire), 456 m a.s.l., 42.7244°N 2.4660°E, 25.iv.2020, leg. X. Lair [coll. AET]; 1 ♀, PARATYPE, Sournia F-66, Chemin de Roquebert, Garrigue à buis et thym (calcaire), 456 m a.s.l., 42.7244°N 2.4660°E, 25.iv.2020, leg. X. Lair [col. XLS].

Remarks: This taxon is being described in parallel to our present study (Lair et al. in prep.), but this species is clearly morphologically different from *Pelecocera hederae* spec. nov.

Pelecocera (*Pelecocera*) *tricincta* Meigen, 1822

Original description: *Pelecocera tricincta* Meigen, 1822: 340.

Material examined: BELARUS: 1 ♂, Minsk, Myadel'skiy Rayon, Zanarach, crossing river Narocz x P60, 54.77113°N 26.85744°E, 14.vii.2015, leg. A. van Eck [col. AET]. NETHERLANDS: 1 ♀, Tilburg, Kaaistoep, 51.54782°N 5.00514°E, 10.ix.2009, leg. A. van Eck [col. AET]; 1 ♀, Tilburg, Sijsten, 51.54782°N 5.00514°E, 21.ix.2009, leg. A. van Eck [col. AET]; 1 ♀, Tilburg, Sijsten, 51.54782°N 5.00514°E, 31.viii.2013, leg. A. van Eck, [col. AET]; 2 ♂♂, 2 ♀♀, Brunssumerheide, 50.92°N 5.97°E, 20.viii.2016, leg. A. van Eck & M. Oosthoek [col. AET]; 2 ♂♂, Goirle, Rechte Hei, in *Calluna vulgaris* (L.) Hull & *Erica tetralix* L. heath, 51.49624°N 5.02859°E, 19.viii.2017, leg. A. v. Eck [col. AET]; 3 ♂♂, 7 ♀♀, Oost-Vlieland, 53.29925°N 5.07443°E, 11.ix.2020, leg. W. Heitmans [col. AET]. PORTUGAL: 1 ♀, Aveiro, São Jacinto, coastal dunes, 40.67304°N 8.72194°W, 13.iv.2006, leg. A. van Eck [col. AET]; 1 ♂, Aveiro, Veiros, flower rich wet meadows, 40.75373°N 8.59129°W, 10 m a.s.l., 13.iv.2006, leg. A. van Eck [col. AET]; 2 ♂♂, 1 ♀, Medas, wet meadow in forest, 41.05941°N 8.44660°W, 40 m a.s.l., 17.iv.2006, leg. A. van Eck [col. AET]; 2 ♂♂, 4 ♀♀, Batalha, Jardoeira, 39.66420°N 8.84261°W, 130 m a.s.l., 17.viii.2007, leg. A. van Eck [col. AET]; 1 ♂, Cabeceiras de Basto, Lameiros, Vale das Flores, 41.49756°N 7.97563°W, 200 m a.s.l., 22.iv.2012, leg. A. van Eck [col. Ave]; 2 ♂♂, 1 ♀, Palmeira de Faro, 41.55003°N 8.74759°W, 90 m a.s.l., 23.iv.2013, leg. A. van Eck [col. AET]; 1 ♂, Porto, Valongo, 41.15927°N 8.48489°W, 21.vii.2017, leg. R. Andrade [col. AET]. SWEDEN: 2 ♂♂, Västra Götaland, Vårgårda, Lärkemossen, 58.08°N 12.72°E, 2.vii.2016, leg. A. van Eck [col. AET]; 3 ♂♂, Värmland, Ärjäng, Blomma, 59.26°N 11.95°E, 4.vii.2016, leg. A. van Eck [col. AET].

DNA analysis: We successfully sequenced 32 *Pelecocera* and *Pseudopelecocera* specimens (Table 1). All the specimens included in our analysis were grouped following the nominal species (based on the morphological identification) in the NJ tree (Fig. 9), with the exception of two pairs of taxa: specimens of *Pelecocera japonica* were resolved inside the cluster of *Pelecocera lusitanica* with low support (BS=83.1), and specimens of *Pelecocera pruinosomaculata* and *Pelecocera scaevoides* were clustered together with a very low support (BS=62.2). *Pseudopelecocera* species were recovered together with high support value (BS=98), and every species included in our analysis had a relatively high support (BS>99; except *Pelecocera lusitanica*, *P. pruinosomaculata* and *P. scaevoides*). The four paratypes of the new species *P. hederae* were resolved together with full support, showing a low intraspecific variation (uncorrected *p*-distance between 0 % and 0.306 %).

In general, the uncorrected *p*-distance was low among specimens of the same species (usually less than 1 %), with the exception of *P. nigricornis* (1.754–1.88 %) and *P. lusitanica* (0–1.031 %). The *p*-distance between different species was usually larger than 3 % and several species have an uncorrected *p*-distance below 3 % but higher than 2 %, for >2 % between the specimen of *P. nigricornis* from Tenerife (MH521943) and specimens of *P. lusitanica*, *P. pruinosomaculata* and *P. scaevoides*. The exception to this trend is a cluster grouping *P. japonica*, *P. lusitanica*, *P. pruinosomaculata* and *P. scaevoides* (BS=90.9). Within this cluster, the p-distance between *P. japonica* and *P. lusitanica* ranges from 0.401 % to 1.262 %, and between *P. scaevoides* and *P. pruinosomaculata* is 0.174–1.881 % (see Appendix S1). The specimens of *P. pruinosomaculata* from Cyprus and Greece were recovered in a cluster with high support (BS=95.2) and the specimens of the same species from Central Europe (Italy and France) were grouped with low support (BS=87.4). Among the *P. pruinosomaculata* specimens from Central Europe we had individuals collected in spring and in autumn.

