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The Finnish species of *Pipizella* Rondani, 1856 (Diptera, Syrphidae), with descriptions of the female sex of *Pipizella certa* Violovitsh, 1981 and *Pipizella obscura* van Steenis & Lucas, 2011

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Abstract. The hoverfly genus *Pipizella* Rondani, 1856 (Diptera: Syrphidae: Pipizinae) is represented by three species in Finland, the widespread Palaearctic species *Pipizella viduata* (Linnaeus, 1758), and two rare Palaearctic species, *Pipizella certa* Violovitsh, 1981 and *Pipizella obscura* van Steenis & Lucas, 2011. Hitherto, species identification of Finnish *Pipizella* spp. was feasible only for the male sex using morphological characteristics of the male genitalia. This study focussed on identifying candidate female specimens of *P. certa* and *P. obscura* using morphological hypotheses. We generated mtDNA COI barcodes for males and females of selected *Pipizella* specimens. The barcoding results corroborated the employed morphological hypotheses by linking the unknown female sex with the correct male species identity. The hitherto unknown females of *P. certa* and *P. obscura* are here morphologically described for the first time. We provide and clarify diagnostic characters to separate both sexes of the three *Pipizella* species occurring in Finland. We provide the first DNA barcode sequences for both sexes of *P. obscura*.

Keywords. Syrphidae, Pipizinae, *Pipizella*, DNA barcoding, identification, female descriptions.

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Introduction

The genus *Pipizella* Rondani, 1856 is a large genus of hover flies (Diptera Linnaeus, 1758: Syrphidae Latreille, 1802) in the Palaearctic region. The revision of the West-Palaearctic species of *Pipizella* by van Steenis & Lucas (2011) included altogether 35 species, of which 22 occur in Europe. From Finland only three species are known, *P. viduata* (Linnaeus, 1758), *P. certa* Violovitsh, 1981 and *P. obscura* van Steenis & Lucas, 2011 (Haarto & Kerppola 2014). One of the Finnish species, *P. viduata*, is an abundant and widespread one in the entire Palaearctic region. A rare species occurring in Finland, *P. certa*, was synonymized with *P. brevis* Lucas, 1976 by Kuznetzov (1987), but van Steenis & Lucas (2011) later

re-instated the taxon as a valid species. *Pipizella certa* is only recorded from Russia (Violovitsh 1981), Estonia (GBIF 2025), Finland (Suomen Lajitietokeskus 2026) and Sweden (SLU 2026). The third Finnish species, *P. obscura*, is very similar in appearance to *P. viduata*. The species was described from northern Sweden, and the distribution in Fennoscandia is still poorly known as only few records of the taxon exist (Suomen Lajitietokeskus 2026, SLU 2025).

The male specimens of *Pipizella* are possible to identify with confidence by examination of their genitalia which provide species-specific characteristics. An identification key to the males for 35 *Pipizella* species of the West-Palaearctic area, using a combination of genitalic and non-genitalic characters, was provided by van Steenis & Lucas (2011). For Finland Haarto & Kerppola (2007) provided an identification key to the males based on genitalic characters, they included the species *P. certa* and *P. viduata* known for Finland in 2007, but also *P. virens* (Fabricius, 1805), a species hitherto not recorded from Finland but occurring in Sweden. Bartsch *et al.* (2009) provided a largely similar identification key using a combination of genitalic and non-genitalic characters for the males of the three mentioned species. Haarto & Kerppola (2007) and Bartsch *et al.* (2009) only provided separation of the females of *P. viduata* and *P. virens*, using the length and composition of pilosity of the hind tibia for separation.

The species identification of the *Pipizella* females is deemed challenging, as for the female sex of the *Pipizella* species in Europe only a few distinct morphological characters potentially useful for separation of species have been identified (van Steenis & Lucas 2011). For only a few *Pipizella* species morphological descriptions of the females exist, e.g., *P. bispina* Šimić, 1987, *P. maculipennis* (Meigen, 1822), *P. viduata* and *P. virens*. Only a few identification keys for the female sex exist (e.g., Vujić 1997; Bot & Van de Meutter 2023), but none of the existing keys to females include all the species occurring in a region.

The habitus of the *Pipizella* species occurring in Finland is generally quite similar. However, linking the unknown female sex with a male for correct species identification was deemed tractable for the Finnish fauna of *Pipizella*, as only three species are recorded from Finland. The employed strategy was to look for female specimens with characteristics differing from the most common and abundant species, *Pipizella viduata*, and to produce DNA barcodes for selected specimens for the purpose of linking the barcodes of unknown females with those of identified males. The aim of the present study was to identify the unknown females of *P. certa* and *P. obscura* and to provide descriptions for these.

Material and methods

Morphological study

The collections were searched for female specimens of *Pipizella* showing some variability in traits like the shape of the abdomen, the length and width of the frons, the colour of the front tarsus and the length and height ratio of the basoflagellomere. The first author identified two such females in the collection IKC. These females were borrowed for morphological study. Additionally, in IKC one female, specimen which was collected together with a male of *P. obscura*, was found. For finalizing the description additional collection materials of *Pipizella* pinned specimens were searched for in the MZH and ZMUT collections to identify candidate *P. certa* and *P. obscura* specimens.

Specimens from the following repositories or individual collections were used:

AHC = Private collection of Antti Haarto, Mynämäki, Finland
IKC = Private collection of Iiro Kakko, Hämeenlinna, Finland
MZH = Finnish Museum of Natural History Luomus, Zoology unit, University of Helsinki, Helsinki, Finland
ZMUT = Zoological Museum of the University of Turku, Turku, Finland

Label information

The Finnish specimens listed for each species have a label including the Finnish grid coordinates (ykj) (Ollikainen & Ollikainen 2004). These Finnish grid coordinates are converted to the corresponding geographical coordinates in WGS84 using the converter at retkikartta.fi and are given in square brackets in the locality data. The specimen labels include an abbreviation of the Finnish biogeographical provinces (for information see https://laji.fi/about/5719). The specimen labels include a unique ID code added by first author Antti Haarto (e.g., ID: AHa24-001297) with the purpose of tracking the specimens identified by AH. These are included on specimen labels for materials collected by AH, and for material from other collections on a separate label on the pinned specimens. The name of the collector (leg.) is given as on the label.

Terminology

The terminology used in the identification key, descriptions and figures follows Thompson (1999) for external morphology and for male genitalia structures van Steenis & Lucas (2011), the latter also provided explanations of the terminology used here.

Measurements

The body length is measured dorsally from the lunule to the tip of the abdomen, in two parts, if the abdomen is bent down. The wing length is measured from the wing base to the end of vein R4+5. To describe the relationship between the width and length of tergum 4 the formula T4WL was created. The formula T4WL was measured as width (Fig. 1: W) of tergum 4 at the posterior margin, divided by the length (Fig. 1: L) of the tergum measured medially. However, as pinned *Pipizella* specimens dry, the lateral margin of tergum 4 bends down to various degrees (Fig. 1: D). Thus, this effect had to be added to the formula. The final formula for T4WL is therefore (W+D)/L (Fig. 1).The width of the frons (DBE) is measured at the level of the posterior ocelli and the distance between the hind ocelli (DBO) is measured between the outer margins of the posterior ocelli (Fig. 2).

Photographs and genitalia drawings

The photographs of the specimens were taken with Euromex Novex RZ trinocular microscope and a AmScope MU1803 microscope digital camera, and images were composed with the software provided with the Amscope camera. The same microscope and camera combination was used for the line drawings of the genitalia of the males.

Molecular study

For specimens selected for DNA barcoding one leg (typically left mid leg) was removed for DNA extraction. The locality information and GenBank accession codes for the specimens used for generating new mtDNA COI barcodes are listed in Table 1. We indicate the repositories of the specimen of the DNA barcodes downloaded from the public sequence repositories of the Canadian National Collections, Canada (CNC), and the Naturalis Biodiversity Center, Netherlands (NBC). Specimens from the Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Serbia (FSUNS) were used for barcoding (Table 1).