Based on the current evidence, the standard DNA barcode (5'-end of the Cytochrome c oxidase subunit 1 or COI) does not resolve into distinct clusters four *Pelecocera* species,

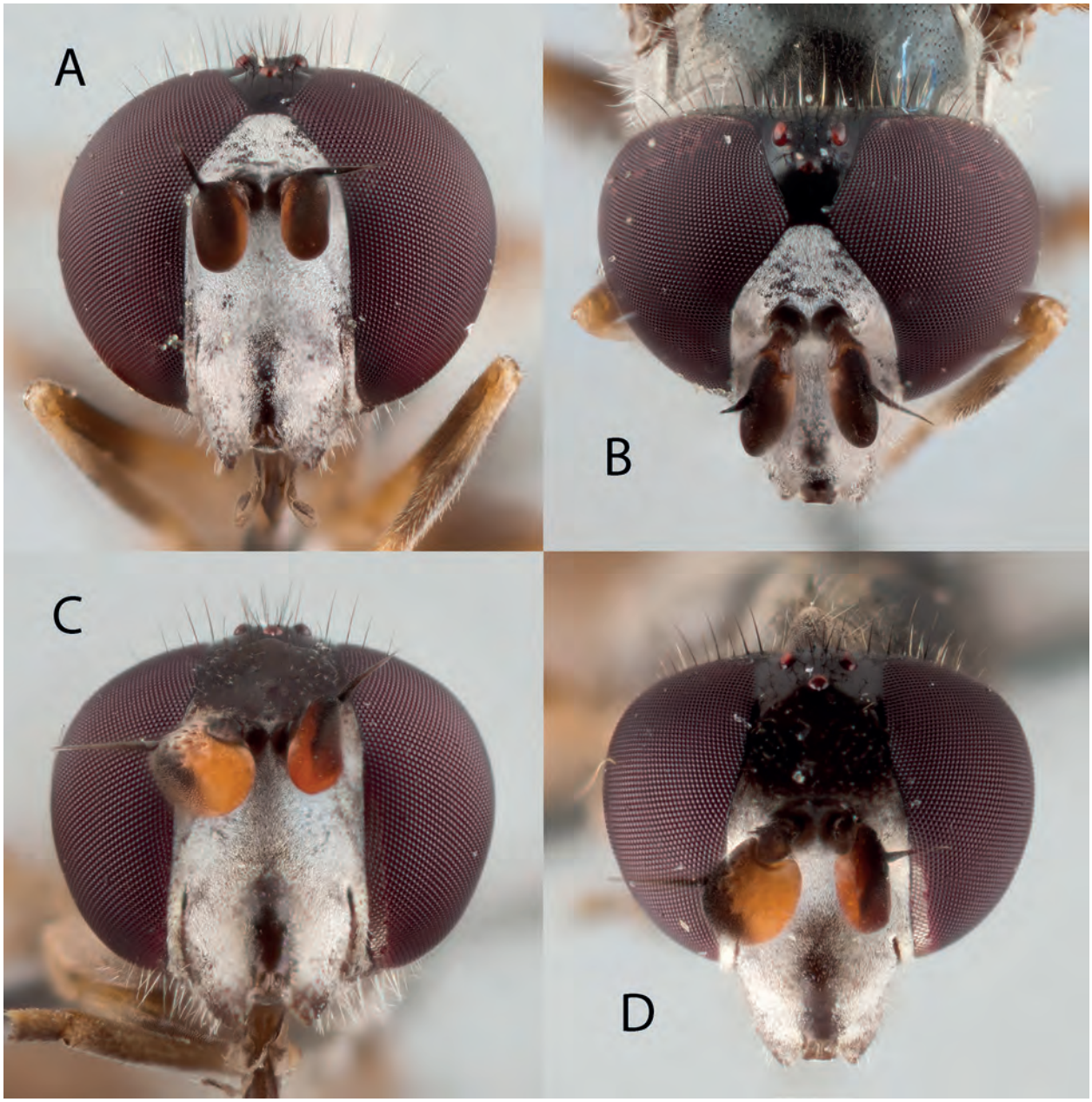

Fig. 7: **A–D** *Pelecocera pruinosomaculata*, both sexes from Cyprus, 8.ii.2016, head, frontal view. **A–B**: male; **C–D**: female.

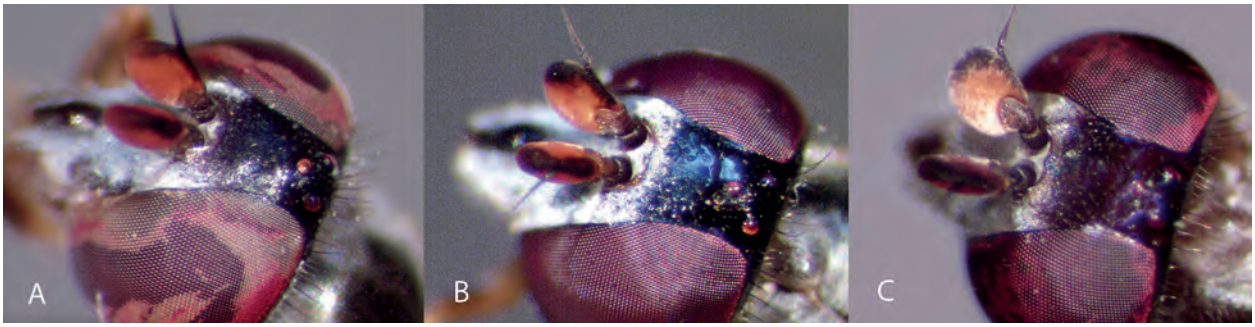

Fig. 8: **A–C** *Pelecocera pruinosomaculata*, females from Cyprus, head, dorsolateral view. **A**: Cyprus, 3-xi-2016; **B**: Cyprus, 5-iii-2019; **C**: Cyprus, 8-ii-2016.

namely *P. japonica*, *P. lusitanica*, *P. pruinosomaculata* and *P. scaevoides*. Morphologically *P. japonica* is very similar to *P. pruinosomaculata*, but more similar to *P. lusitanica* based on the DNA barcode. Whereas *P. japonica* is only known from Japan, the other three taxa are widespread in the Mediterranean Basin (*P. pruinosomaculata*), in Western Palaearctic (*P. lusitanica* and *P. scaevoides*); *P. scaevoides* even reaches the Russian Far East. We do

Table 1: DNA voucher specimens sequenced for the present study, with GenBank accession numbers for the COI sequences.