Laboratory procedures

DNA was extracted from a leg using the Phire™ Tissue Direct PCR master Mix #F-170S kit (Thermo Scientific Baltics UAB, Vilnius, Lithuania) following the Dilution & Storage protocol with some modifications. The Phire™ Tissue Direct PCR master Mix is designed to perform PCR directly from tissue samples with no prior DNA purification. The protocol used 40 µl of Dilution Buffer and 0.8 µl of DNA Release Additive was added. The tube was briefly vortexed and centrifuged and then: 1) incubated

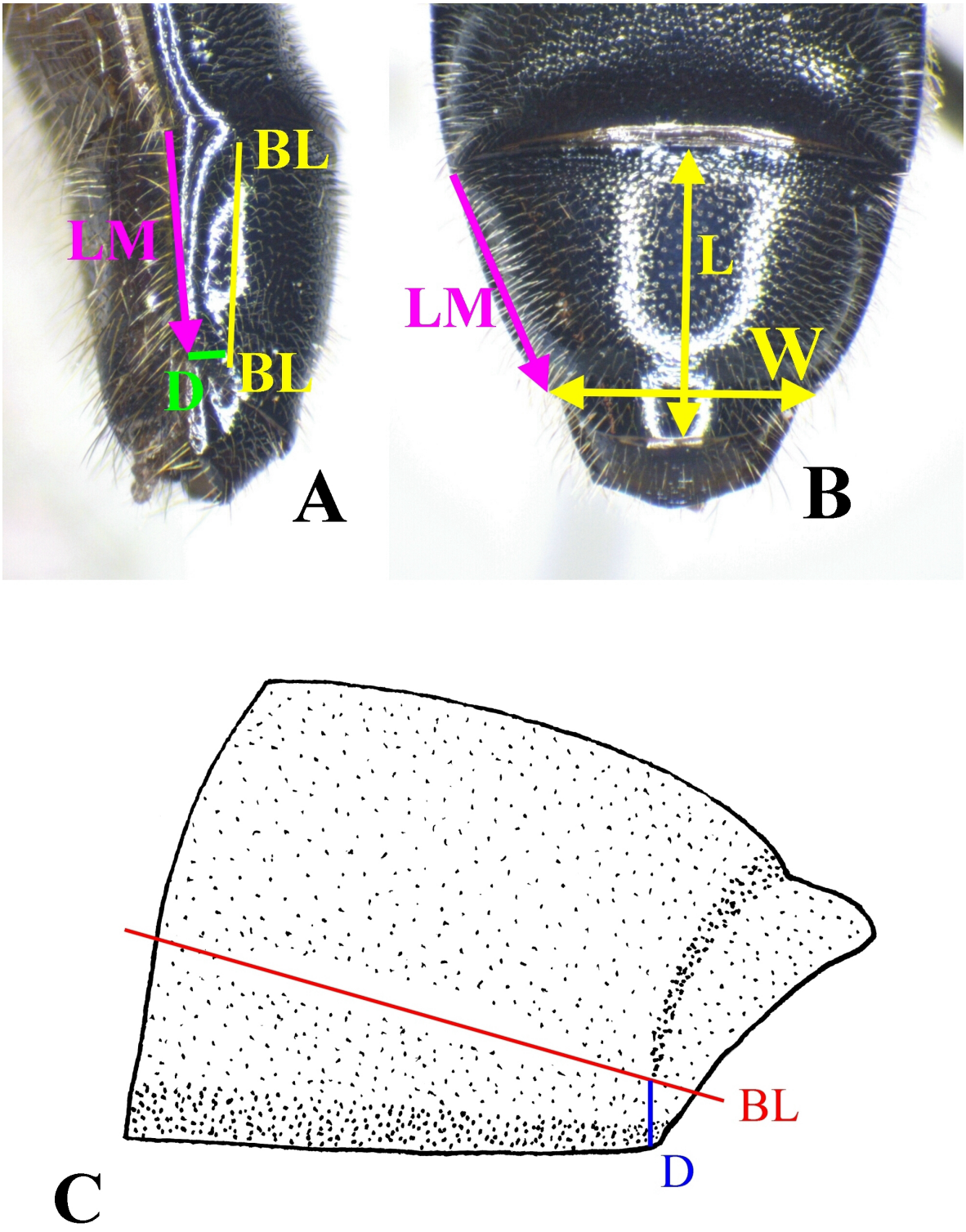

Fig. 1. *Pipizella obscura* van Steenis & Lucas, 2011 ♀ (AHa19-000709), abdomen. **A**. Lateral view. **B**. Dorsal view. **C**. Tergum 4 in lateral view schematically. Guideline for measurement of the ratio T4WL = (W+D)/L: W is the width of the posterior margin of tergum 4 measured dorsally from the posterior corners of the lateral margin (LM); L is the length of tergum 4 measured dorsally; D is the distance between the bending line (BL) and the posterior corner of the lateral margin (LM) measured laterally.

at room temperature for about 20 min, 2) placed in 56°C for 10 min, and 3) placed in a pre-heated block at 98°C for 2 minutes, and finally centrifuged at 11 000 rpm for 1 min. One µl of supernatant was used in a 25 µl PCR reaction using the PCR Master Mix solution provided with the kit. The mtDNA COI barcode was PCR-amplified using universal primers (Folmer *et al*. 1994). Amplified PCR products were electrophoresed on 1.5% agarose gels. Successful amplifications were treated with Exo-SapIT (USB Affymetrix, Ohio, USA) prior to sequencing. The PCR primers were used for sequencing, which was outsourced to the Sequencing Service Laboratory of FIMM Genomics (www.fimm.fi). The sequences were edited for base-calling errors and assembled using Sequencher™ (ver. 5.0) (Gene Codes Corporation, Ann Arbor, MI, USA) and selected barcode sequences were submitted to GenBank.

COI barcode sequence analysis

A COI barcode data matrix was created with selected sequences of *Pipizella* spp. mined from the NCBI GenBank database (www.ncbi.nlm.nih.gov/) and BOLD (id.boldsystems.org), and added to the newly generated barcodes (Table 1). The barcode sequences of *Neocnemodon pubescens* (Delucchi & Pschorn-Walcher, 1955), *N. vitripennis* (Meigen, 1822), *Heringia heringi* (Zetterstedt, 1843) and *Triglyphus escalerai* Gil Collado, 1929 were included as outgroups, and *Heringia heringi* was used to root the tree. The sequence similarity-based Neighbor-Joining method (Saitou & Nei 1987) under the Kimura 2-parameter substitution model (Kimura 1980) was used for clustering the sequences in the software MEGA11 (Tamura *et al.* 2021). All positions with less than 95% site coverage were eliminated, i.e., fewer than 5% alignment gaps, missing data, and ambiguous bases were allowed at any position (partial deletion option).

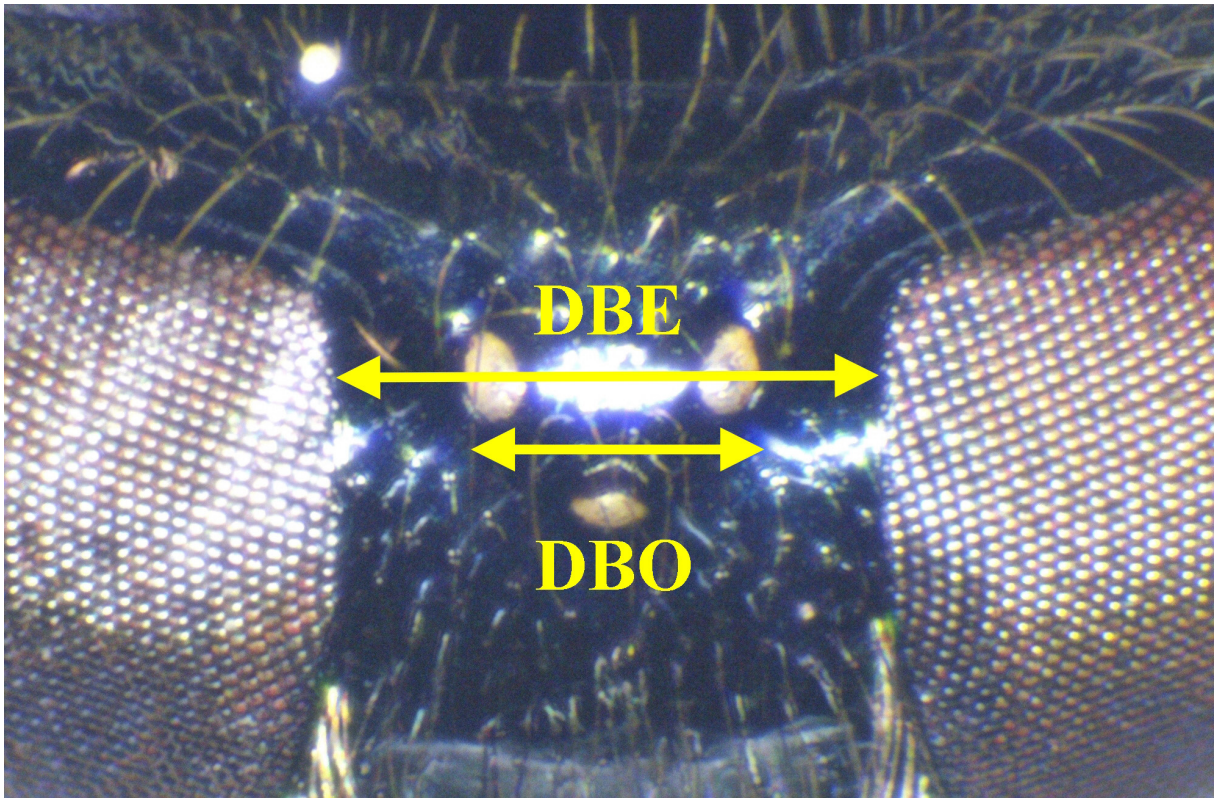

Fig. 2. *Pipizella obscura* van Steenis & Lucas, 2011, ♀(AHa19-000709), frons. The arrows indicate how to measure the ratio DBE/DBO, width of frons at level of posterior ocelli (DBE) / distance between outer margins of hind ocelli (DBO).

Table 1 (Continue on next page)**.** Molecular data of specimens used for DNA barcoding including GenBank codes. In bold newly generated sequences for this study. na = not available

Species	Specimen data	Sex	Lab IDs	GB/BOLD	Institution	Extra info
Pipizella viduata	Finland, Mynämäki, 4 Jun. 2011, Antti Haarto leg. http://id.luomus.fi/HP.149	M	MZH_HP.149	OK065547	MZH	aHa11-002734
Pipizella viduata	Finland, Jämsä, 27 Jun. 2011, Antti Haarto leg. http://id.luomus.fi/HP.304	F	MZH_HP.304	OK065315	MZH	aHa11-003051
Pipizella viduata	Finland, Pukkila, 11 Jun. 2011, Jere Kahanpää leg. http://id.luomus.fi/HP.682	M	MZH_HP.682	MZ632212	MZH	jka11-00007
Pipizella viduata	Finland, Obb: Tornio ravirata, ykj73022:3796, 3 Jul. 2008, Iiro Kakko leg.	F	MZH_Y843	**HE774499**		
Pipizella viduata	Finland, Karkkila, 23 May 2010, Erkki M. & Leena Laasonen leg.	M	MZH_Y1409	**PX852812**		
Pipizella viduata	Finland, Joutseno, Kaukoranta, 67832:35837, 30 Jun. 2023, Antti Haarto leg.	F	MZH_Y3003	**PX852810**	AHC	AHa24-001294
Pipizella viduata	Finland, Siuntio, 29 Jul. 2013, Erkki M. & Leena Laasonen leg.	F	ZMUO. 030352	MZ658269		LEFIJ8072-19.COI-5P
Pipizella viduata	France	NA	EY5793	MW077826	na	GenBank
Pipizella viduata	Switzerland, Valais, Mission, 30 May 2008, W. van Steenis leg. http://id.luomus.fi/GJ.7206	M	MZH_Y1156	**HE774500**	MZH	
Pipizella certa	Finland, Ab: Mynämäki, Perkka, 6733:3222, 1 Jun. 2008, A. Haarto leg.	M	MZH_Y842	(HE774497)	AHC	AHa08-000393
Pipizella certa	Finland, Joutseno, Kaukoranta, 67832:35837, 30 Jun. 2023, A. Haarto leg.	F	MZH_Y3098	**PX852816**	AHC	AHa23-000414
Pipizella certa	Sweden, Skållerud, 29 Jun. 2006, Nils Ryrholm leg. http://id.luomus.fi/GJ.7207	M	XP-119	**KM224518**	MZH	
Pipizella divicoi	Montenegro, Durmitor, 22 May 2009, Ante Vujić leg. http://id.luomus.fi/GJ.7208	M	MZH_Y981	**PX852815**	MZH	
Pipizella divicoi	Switzerland, Valais, Simplon Dorf, 1460 m, 46°11′37.11 ″ N 8°03′28.47 ″ E, 27 May 2019, G. Ståhls leg. http://id.luomus.fi/GJ.7209	M	MZH_Y3102	**PX852814**	MZH	
Pipizella obscura	Finland, Suomussalmi, Lehtovaara, 29 Jun. 2011, A. Haarto leg.	F	MZH HP.585	OK065525	na	aHa11-003676

Table 1 (Continue)**.** Molecular data of specimens used for DNA barcoding including GenBank codes. In bold newly generated sequences for this study. na = not available

Species	Specimen data	Sex	Lab IDs	GB/BOLD	Institution	Extra info
Pipizella obscura	Finland, Kuusamo, Juuma, 21 Jun. 2019, A. Haarto leg.	F	JP2022-010	BOLD: AAY3612	AHC	TACHF158-22; AHa19-000709
Pipizella obscura	Finland, Kuusamo, Riisitunturi, 14 Jul. 2022, Sander Bot leg. http://id.luomus.fi/GJ.7360	M	MZH_Y2944	**PX852811**	MZH	
Pipizella obscura	Finland, 26 Jul. 2023 909 Utsjoki, Pappila, pyydys 1. PÖLYSEURA 2023.	M	MZH_Y3092	**PX852808**	MZH	Pölyseura
Pipizella maculipennis	Montenegro, Durmitor, 22 Jul. 2009, Ante Vujić leg. http://id.luomus.fi/GJ.7210	M	MZH_Y980	**PX852813**	FSUNS	
Pipizella siciliana	Italy, Sicily, 20 Apr. 2024, Gunilla Ståhls leg. http://id.luomus.fi/GJ.7211	M	MZH_Y3019	**PX852808**	MZH	
Pipizella virens	Serbia, Dubasnica, 20 Jun. 2025, Ante Vujić leg.	M	RU958_ 71866	**PX906603**	FSUNS	
Pipizella virens	Serbia, Dubasnica, 19 Jun. 2025, Ante Vujić leg.	M	RU956_ 71858	**PX906604**	FSUNS	
Pipizella virens	Netherlands, Limburg, 10 May 2012, John Smit leg.	M	RMNH. INS.551603	BOLD: AAY3612	NBC	
Pipizella zenegeensis	France, Hautes-Alpes, Vallouise, 3 Jun. 2020, Jeroen van Steenis leg.	M	CNC DIPTERA 162757	BOLD: AAY3612	CNC	
Neocnemodon vitripennis	Finland, Suomussalmi, 28 Jun. 2011, Antti Haarto leg.	M	MZH_HP.236	MZ609405	MZH	AHa11-003012
Neocnemodon pubescens	Finland, Suomussalmi, 29 Jun. 2011, Antti Haarto leg. http://id.luomus.fi/HP.531	F	MZH_HP.531	MZ626667	MZH	AHa11-003527
Triglyphus escalerai	Greece, Lesvos, 3 May 2008, Ante Vujić leg. http://id.luomus.fi/GJ.7212	M	FSUNS_ A506	**PX852806**	MZH	
Heringia heringi	Greece, Lesvos, 3 May 2008, Ante Vujić leg. http://id.luomus.fi/GJ.7213	M	FSUNS_ A507	**PX852807**	MZH	

Results

Morphological study

A total of 223 males and 152 females pinned specimens of *Pipizella* from the listed collections were identified by the first author. Among these a total of seven specimens of *Pipizella certa* were found (4 males and 3 females), 24 specimens of *P. obscura* (12 males, 12 females) and 344 specimens of *P. viduata* (207 males, 137 females). The three female specimens of *P. obscura* identified in the collecion IKC were used to draft a description of the female sex, and the description was finalized based on all identified female specimens. The *P. certa* females were identified using the same strategy as described above, and the description of the female of *P. certa* is based on the three available female specimens.

Taxonomy

Class Insecta Linnaeus, 1758
Order Diptera Linnaeus, 1758
Family Syrphidae Latreille, 1802
Subfamily Pipizinae Williston, 1885
Tribe Pipizini Williston, 1885
Genus *Pipizella* Rondani, 1856

Pipizella certa Violovitsh, 1981
Figs 3, 4A, 7, 11A, 12A

Material examined (females only)

FINLAND • 1 ♀; Lohja, Vainiola; 6680:3328 [60°12′ N, 23°55′ E]; 16 Jun. 2004; A. Haarto leg.; A. Haarto det.; AHa24-001288, Coll. ZMUT, DIPT_01239 • 1 ♀; Laukaa, sorakuoppa; 69207:34333, [62°23.1’′N, 25°43.2′ E];17 Jul. 2006; Iiro Kakko leg.; det. A. Haarto; AHa24-001311, Coll. IKC • 1 ♀ Joutseno, Riikanmaa; 67765:35913 [61°05.3′ N, 28°41.4′ E]; 28 Jun. 2023; A. Haarto leg.; AHa23-000414, Coll. AHC.

Description of female

General appearance as in Fig. 3. Body length 7.34–7.75 mm (mean 7.48 mm) and wing length 4.64–4.89 mm (mean 4.74 mm) by three measured specimens.