Genus	Species	Author and year	Sex	ZFMK identification N°	GenBank Accession N°
Chrysotoxum	*bicinctum*	(Linnaeus, 1758)	female	ZFMK-DIP-00082357	MZ303461
Rhingia	*mecyana*	Speiser, 1910	male	ZFMK-DIP-00082358	MZ303486
Pelecocera	*caledonica*	(Collin, 1940)	male	ZFMK-TIS-2625459	MZ303056
Pelecocera	*hederae*	Van Eck spec. nov.	male	ZFMK-DIP-00082340	MZ303466
Pelecocera	*hederae*	Van Eck spec. nov.	female	ZFMK-DIP-00082341	MZ303468
Pelecocera	*hederae*	Van Eck spec. nov.	female	ZFMK-DIP-00082362	MZ303469
Pelecocera	*hederae*	Van Eck spec. nov.	male	ZFMK-DIP-00027873	MK959048
Pelecocera	*japonica*	(Shiraki, 1956)	male	ZFMK-DIP-00055304	OL665132
Pelecocera	*japonica*	(Shiraki, 1956)	female	ZFMK-DIP-00055306	OL665131
Pelecocera	*lusitanica*	(Mik, 1898)	male	ZFMK-TIS-2507292	MZ303060
Pelecocera	*lusitanica*	(Mik, 1898)	male	LPRC2021-2417	OK330482
Pelecocera	*nigricornis*	(Santos Abreu, 1924)	male	ZFMK-DIP-00082364	MZ303471
Pelecocera	*nigricornis*	(Santos Abreu, 1924)	female	ZFMK-DIP-00082365	MZ303470
Pelecocera	*pruinosomaculata*	Strobl, 1906	male	ZFMK-DIP-00082361	MZ303473
Pelecocera	*pruinosomaculata*	Strobl, 1906	male	ZFMK-DIP-00027919	MK959049
Pelecocera	*pruinosomaculata*	Strobl, 1906	female	ZFMK-DIP-00055309	OL665133
Pelecocera	scaevoides	(Fallén, 1817)	female	ZFMK-DIP-00055239	MZ303474
Pelecocera	*scaevoides*	(Fallén, 1817)	male	ZFMK-TIS-2515090	MZ303061
Pelecocera	*scaevoides*	(Fallén, 1817)	male	ZFMK-TIS-2615550	MZ303049
Pelecocera	*scaevoides*	(Fallén, 1817)	female	BC-ZSM-DIP-24155-B04	OL665129
Pelecocera	*scaevoides*	(Fallén, 1817)	female	BC-ZSM-DIP-24052-G10	OL665130
Pelecocera	*tricincta*	Meigen, 1822	male	ZFMK-TIS-2524441	MZ303052
Pelecocera	*tricincta*	Meigen, 1822	female	ZFMK-TIS-2516641	MZ303062
Pseudopelecocera	*latifrons*	(Loew, 1856)	female	ZFMK-DIP-00082359	MZ303475
Pseudopelecocera	*latifrons*	(Loew, 1856)	male	ZFMK-DIP-00055228	MZ303477
Pseudopelecocera	*latifrons*	(Loew, 1856)	female	ZFMK-DIP-00040504	MZ303476
Pseudopelecocera	*persiana*	(Kuznetzov, 1989)	male	ZFMK-DIP-00082360	MZ303480
Pseudopelecocera	*persiana*	(Kuznetzov, 1989)	male	ZFMK-DIP-00082363	MZ303482
Pseudopelecocera	*persiana*	(Kuznetzov, 1989)	male	ZFMK-DIP-00055244	MZ303484
Pseudopelecocera	*persiana*	(Kuznetzov, 1989)	male	ZFMK-DIP-00055246	MZ303483
Pseudopelecocera	*persiana*	(Kuznetzov, 1989)	male	ZFMK-DIP-00055247	MZ303478
Pseudopelecocera	*persiana*	(Kuznetzov, 1989)	male	ZFMK-DIP-00055248	MZ303479
Pseudopelecocera	*persiana*	(Kuznetzov, 1989	male	ZFMK-DIP-00055245	MZ303485
Pseudopelecocera	*persiana*	(Kuznetzov, 1989)	male	ZFMK-DIP-00055249	MZ303481