Head. Shiny black. Eyes with short white hairs. Width of ocellar triangle is 1.3 times its length. Ocellar triangle with pale yellow erect hairs. Vertex over three times as broad as the diameter of an ocellus and dorsally with pale yellow erect hairs. Occiput laterally narrower than the diameter of an ocellus and with white short erect hairs. Face flat without facial tubercle and with a small prominent mouth edge. Face with white semierect hairs. Height of gena is about a third of the length of its white erect hairs. Frontal ratio DBE/DBO is 1.61–1.94 (mean 1.72). The width of frons (DBE) and the distance between outsides of the hind ocelli (DBO) are measured at level of the posterior ocelli (see Fig. 2). Frons mainly with white erect hairs, but anteriorly near lunule and in posterior third in front of ocelli with black erect hairs. Lunule shiny black. Antennal fossa not separated by a medial extension of the lunule. Antenna brownish black. Maximum length of basoflagellomere 1.96–2.26 (mean 2.09) times as long as its maximum width. Arista bare, apically brownish black and yellowish brown on basal ⅓ and about as long as basoflagellomere.

Thorax. Scutum and scutellum shiny black with short, pale yellow erect hairs. Posterior margin of scutellum dorsally with pale yellow erect hairs almost as long as length of scutellum and ventrally with short white hairs. Pleura dull black mainly with grey pollinosity, anepimeron and katepisternum partly shiny and anepisternum anteriorly shiny and posteriorly pollinose. Posterior part of anepisternum and anterior part of anepimeron with long pale yellow erect hairs. Dorsal part and ventral corner of

Fig. 3. *Pipizella certa* Violovitsh, 1981, ♀ (AHa23-000414), habitus.

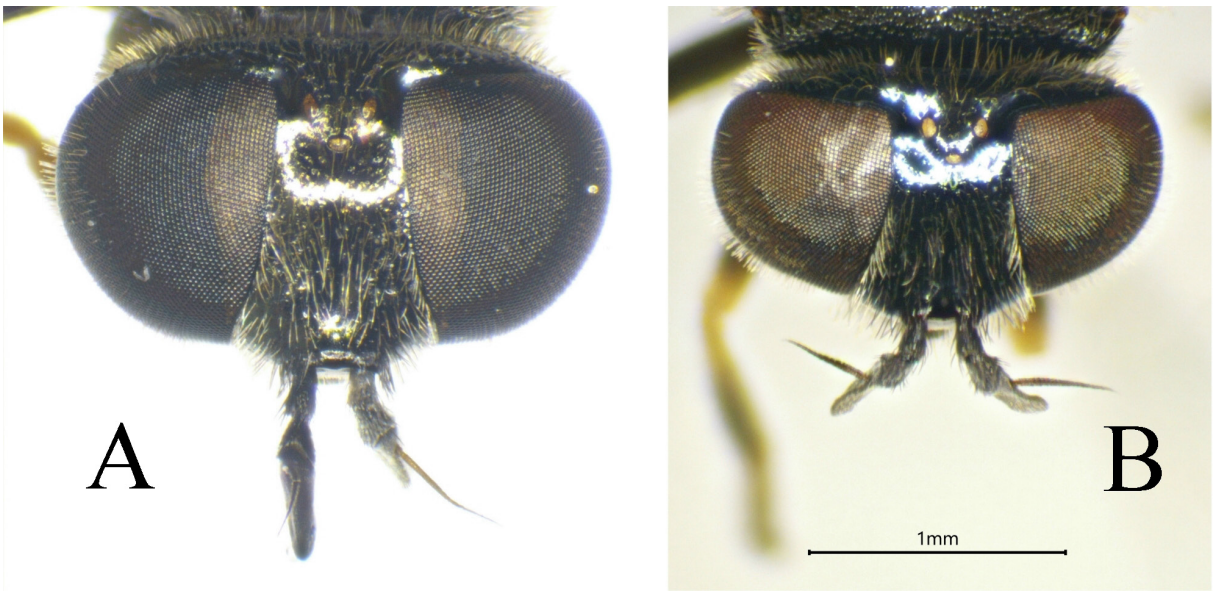

Fig. 4. The female frons. **A**. *Pipizella certa* Violovitsh, 1981 (AHa23-000414). **B**. *Pipizella obscura* van Steenis & Lucas, 2011 (AHa19-000709) [not avaiable, considered lost].

katepisternum with white erect hairs. Calypter white with pale yellow margin and white hairs on margin. Halter pale yellow with pale brown base of stem.

Wing. Completely microtrichose. Membrane hyaline. Pterostigma yellowish brown.

Legs. Coxae dull black with grey pollinosity. Front and mid coxae with adpressed short white hairs. Hind coxa with erect white hairs. Trochanters black, front and mid trochanters dull with grey pollinosity and hind trochanter shiny. Femora mainly black but apically narrowly yellow. Front and mid femur mainly with semi-erect short pale yellow hairs but posteriorly with pale yellow hairs about as long as diameter of femur. Hind femur mainly with erect pale yellow hairs somewhat longer than the diameter of the femur. Tibiae black, but apically narrowly yellow, and basally the length of the yellow part varies from a third to half of tibial length. Tibiae with semi-erect white hairs sometimes mixed with some black hairs. Longest hairs on anterior side of hind tibia are about 1.4 times as long as diameter of tibia. Basotarsomere of front and mid tarsi yellow. Hind tarsus with basotarsomere dorsally brown and ventrally yellow. Otherwise, tarsi brown, but 2nd tarsomere of mid tarsus sometimes yellow. All tarsi with adpressed pale yellow hairs.

Abdomen. Terga shiny black, with predominantly short white erect hairs, interspersed with various amounts of black hairs. Posterior margins of terga 2–3 broadly with short black erect hairs. Anterior margins of terga 3–4 broadly with short black erect hairs. Anterior corner of tergum 2 laterally with some long white hairs. Terga 2–4 at least twice as wide as wide as long. Ratio T4WL is 1.31–1.45 (mean 1.38) measured as in Fig. 1. Sterna shiny brown, but sternum 1 dull black with grey pollinosity. Sternum 2 with long white erect hairs. Sternum 3 with semi-erect white hairs anteriorly and adpressed white hairs posteriorly. Sternum 4 with erect white hairs anteriorly and adpressed white hairs posteriorly. Sternum 5 with some black erect hairs.

Differential diagnosis

Both sexes of *Pipizella certa* can be readily differentiated from the two other Finnish species based on the entirely yellow front basotarsomere, and in the males also by the structure of the male genitalia. The female of *Pipizella certa* has on average a narrower frons and a shorter basoflagellomere than either *P. obscura* or *P. viduata* (Fig. 4); however, the number of studied specimens is small.

Distribution.

Estonia, Finland (Fig. 14A), Russia, Sweden.

Pipizella obscura van Steenis & Lucas, 2011
Figs 1–2, 4B, 5, 6A, 8–9, 11B, 12B

Material examined (females only)

FINLAND • 1 ♀; Suomussalmi, Lehtovaara; 72388:36243 [65°13.3′ N, 29°39.2′ E]; 29 Jun. 2011; A. Haarto leg.; AHa11-003676; DNA MZH_HP.585 [specimen considered lost] • 1 ♀; Kuusamo, Juuma; 73543:36056 [66°15.8′ N, 29°20.8′ E]; 26 Jun.2019; A. Haarto leg.; AHa19-000709; FinBOL DNA, JP2022-010, TACHF158-22; Coll. AHC • 1 ♀; Hämeenlinna, Hattelmalanharju; 6766:3362 [60°58′ N, 24°26′ E]; 24 May 2010; Iiro Kakko leg.; AHa24-001297; Coll. IKC • 1 ♀; Riihimäki, Monni; 67311:33819 [60°40.3′ N, 24°50.1′ E]; 20 Jul.2014; Iiro Kakko leg.; AHa24-001298; Coll. IKC • 1 (Collected with a male (AHa24-001308, Coll. IKC)) ♀; Janakkala, Suurisuo; 67663:33816 [60°59.3′ N; 24°48.5′ E]; 4 Jun. 2018; Iiro Kakko leg.; AHa24-001299; Coll. IKC • 1 ♀; Hämeenlinna, Hattelmalanharju; 67651:33632 [60°58.3′ N; 24°28.2′ E]; 12 Jun. 2021; Iiro Kakko leg.; AHa24-001300; Coll. IKC • 1 ♀; Luumäki; 67553:35174 [60°54.4′ N, 27°19.0′ E]; 16 Jun. 2022; Iiro Kakko leg.; AHa24-001301; Coll. IKC • 1 ♀; Imatra, Mellonmäki; 67848:35942 [61°09.6′ N; 28°44.8′ E]; 30 Jun. 2023; Iiro Kakko leg.; AHa24-001302; Coll. IKC • 1 ♀; Lappeenranta, Rantatie X; 67832:35838 [61°08.9′ N;

28°33.1′ E]; 28 Jun. 2023; Iiro Kakko leg.; AHa24-001303; Coll. IKC • 1 ♀; Liperi, Ylämylly, ratapiha; 69489:36320 [62°37.2′ N; 29°34.1′ E]; 9 Jul. 2018; Iiro Kakko leg.; AHa24-001305; Coll. IKC • 1 ♀; Kitee, Partasensaari; 68863:36702 [62°02.7′ N; 30°15.2′ E]; 10 Jul. 2018; Iiro Kakko leg.; AHa24-001306; Coll. IKC • 1 ♀; Sodankylä, Madevaara S; 74547:34836 [67°10.8′ N; 26°36.7′ E]; 24 Jun. 2018 Iiro Kakko leg.; AHa24-001307; Coll. IKC.

Description of female

General appearance as in Fig. 5. Body length 5.32–7.36 mm (mean 6.28 mm) and wing length 3.64–4.82 mm (mean 4.19) (n = 11).

Head. Shiny black. Eye with short white hairs. Width of ocellar triangle is 1.3 times its length. Ocellar triangle with pale yellow erect hairs. Vertex over three times as broad as the diameter of an ocellus and with pale yellow erect hairs. Occiput laterally narrower than the diameter of an ocellus and with white

Fig. 5. *Pipizella obscura* van Steenis & Lucas, 2011, ♀(AHa19-000709), habitus.

short erect hairs. Face flat without facial tubercle and with a weakly prominent mouth edge. Face with white semi-erect hairs. Height of gena is about a third of the length of its white erect hairs. The frontal ratio DBE/DBO is 1.85–2.08 (mean 1.96). Frons mainly with white erect hairs but anteriorly near lunule and at most the posterior third in front of ocelli with black erect hairs. Lunule shiny black. Antennal fossa not separated by a medial extension of the lunule. Antenna brownish black. Maximum length of basoflagellomere 2.05–2.55 (mean 2.25) times as long as its maximum width. Arista bare, apically brownish black and yellowish brown in basal ⅓, about as long as basoflagellomere.

Thorax. Scutum and scutellum shiny black with short, pale yellow erect pilosity. Posterior margin of scutellum dorsally with pale yellow erect hairs as long as half the length of scutellum, and ventrally with short white hairs. Pleuron dull black, mainly with grey pollinosity, anepimeron and katepisternum partly shiny and anepisternum anteriorly shiny and posteriorly pollinose. Posterior part of anepisternum and anterior part of anepimeron with pale yellow erect hairs. Dorsal part and ventral corner of katepisternum with white erect hairs. Calypter white with pale yellow margin and white hairs on margin. Halter pale yellow with pale brown base of stem.

Wing. Completely microtrichose. Membrane with a slightly brownish tinge. Pterostigma yellowish brown.

Legs. Coxa dull black with grey pollinosity. Front and mid coxa with adpressed short white hairs. Hind coxa with erect white hairs. Trochanters black, front and mid trochanter dull with grey pollinosity and hind trochanter shiny. Femora mainly black but apically narrowly yellow. Front and mid femur mainly with semi-erect short pale yellow hairs but posteriorly with pale yellow and apically some black erect hairs about as long as diameter of femur. Hind femur mainly with erect pale yellow hairs somewhat

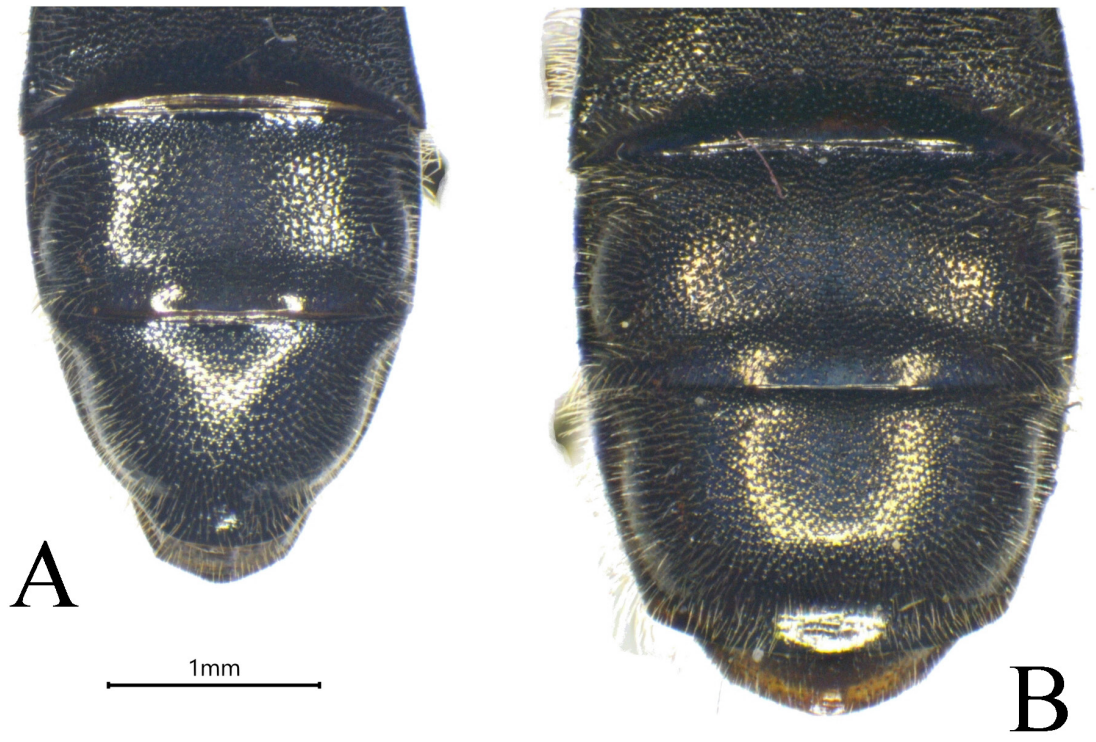

Fig. 6. Apical part of the female abdomen. **A**. *Pipizella obscura* van Steenis & Lucas, 2011 (AHa19-000709). **B**. *Pipizella viduata* (Linnaeus, 1758) (AHa24-001293).

longer than diameter of femur. Tibiae black but apically narrowly yellow and basally length of yellow part varies from a third to half of tibial length. Tibiae with semi-erect white hairs sometimes mixed with some black hairs. Longest hairs on anterior side of hind tibia are about 1.3 times the diameter of the tibia. Basotarsomere of front tarsus dorsally brown and ventrally brownish yellow. Basotarsomere of mid tarsus yellow. Otherwise, front and mid tarsi brown. Hind tarsus dark brown with a long thickened basotarsomere. All tarsi with adpressed pale yellow hairs sometimes mixed with some black hairs.

Abdomen. Terga shiny black, with predominantly short white erect hairs, interspersed with various amounts of black hairs. Posterior margins of terga 2–3 broadly with short black erect hairs. Anterior margins of terga 3–4 broadly with short black erect hairs. Anterior corner of tergum 2 laterally with some long white hairs. Terga 2–3 at least twice as wide as long, and tergum 4 often somewhat less than twice as wide as long. Ratio T4WL is 1.03–1.17 (mean 1.14) (measured as in Fig. 1). Sterna shiny brown, but sternum 1 dull black with grey pollinosity. Sternum 2 with long white erect hairs. Sterna 3–5 with white erect hairs, but adpressed on posterior half of sternum 4.

Differential diagnosis

The female of *P. viduata* is on average slightly longer (mean 6.78 mm) than that of *P. obscura* (Supp. file 2). The longest hairs on the anterior side of the hind tibia are about 1.4 times as long as the diameter of tibia, whereas in *P. obscura* this ratio is about 1.3.

The distinct difference between females of *Pipizella obscura* and *P. viduata* is the shape of tergum 4. In *Pipizella viduata* tergum 4 is short and its width at the posterior margin is broad, whereas in *P. obscura* tergum 4 is long and its width at the posterior margin is narrow (Fig. 6). Thus, the ratio T4WL is not overlapping between these species. The mean of the ratio T4WL is 1.41 (range 1.33–1.54) in *P. viduata* and 1.14 (range 1.03–1.17) in *P. obscura* (Supp. file 2). Almost all *P. viduata* specimens could be separated from *P. obscura* using the shape of tergum 4. The males of these species can be identified by the characteristic features of the male genitalia. *Pipizella obscura* has a narrow, basally broadest, inner median flange of the hypandrium, whereas the inner median flange is broad (with broadest point medially) in *P. viduata*. The post-anal hood is apically almost straight in *P. obscura* (Figs 8C and 9C), whereas it is apically rounded in *P. viduata* (Fig. 10C).