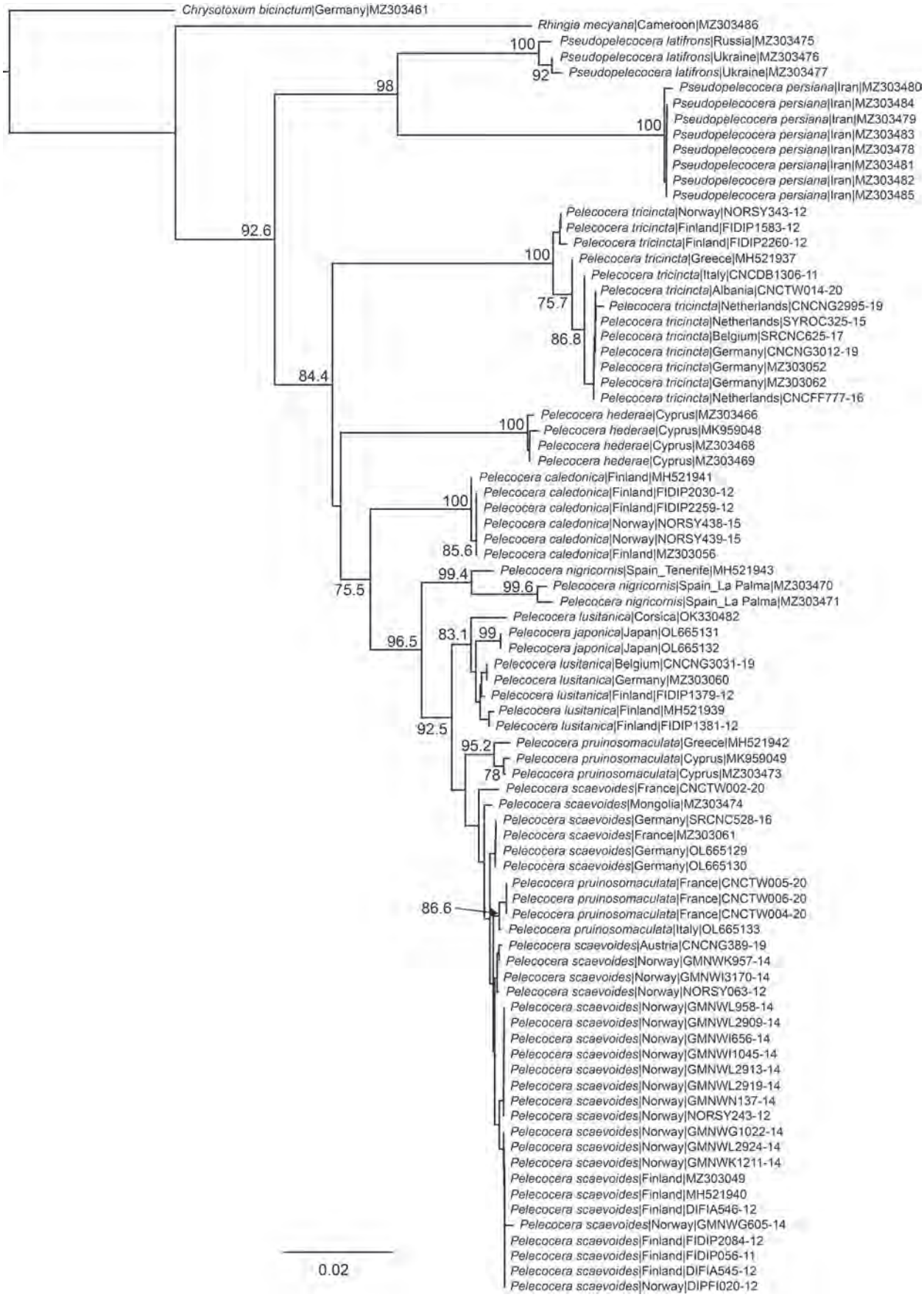

Fig. 9: Neighbour-Joining tree using Jukes-Cantor model based on COI sequences of *Pelecocera* and *Pseudopelecocera* species, with *Chrysotoxum bicinctum* constrained as outgroup. GenBank Accession numbers and BOLD Sample IDs are indicated for each included sequence. Bootstrap support values above 75 are given at the nodes.