Distribution.

Finland (Fig. 14B), Sweden.

Identification key to the Finnish species of *Pipizella*, with addition of *P. virens* known from neighbouring countries.

1. Males 2
– Females 5

2. Basotarsomere of front tarsus distinctly yellow. Surstylus (in blue colour) in lateral view widely oval, widest in apical half (Fig. 7A) ..... ***Pipicella certa*** Violovitsh, 1981
– Basotarsomere of front tarsus dorsally brown and ventrally brownish yellow. Surstylus (in blue colour) in lateral view widest at base, usually gradually tapering towards apex (Figs 8B, 9B, 10B) 3

3. Surstylus with wide base and very narrow apex in lateral view (van Steenis & Lucas 2011: fig. 169). Post-anal hood small, rectangular (van Steenis & Lucas 2011: fig. 168) ..... ***Pipizella virens*** (Fabricius, 1805)
– Surstylus (in blue colour) tapering gradually in lateral view (Figs 8B, 9B, 10B). Post-anal hood (in red colour) large or apically rounded (Figs 8C, 9C, 10C) 4

4. Inner median flange of hypandrium narrow (in red colour) basally broadest, evenly tapering (Figs 8B, 9B). Post-anal hood (in red colour) usually apically almost straight (Figs 8C, 9C) ..... ***Pipizella obscura*** van Steenis & Lucas, 2011
– Inner median flange of hypandrium (in red colour) evenly broad, not basally broadest (Fig. 10B). Post-anal hood (in red colour) apically rounded (Fig. 10C).....***Pipizella viduata,*** (Linnaeus, 1758)

5. Longest hairs on anterior side of hind tibia about twice diameter of tibia, as in males (van Steenis & Lucas 2011: fig. 167) .....***Pipizella virens*** (Fabricius, 1805)
– Longest hairs on anterior side of hind tibia less than 1.5 times diameter of tibia (Figs 11A, 11B, 11C)..... 6

6. Basotarsomere of front tarsus entirely and distinctly yellow (Fig. 12A). … ***Pipizella certa*** Violovitsh, 1981
– Basotarsomere of front tarsus dorsally brown and ventrally brownish yellow (Figs 12B, 12C) 5

7. Ratio T4WL is less than 1.20..... ***Pipizella obscura*** van Steenis & Lucas, 2011
– Ratio T4WL is more than 1.30 .....***Pipizella viduata*** (Linnaeus, 1758)

Observations of one additional *Pipizella* species, *Pipizella virens* (Fabricius, 1805), are known from the neighbouring countries to Finland. The species is reported from Sweden (SLU 2024, GBIF 2024) and from Estonia (GBIF 2024), and it thus appears possible to find *P. virens* also from Finland. Both sexes of *P. virens* have the longest hairs on the anterior side of the hind tibia which is up to twice as long as wide, whereas the *Pipizella* species known from Finland have the longest hairs on the anterior side of the hind tibia at most 1.5 times as wide as the tibia. In the male genitalia the lateral view of the surstylus of *P. virens* male shows a long narrow apical part and the lower gonocercus is shaped as a bifid plate (T-shaped) (Verlinden 1999: 20) which differentiates it from the *Pipizella* species known from Finland in which these structures are different (Figs 7–10; Haarto & Kerppola 2007; Bartsch *et al.* 2009; van Steenis & Lucas 2011; Bot & Van de Meutter 2023).

Molecular study

The final COI barcode data matrix comprised 24 COI barcodes of *Pipizella* specimens in total, of which 16 were newly generated for this study (Table 1).

The morphological identifications of the unknown female sexes were supported by the generated DNA barcodes, which linked the included male and female samples of the focal species *Pipizella certa*, *P. obscura* and *P. viduata* in independent clusters as visualized in the Neighbor-Joining tree (Fig. 13). The uncorrected pairwise COI barcode sequence divergences between *Pipizella obscura* and *P. viduata* is 0.16%, between *P. certa* and *P. viduata* it ranges between 1.3–1.7%, and between *P. obscura* and *P. certa* between 1.2–1.9%.

Discussion

The study of the Palaearctic species of the genus *Pipizella* by van Steenis & Lucas (2011) showed that the study of the male genitalia allows for species-specific identification of the majority of the species, but the authors discussed that external characters can (at least partly) be used to recognise species within restricted faunal regions, and our study constitutes such an example.

Both sexes of *Pipizella obscura* are morphologically very similar in appearance to the corresponding sex of the common and abundant species *P. viduata*, and the identification of *P. obscura* needed meticulous examination of the specimens. The original description of *P. obscura* (van Steenis & Lucas 2011) indicated that the cockscomb-shaped upper gonocercus has seven more irregularly placed "teeth" in the figured *P. obscura* holotype (Fig. 8), but several specimens studied here show seven rather regularly

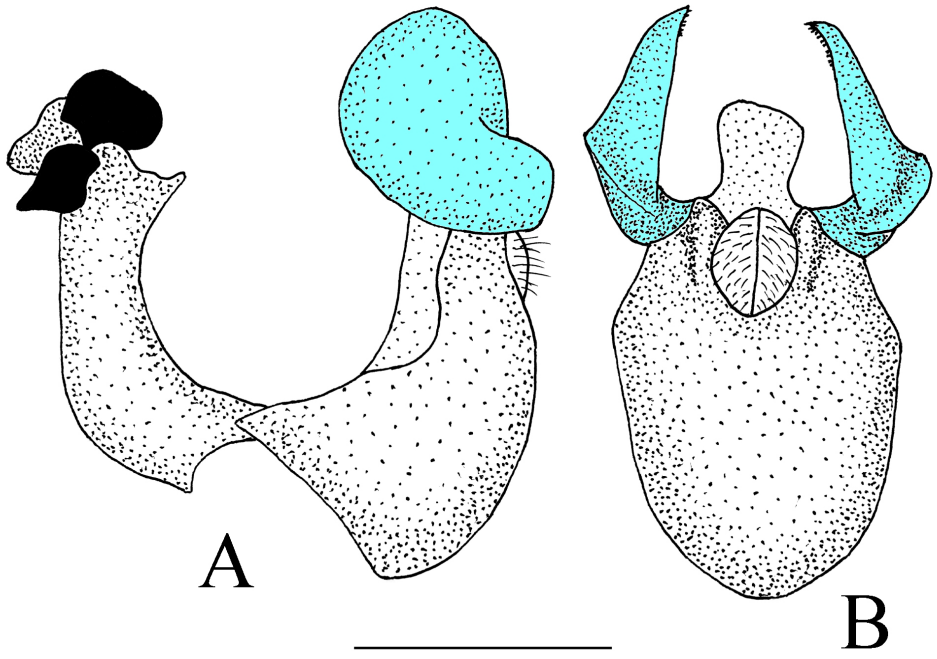

Fig. 7. The genitalia of *Pipizella certa* Violovitsh, 1981, ♂, genitalia (AHa24-001290). **A**. Hypandrium and epandrium, lateral view. **B**. Epandrium, dorsal view. Surstylus coloured in blue. Scale bar = 0.5 mm.

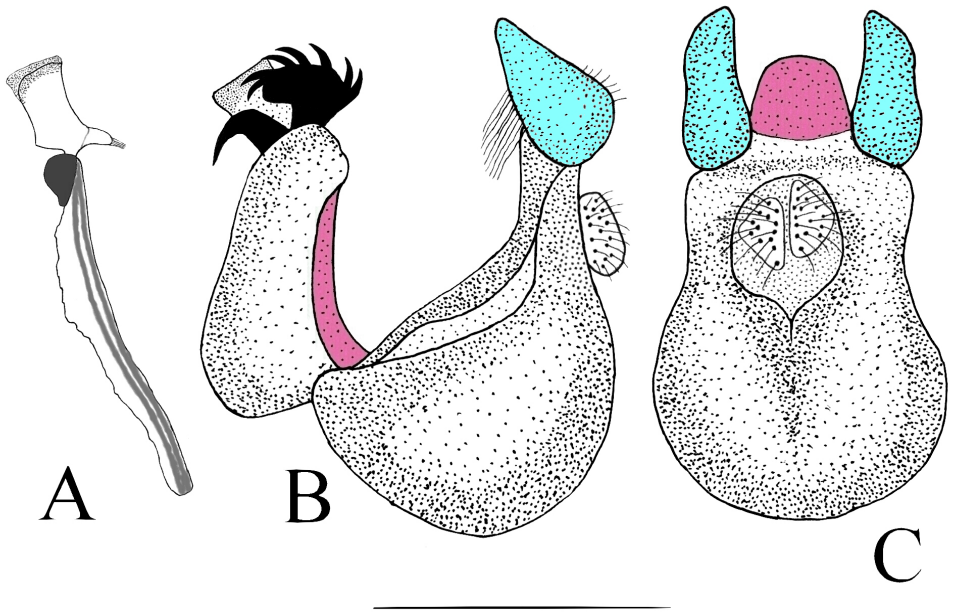

Fig. 8. The genitalia of *Pipizella obscura* van Steenis & Lucas, 2011, holotype, ♂ (NHRS-BYWS000002973), genitalia. **A**. The aedeagus. **B**. Hypandrium and epandrium, lateral view. Inner median flange of hypandrium coloured in red. **C**. Epandrium, dorsal view. Surstylus coloured in blue and post-anal hood in red. Scale bar = 0.5 mm.