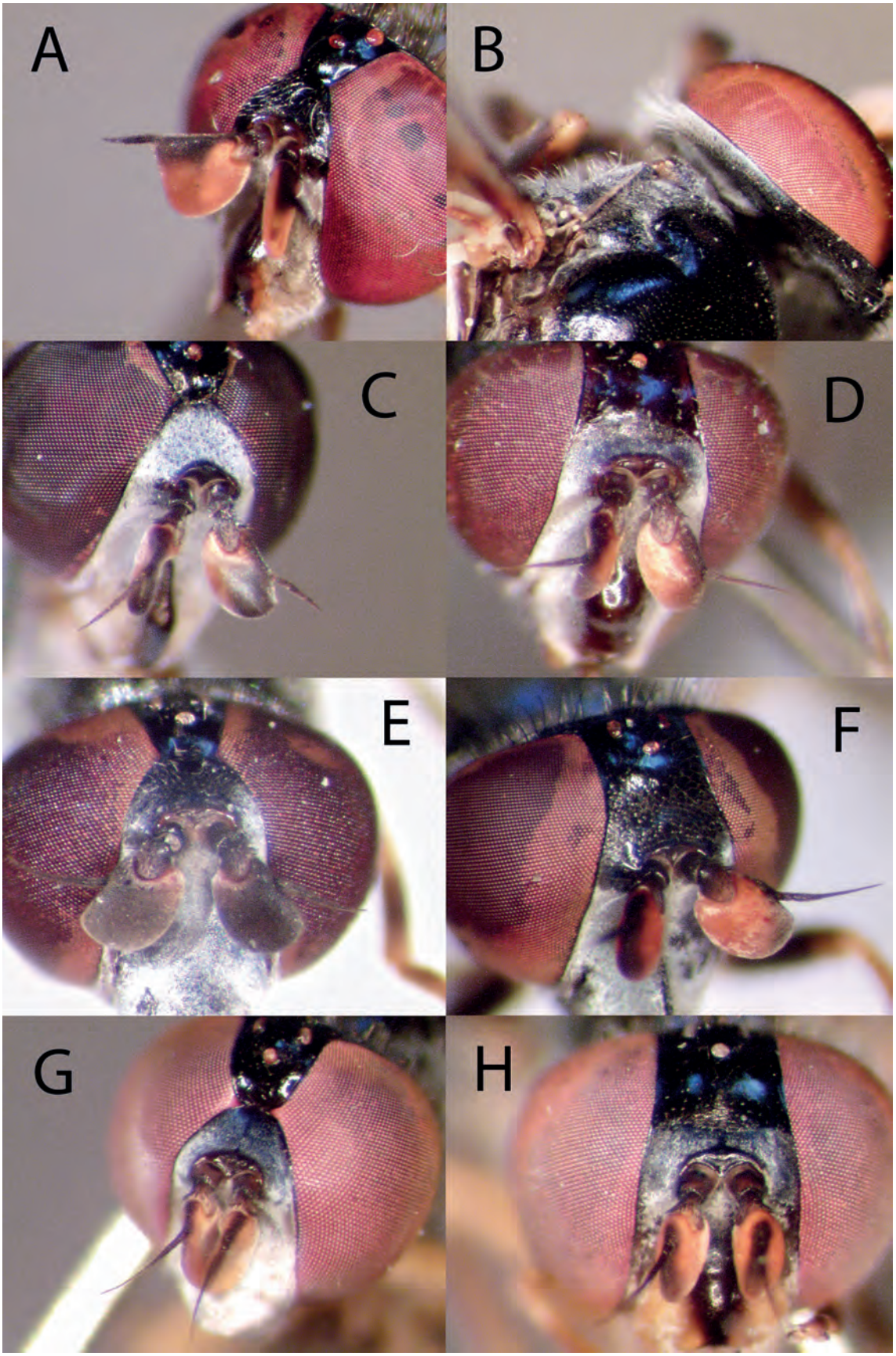

Fig. 10: **A–H** *Pelecocera* species: **A**–*Pelecocera tricincta,* antennae, male, Belarus, 14.vii.2015; **B**–*Pelecocera lusitanica,* anepisternum pile, female, Portugal, 19.iv.2012; **C**–*Pelecocera caledonica,* lunule, male, Portugal, 11.x.2010; **D**–*Pelecocera caledonica,* lunule, female, Norway, 15.vii.1988; **E**–*Pelecocera* spec. nov. Lair & Neve (*in litt.*), lunule, male paratype France 25.iv.2020; **F**–*Pelecocera* spec. nov. Lair & Neve (*in litt.*), lunule, female paratype, France, 28.iv.2020; **G**–*Pelecocera hederae* spec. nov., lunule, male paratype, Cyprus, 29.x.2016; **H**–*Pelecocera hederae* spec. nov., lunule, female paratype, Cyprus, 3.xi.2016.

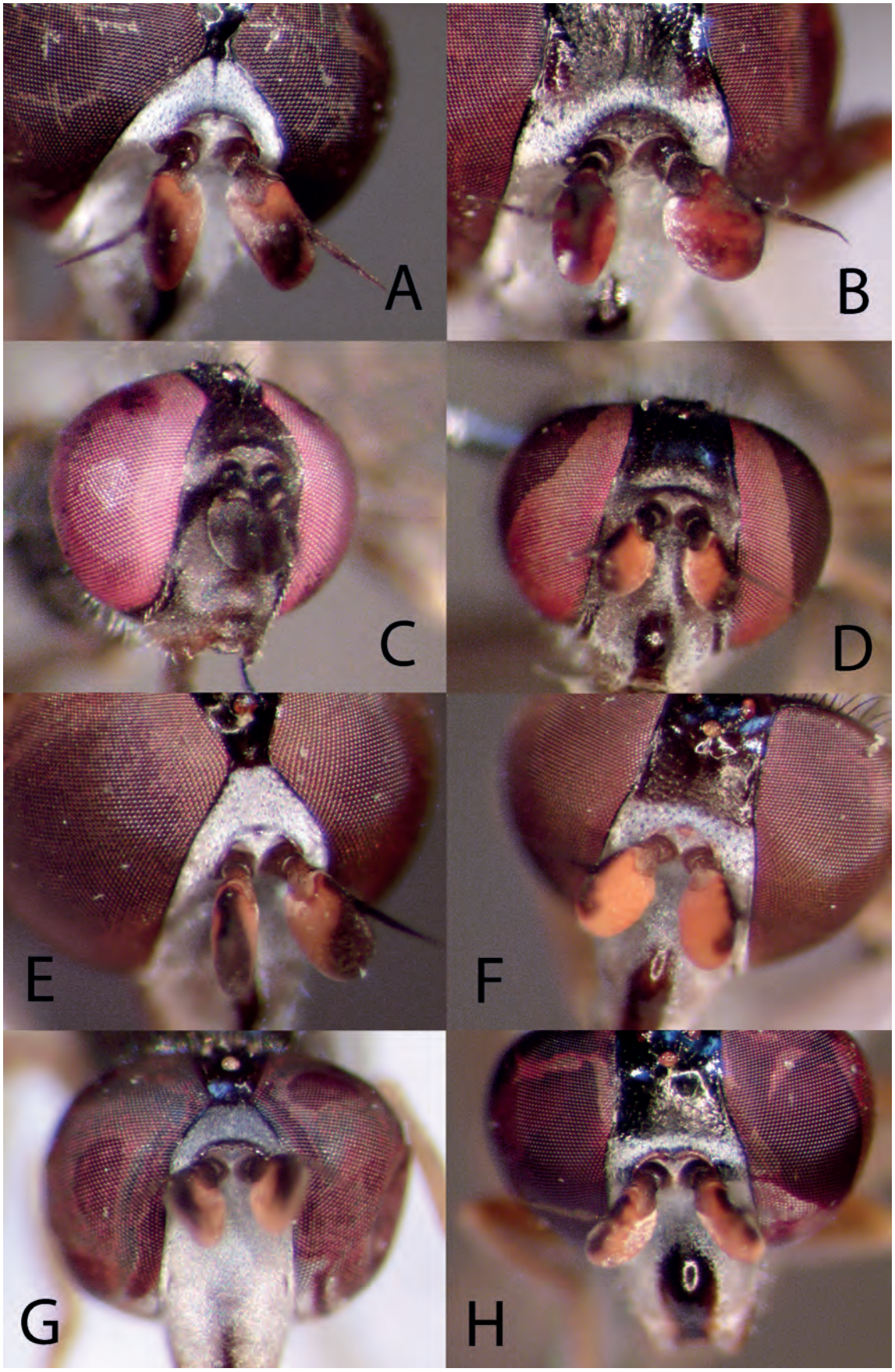

Fig. 11: **A–H** *Pelecocera* species: **A**–*Pelecocera lusitanica,* lunule, male, Netherlands, 7.ix.1958; **B**–*Pelecocera lusitanica,* lunule, female, Netherlands, 13.ix.1954; **C**–*Pelecocera nigricornis,* lunule, male, Canary Islands, 31.x.2017; **D**–*Pelecocera nigricornis,* lunule, female, Canary Islands, 31.x.2017; **E**–*Pelecocera pruinosomaculata,* lunule, male, Italy, 16.ix.1976; **F**–*Pelecocera pruinosomaculata,* lunule, female, Italy, 16.ix.1976; **G**–*Pelecocera scaevoides,* lunule, male, Sweden, 31.v.1998; **H**–*Pelecocera scaevoides,* lunule, female, France 17.viii.2014.

not know if the impossibility to resolve these taxa into clusters is due to their variability as a consequence of their wide distribution, or is due to the natural history of this mitochondrial gene (Funk & Omland 2003). If the wide distribution was causing this variability and the consequent lack of cluster resolution, we would expect a similar phenomenon to occur with other *Pelecocera* taxa with similar broad distributional ranges (*P. caledonica* and *P. tricincta*). We will need more sequences from the whole distributional range to shed light on this.

Key to the Palaearctic *Pelecocera* species

In Syrphidae, due to intraspecific variation, chaetotaxy of the thorax is considered not useful to distinguish species because it is not a constant taxonomic character (Hippa & Ståhls 2005). The presence of setae in the species of *Pelecocera* however, could support the identification of the different species. Van der Goot (1957) was one of the first authors to value the use of chaetotaxy in this genus, specifically for some species in the subgenus *Chamaesyrphus*. The number of setae may vary, e.g. on the postalar callus and scutellum. In some species the colour seems stable, but in most species the colour of the setae can be black or yellow, even on the same specimen. The presence of setae on scutellum and postalar callus do not play a role in the identification between species of the subgenus *Chamaesyrphus*, and are therefore not included in the key presented here.

[Adapted from: Speight & Sarthou 2017; Mengual et al. 2015; Vujić et al. 2018; Ichige 2014].

1a Arista thinner, inserted subapically or medially on dorsal side of third antennal segment (postpedicel) and pointing upwards or sometimes slightly forwards (e.g. Figs 1E, 3, 8). Pleuron pollinose, dull. Wing vein M_1 ends in a sharp angle to vein R_{4+5} ..... **3** [***Pelecocera* subgenus *Chamaesyrphus* (Mik)**]

1b Arista thick, inserted at apex of postpedicel, pointing forwards (e.g. Fig. 10A). Either wing vein M_1 ends in an almost straight angle to vein R_{4+5} and pleurae shiny, or wing vein M_1 ends in a very sharp angle and pleuron very dull **2**

2a Frons, at the level of the antennal insertions, clearly narrower than the width of an eye at the same level. Lunule and frons, including space between antenna and eye margin, shining (Fig. 1A). Pleuron ventrally and posteriorly shiny; katepisternum shiny. Scutellum with bristles on hind margin. Both males and females with yellow markings on abdomen ..... ***Pelecocera* (*Pelecocera*) *tricincta* Meigen**

2b Frons, at the level of the antennal insertions, wider than an eye at the same level. Thorax laterally and ventrally, very dull, pruinose. Scutellum without marginal bristles. Males with yellow markings on abdomen (sometimes reduced), females with black abdomen ..... genus ***Pseudopelecocera* Vujić & Radenković**

3a Antero-dorsal flat portion of anterior anepisternum pollinose and with longer pile, in a patch just below its dorsal margin (Fig. 10B), and/or along its posterior margin (where it meets the convex surface of posterior anepisternum) **4**

3b Antero-dorsal portion of anterior anepisternum without longer pile, pollinose only **7**

4a Both sexes: lunule densely pollinose, dull (Fig. 11A–B); almost entire surface of anterior anepisternum with longer pile (Fig. 10B); wings entirely covered in microtrichia. Coxae dark, brown with grey pollinosity. Female: frons just above lunule with a narrow, transverse band of dense, grey pollinosity across its entire width, otherwise black and shining (Fig. 11B). Frons, in anterior view, with V-shaped grooves bordering the elevated part of the ocellar triangle, which reach the lunule ..... ***Pelecocera* (*Chamaesyrphus*) *lusitanica* (Mik)**

4b Lunule shiny (Fig. 10C–H). Anterior anepisternum at most with few longer pile, often restricted to its posterior margin. Female: grooves on frons different, or absent **5**

5a Frons just above lunule pollinose (male) or with a transverse band of grey pollinosity from eye to eye (female) (Figs 10C–D, 10G–H). Ground surface of lower face, genae and postpronotum, under the grey dusting, yellow to dark grey. Notopleuron completely pollinose. Male and female with usually clear to bright yellow maculae on the abdominal tergites II–IV, which are covered with white pollinosity (sometimes partly covered). Scutellum somewhat tapering, looking more or less triangular **6**