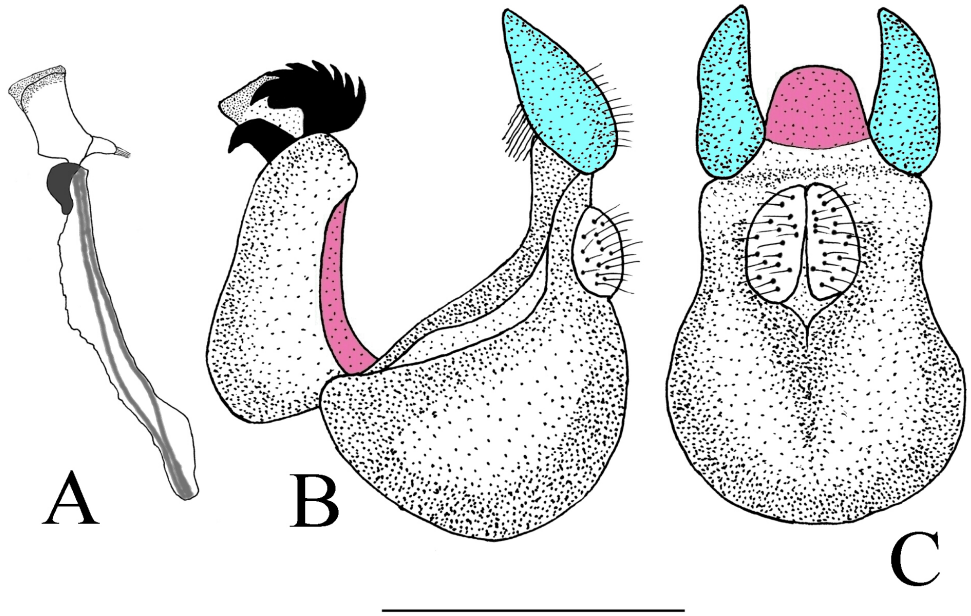

Fig. 9. *Pipizella obscura* van Steenis & Lucas, 2011, ♂, genitalia. **A**. (AHa08-000757) Aedeagus. **B–C**. (AHa08-000780). **B**. Hypandrium and epandrium, lateral view. Inner median flange of hypandrium coloured in red. **C**. Epandrium, dorsal view. Surstylus coloured in blue and post-anal hood in red. Scale bar = 0.5 mm.

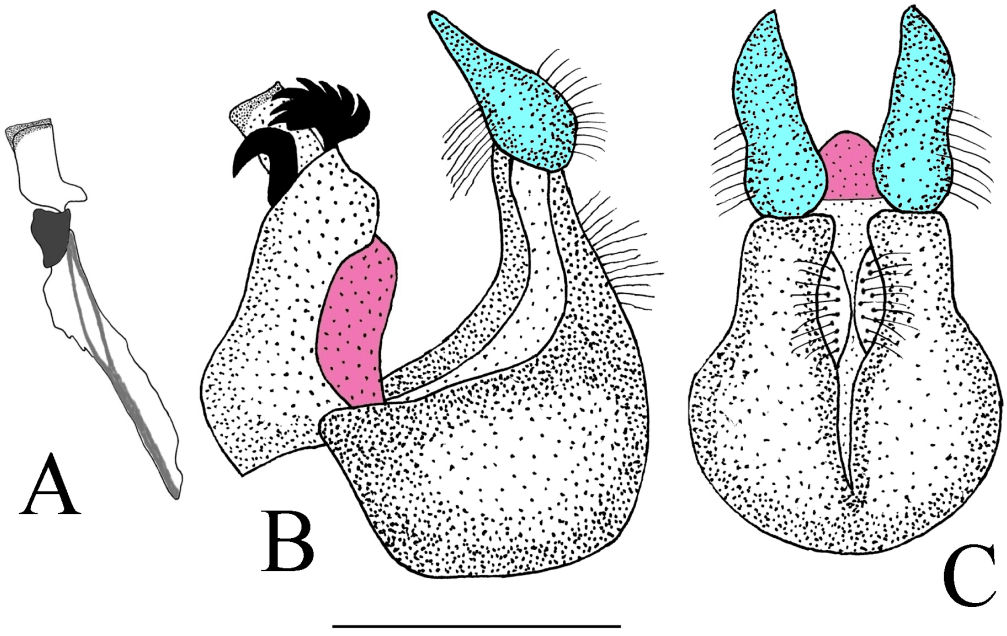

Fig. 10. *Pipizella viduata* (Linnaeus, 1758), ♂, genitalia. **A**. (AHa24-001295), Finland. Aedeagus. **B–C**. (AHa24-001291), Finland. **B**. Hypandrium and epandrium, lateral view. Inner median flange of hypandrium coloured in red. **C**. Epandrium, dorsal view. Surstylus coloured in blue and post-anal hood in red. Scale bar = 0.5 mm.

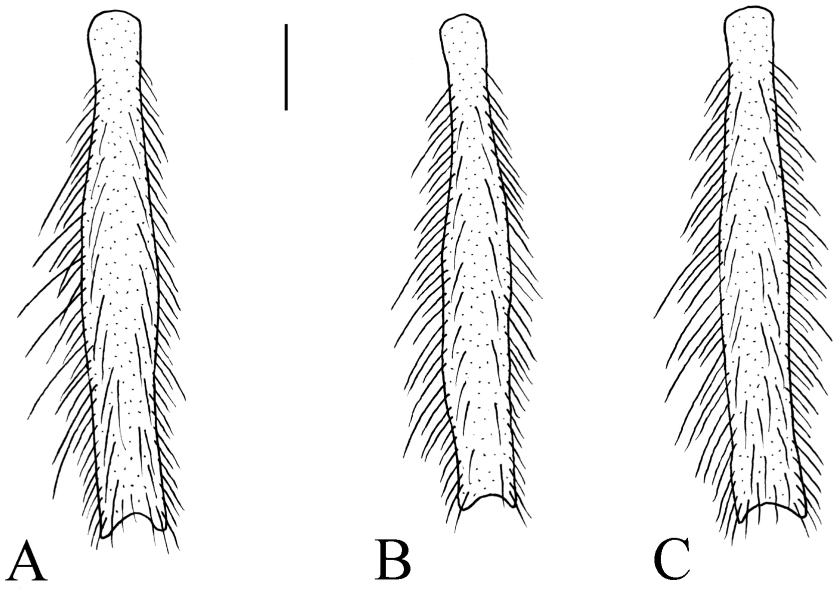

Fig. 11. The female left leg hind tibia, dorsal view, Finland **A**. *Pipizella certa* Violovitsh, 1981 (AHa23-000414). **B**. *Pipizella obscura* van Steenis & Lucas, 2011 (AHa19-000709). **C**. *Pipizella viduata* (Linnaeus, 1758), (AHa24-001293). Scale bar = 0.2 mm.

Fig. 12. Tibia and tarsus of the right front leg, ♀, Finland **A**. *Pipizella certa* Violovitsh, 1981 (AHa23-000414). **B**. *Pipizella obscura* van Steenis & Lucas, 2011 (AHa19-000709). **C**. *Pipizella viduata* (Linnaeus, 1758) (AHa24-001292).

distributed teeth in both *P. obscura* and *P. viduata*. We found that the shape of the upper gonocercus is variable in both species (Figs 8–10) and is thus not diagnostic.

The usefulness of the indicated morphological characters for the separation of *Pipizella certa* and *P. viduata* is limited because the characters are variable and overlapping between the species, and the number of specimens studies is small. The COI barcodes showed that *P. certa* consistently differs from *P. viduata* at six nucleotides sites, and the barcode sequence comparisons is a consistent tool for separation of this pair of species (Supp. file 1).