5b Male: frons without pollinosity right above lunule (Fig. 10E); however, it may appear dull due to strong punctuation. Pollinosity clear on, but limited to, lateral sides of lunule, between lunule and eyes. Female: frons above lunule entirely without dusting, shiny all over (Fig. 10F). Frontal grooves absent. Both sexes: Ground surface of lower face, genae and postpronotum, under the grey dusting, black. Notopleuron shiny in dorsal part, pollinose in ventral area along the suture. Abdomen black, or with small triangularly shaped, reddish maculae on tergites II–V or III–IV away from dorsal midline of the abdominal tergites, sometimes vaguely visible and completely lacking pollinosity. Abdomen, except for tergite I, shiny black all over. Scutellum relatively broader and gently rounded, not tapering ..... ***Pelecocera* (*Chamaesyrphus*) Lair & Nève spec. nov.** (*in litt.*)

6a Wings: basal cells (br & bm) and anal cell (cup) with a variable area bare of microtrichia (this seems unique among Palaearctic species in the genus *Pelecocera*). Metafemur with broad dark ring and yellow base and apex. Metacoxae slightly to strongly darkened. Lower part of the face projected forward in lateral view. Abdomen with pollinose maculae. Male: face strongly dusted, yellow but with a narrowly shining median stripe between mouth edge and facial tubercle (Fig. 10C). Female: frons, with a groove bordering the elevated part of the ocellar triangle, this elevated part being more than twice as long as the length of the ocellar triangle. Both sexes: antero-dorsal portion of anterior anepisternum without hairs or bristles along its dorsal margin but often with distinct, pale hairs along the posterior margin of the sclerite (where it meets the convex surface of posterior anepisternum) . ..... ***Pelecocera* (*Chamaesyrphus*) *caledonica* (Collin)** (partim)

6b Wings completely microtrichose. Metafemur with yellow basal half, black ring at top half of its length and yellow at apex (Figs 1A, G). All coxae yellow. Lower part of the face not or hardly projected forward. Facial tubercle very shallow and smoothly curved, in lateral view (Figs 1E, J). Abdomen at most slightly pollinose. Male: face strongly pollinose, yellow with a narrowly darkened median stripe under the pollinosity (Fig. 1C). Female: frons without grooves, flat, without elevated parts. Both sexes: anterior anepisternum with only a few longer pile. (Cyprus.) .. .. ***Pelecocera* (*Chamaesyrphus*) *hederae* van Eck spec. nov.** (partim)

7a Collected in the Palaearctic, except Sakhalin Island, Kuril Islands and Japan **8**

7b Collected on Sakhalin Island, Kuril Islands or in Japan **13**

8a Male: frons without pollinosity right above lunule; however, it may appear dull due to strong punctuation (Fig. 10E). Pollinosity clear on, but limited to, lateral sides of lunule, between lunule and eyes. Female: frons above lunule entirely shiny (Fig. 10F). Both sexes: Lunule entirely without pollinosity. Notopleuron shiny in dorsal part, pollinose in ventral area along the suture. Scutellum relatively broader and gently rounded, not tapering. (See also couplet 5b) ..... ***Pelecocera* (*Chamaesyrphus*) Lair & Nève spec. nov.** (*in litt.*)

8b Male: frons above lunule completely and strongly pollinose, clearly differentiating from the shiny black vertex (Figs 10C, G and 11C, E, G) . Female: frons above lunule with a transverse band of grey pollinosity from eye to eye (Figs 10D, H and 11D, F, H). Both sexes: Lunule with or without pollinosity. Notopleuron completely pollinose or with a shiny central area. Scutellum somewhat tapering, looking more or less triangular **9**

9a Both sexes: wings: the 2nd basal cell (bm) and anal cell (cup) each with a variable area bare of microtrichia. Lunule entirely without pollinosity, brightly shining (Fig. 10C–D). Face with shiny median black stripe from oral margin to facial tubercle. Margin of postocular orbits dorsally, at the inner end of the eye, clearly longer than the length of a posterior ocellus. Notopleuron completely pollinose. Female: frons, with a groove bordering the elevated part of the ocellar triangle, this elevated part being more than twice as long as the length of the ocellar triangle. (See also couplet 6a.) ..... ***Pelecocera* (*Chamaesyrphus*) *caledonica* (Collin)** (partim)

9b Both sexes: wings completely covered with microtrichia. Margin of postocular orbits dorsally, at the inner end of the eye, about equal to the length of a posterior ocellus. Notopleuron either pollinose or with a shiny central area. Lunule with or without pollinosity. Males only: face entirely grey pollinose (may be a little worn off around the tip of the facial tubercle). Female: frons without raised ocellar triangle, or only a small area around the ocellar triangle raised **10**

10a Lunule pollinose centrally but shiny lateral arms, or completely shiny (Figs 10G–H, 11G–H). All coxae bright yellow, with inconspicuous white pollinosity. Notopleuron with or without a shiny central patch **11**

10b Lunule densely grey pollinose centrally and usually also the lateral arms pollinose (Figs 11C–D, 11E–F). However, especially in females the lateral arms can be more or less shiny (e.g., Figs 7 and 8). All coxae from dark yellow to black, clearly pollinose (best visible on coxae I and III). Notopleuron always completely pollinose, dull **12**

11a All legs entirely yellow, at most metatibia and metatarsomeres turning slightly brownish. Lower face prominently projected forward. Lunule pollinose centrally, but with shiny arms (Fig. 11G–H). Notopleuron with a shiny central area ..... ***Pelecocera* (*Chamaesyrphus*) *scaevoides* (Fallén)**

11b Metafemur with yellow basal half, black ring at top half of its length and yellow at apex (Figs 1A, G and 5). Tibia and tarsomeres of metaleg almost completely black or very dark at least. Face only slightly and very gently projected forward in lower half (Fig. 1E, J). Lunule brightly shining black. Notopleuron pollinose, dull, on its entire surface. (See also couplet 6b) ..... ***Pelecocera* (*Chamaesyrphus*) *hederae* van Eck spec. nov.** (partim)