The COI barcodes produced for this study were diagnostic for each species and can be applied as an additional tool to verify the morphological hypothesis, but the amount of nucleotide differences between some species was very low. In summary, the barcode sequences of *Pipizella certa* showed six consistent and unique nucleotide differences compared to *P. viduata*, and those of *P. obscura* showed two

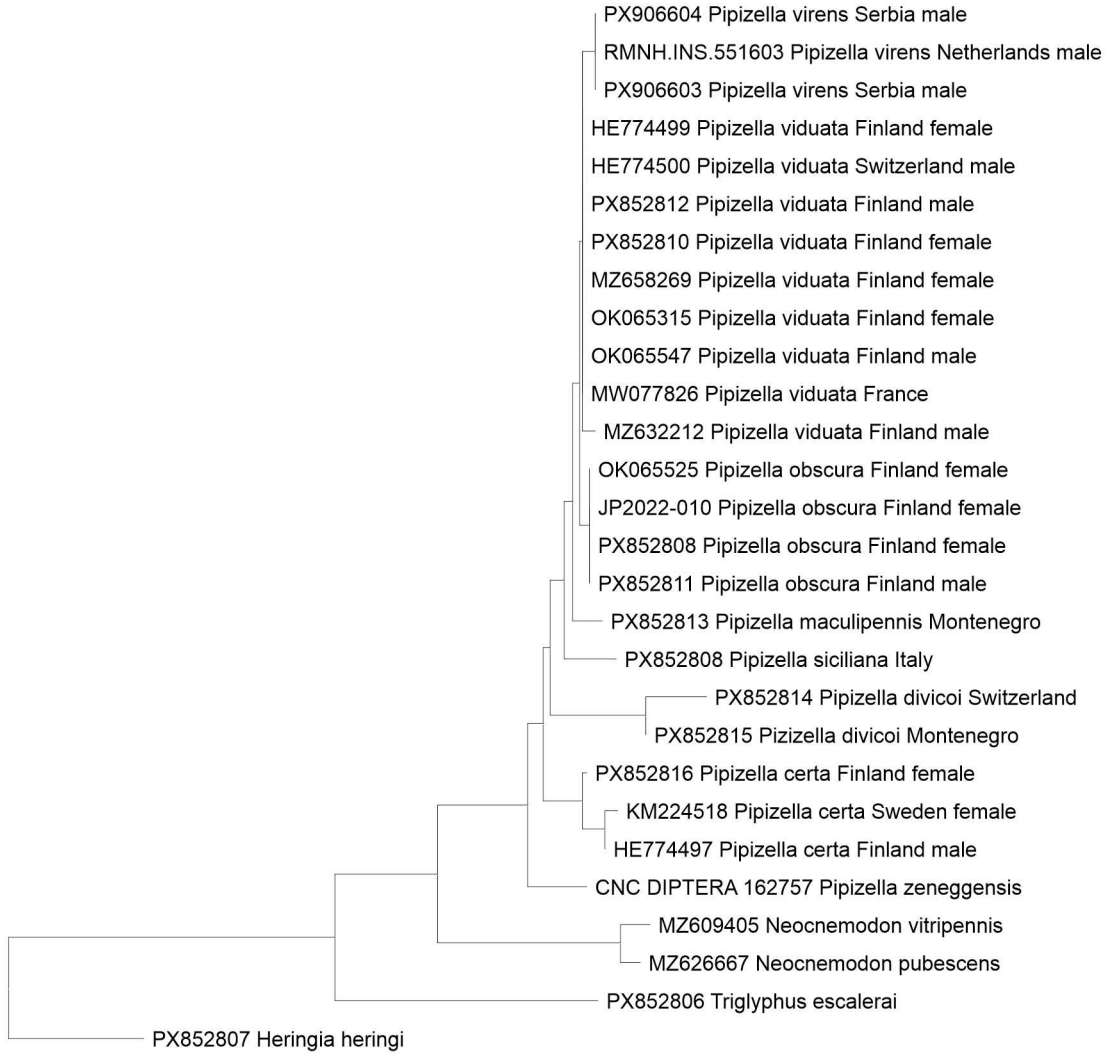

Fig. 13. Neighbor-Joining tree under K2P model for clustering of DNA barcode sequences of included *Pipizella* spp., the tree is rooted on *Heringia heringi*.

consistent and unique differences from *P. viduata*, whereas in the present data the barcode comparison of *P. virens* and *P. viduata* shows that the species can be differentiated using the nucleotide difference at only one nucleotide site (Supp. file 1). The observed low level of comparative sequence variability in the applied COI barcode between these species pairs is not reflected in the morphology, as the species can be separated using diagnostic (albeit sometimes subtle) morphological characteristics in both the males and the females. Additional COI barcodes most be produced for these taxa across Europe to verify these findings, and to document the level of sequence divergences, and to possibly apply nuclear genetic markers like the nuclear Second Internal Transcribed Spacer region as an additional tool for species identification.

Distribution in Finland

Pipizella certa appears to be a rare species in Finland, only 18 specimens collected in the period of 1965–2023 are hitherto known. Among the studied specimens, the identification of the males in collections was correct, but part of the females turned out to belong to the *P. viduata* taxon. The distribution of *Pipizella certa* seems to be southern Finland (Fig. 14A). [In GBIF (2025) a specimen with coordinates [65.0 N; 25.7 E] was noticed to be *P. viduata*.]

Pipizella obscura was noticed to be problematic to identify. Males in collections had earlier been identified as *P. viduata* as the drawing of the surstylus in the original description of *P. obscura* (van Steenis & Lucas 2011) was done using an atypical specimen. Additionally, the female of *P. obscura* was not known. Based on our results, it appears that this rare species is more common in Finland than hitherto known, but it is possible that it does not occur in the coastal regions (Fig. 14B).

Pipzella viduata is a common and widespread species in Finland, as in other parts of Northern Europe, and the species is widely distributed in the West Palaearctic area. However, it seems to be less common in northern Finland than previously estimated based on data summarized for approximately 1200 specimens (Fig. 14C, the abundant records for central and southern Finland are summarized in a pale blue colour, single observations from northern Finland indicated with dots).

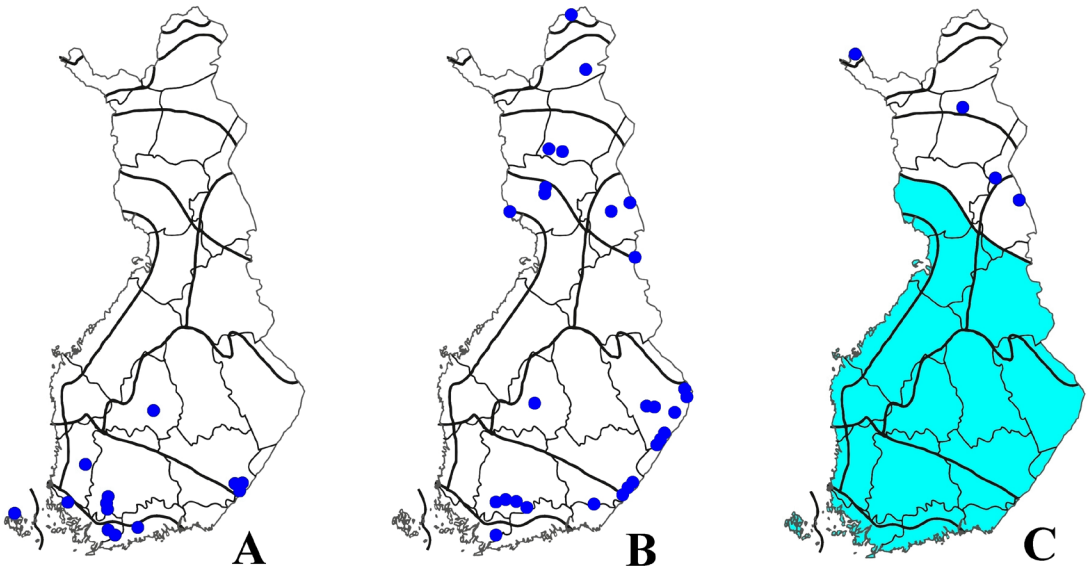

Fig. 14. Distribution maps for Finnish *Pipizella* species. **A**. *Pipizella certa* Violovitsh, 1981. **B**. *Pipizella obscura* van Steenis & Lucas, 2011. **C**. *Pipizella viduata* (Linnaeus, 1758).

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Supp. file 1. *Pipizella*_COI_nucleotides_interleaved.
https://doi.org/10.5852/ejt.2026.1066.3290.14503

Supp. file 2. *Pipizella* spp. measurements. Abdomen, frons and postpedicel.
https://doi.org/10.5852/ejt.2026.1066.3290.14504