12a Lower part of the face projected forward in lateral view, with oral margin often more so than facial tubercle. Clypeus 2–3 times as long as broad, measured at its oral margin. Male: frons entirely and densely pruinose. (Figs 7A–B, 11E) ..... ***Pelecocera* (*Chamaesyrphus*) *pruinosomaculata* Strobl**

12b Lower part of the face is not projected forward so that the shape of the facial tubercle is round, with a concavity between the facial tubercle and oral margin. Clypeus as long as broad, measured at its oral margin. Male: frons (area between lunule and the ridge at the smallest distance between eyes) densely pruinose anteriorly and shiny (and punctuated) on posterior half (Fig. 11C). (Canary Islands) ..... ***Pelecocera* (*Chamaesyrphus*) *nigricornis* (Santos Abreu)**

13a All femora largely dark coloured. All tibiae with a dark ring. Lunule completely dusted (similar to *P. pruinosomaculata*, couplet 12a). Notopleural triangle pollinose, dull, on its intire surface. Posterior anepisternum with a strong black bristle. (Japan) ..... ***Pelecocera* (*Chamaesyrphus*) *japonica* (Shiraki)**

13b All femora yellow. Both sexes: lunule dusted centrally, with shiny arms (arms may turn yellow) (Fig. 11G–H). All tarsomeres of fore and mid legs entirely yellow, the same colour as the tibiae. Notopleural triangle mostly undusted, brightly shining centrally. Posterior anepisternum usually with a yellow bristle. (Sakhalin) ..... ***Pelecocera* (*Chamaesyrphus*) *scaevoides* (Fallén)**

Discussion

The genus *Pelecocera* is widespread in the Palaearctic Region, but the majority of the species in this genus have a known distribution restricted to Europe, Turkey, Lebanon and Israel (G.W.A. Pennards, assessor for the IUCN European Red List of Hoverflies 2020, pers. comm., 2021; this paper). There are no confirmed records for continental North-Africa. *Pelecocera scaevoides* is the only species with a truly wide distribution, from Europe to the Far East of Russia and also *P. tricincta* has a large range, from Europe to Siberia (Barkalov & Mutin 2018). On the other side of the distributional spectrum, one endemic island species exists with a very much restricted distribution, *P. nigricornis* from the Canary Isles. Most likely *P. hederae* spec. nov. may also be called endemic, in this case to Cyprus. All known localities for *P. hederae* spec. nov. from Cyprus are situated in the central mountain range of the Troodos massif, and at relative high altitudes, from 550 to 1450 m a.s.l., where also ivy *Hedera* spec. is growing. Further research is needed to find out whether this is really the home range of this species. Maybe this taxon can be found in the northern Pentadactylos range or in lower elevations, like in the Pafos Mountains or even in the plains. Further field work may also reveal if *P. hederae* visits other plants. Collecting in autumn on ivy proved very rewarding in Cyprus, so this may not be very different in the Mediterranean, but probably often neglected. Collecting in the right season on the right flowers may reveal that this species can be found in (southern) Turkey, and in the mountains of Lebanon, Israel or Jordan. All this makes the statement of calling *P. hederae* spec. nov. a true endemic to Cyprus slightly premature.

The only wild ivy species in the Troodos Mountains of Cyprus is *Hedera pastuchovii* subspecies *cypria* (Christofides 2017). On some labels from material collected in 2017 (see van Steenis et al. 2019), *Hedera helix* L. is mentioned, but this is incorrect. *P. hederae* spec. nov. has solely been found on *Hedera pastuchovii* subsp. *cypria* (Fig. 5) and on Oriental Alder, *Alnus orientalis*. In contrast, *P. pruinosomaculata* has been found a few times on ivy, sometimes in flight with *P. hederae* spec. nov. (this paper; van Steenis et al. 2019), but mostly on white umbels and on the inflorescences of *Smyrnium* spec. and *Polygonum equisetiforme* (van Steenis et al. 2019).

Most specimens of *P. hederae* spec. nov. were found on ivy, which is abundant in the Cyprus forests. In a number of places, ivy is quite well accessible to collect insects. *Alnus orientalis* is a common tree species in and around the central mountain range of Cyprus at altitudes ranging from 125 to 1375 m a.s.l. (Christofides 2017; Hand et al. 2011), especially near streams and it is one of the dominant species in riparian forests (Department of Forests 2012). Its catkins are often less accessible for collecting. At the site where *P. hederae* spec. nov. appeared to forage on the catkins of *Alnus orientalis*, the branches were low enough to allow sampling with a hand net. A 'blind' sampling of the tree – the flies themselves were not readily visible – yielded several specimens of *P. hederae* spec. nov. It is therefore possible that, besides ivy, *Alnus orientalis* is an important additional food source for *P. hederae* spec. nov. in Cyprus.

Ivy flowers carry pollen and are rich in easily accessible nectar, which is the main food source this plant has to offer to pollinators (Garbuzov & Ratnieks 2014; Jacobs et al. 2009; Konarska 2014). *Alnus orientalis* is an anemophilous plant, characterized by high pollen production, as the vector of pollination is the wind (Molina et al. 1996). Its small female pistillate flowers are poor in nectar but the male catkins are rich in pollen. According to Christofides (2017), this tree is in flower from February to April. Given the collecting date on flowering *Alnus orientalis* (November 7th), the flowering period of *Alnus orientalis* in Cyprus appears to start much earlier than expected (pers. comm., Yiannis Christofides). The flowering period of *Hedera pastuchovii* subspecies *cypria* would be November to March. Given the collecting dates of *P. hederae* spec. nov. in van Steenis et al. (2019) flowering of this plant in Cyprus already starts in October. Thus, with further collecting, it may appear that the flight period of *P. hederae* spec. nov. stretches over a larger part of autumn and winter than presented in the current paper.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1. COI uncorrected pairwise distances (% similarity) between studied specimens.