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Belgian Journal of Entomology

***Drapetis bruscellensis* (Diptera: Hybotidae) a new species for
science from the outskirts of Brussels, a not so cryptic species
supported by COI barcoding**

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Published : Brussels, May 23, 2016

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ISSN : 1374-5514 (Print Edition)
ISSN : 2295-0214 (Online Edition)



Le Belgian Journal of Entomology est édité par la Société royale belge d'Entomologie, association sans but lucratif, fondée le 9 avril 1855.

Siège social : rue Vautier 29, B-1000 Bruxelles

De Belgian Journal of Entomology is uitgegeven door de Koninklijke Belgische Vereniging voor Entomologie, vereniging zonder winstoogmerk, opgericht op 9 april 1855.

Sociale zetel : Vautierstraat 29, B-1000 Brussel

Les publications de la Société sont financées avec le concours de la Fondation Universitaire de Belgique

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Abstract

Drapetis bruscellensis sp. nov. is described from the botanical garden Jean Massart situated at the border of the Sonian forest in Brussels. Its identity has been confirmed both morphologically and genetically by the study of the closely related species *D. pusilla* Loew, 1859 and *D. parilis* Collin, 1926. The terminalia of all three species have been illustrated and COI barcodes are provided for five of the eight species known from Belgium: *D. assimilis* Fallén 1815, *D. bruscellensis* sp. nov., *D. exilis* Meigen, 1822, *D. parilis* and *D. pusilla*. In addition the male terminalia from *D. subparilis* Raffone, 2013 recently described from Tuscany (Italy) are illustrated as well. It is shown that *D. subparilis* is not closely related to the above mentioned species.

Keywords: *Drapetis*, new species, Belgium

Introduction

The genus *Drapetis* Meigen, 1822 (or subgenus by authors) includes small, shining black, morphologically quite uniform species, which can be mostly found dwelling on tree trunks and leaves. They are rarely found by sweep netting but are rather common in Malaise trap samples. Currently, 24 species of *Drapetis* have been described from the Palaearctic Region.

Only seven *Drapetis* species were hitherto known from Belgium which is merely due to the fact that no recent revision of the complete Palaearctic fauna is available to identify our fauna so that cryptic species remain hidden. KOVALEV (1972) published the most comprehensive key to *Drapetis* including 13 species. However, it covers only the European part of Russia and bordering territories. CHVÁLA's key in the series Fauna Scandinavica is limited to 9 species (CHVÁLA, 1975). Recently, RAFFONE (2013) described three new species from Tuscany in Italy adapting the latest key provided in GROOTAERT *et al.* (2010).

Drapetis is a genus in the family Hybotidae that still gives problems in identification and a number of new species for science is expected to occur in that genus (Stark, unpubl.) and in fact a revision of the whole genus in Europe and North Africa is needed. Unfortunately this is a very tedious work that needs examination of the types of a large number of species actually put in synonymy. Moreover, the types are spread over many collections in Europe and often only the female was described. Maybe it is more relevant to describe and illustrate species that do not fit to the actually revised species and later on study the old type material. It is also recommended to barcode fresh specimens and see whether genetic differences are congruent

with morpho-species. In the near future new techniques might become available to barcode old museum specimens (types) without destruction.

In the present paper we describe *Drapetis bruscellensis* a new species for science and compare it with related species that were found sympatric. COI barcodes are provided for five species. The new species is quite distinct and characters supposed to be variable are less variable than supposed and hence the species is not so cryptic after all.

Material and methods

The new species was collected in the botanical garden: “Jardin botanique Jean Massart” that is situated on the outskirts of the city of Brussels in the suburb town of Auderghem at the border of the Sonian forest. The garden is located in a valley and is surrounded by habitations in the West, a motorway in the South, a small lake borders it in the North and the East side opens towards the Sonian forest (Fig. 1). The garden, also a Natura 2000 site, is nearly 5 ha, and was created in 1922 by Jean Massart, a botanist and ecologist “avant la letter”. It contains several areas and thematic collections such as medicinal and aromatic plants, a collection of cultivated plants, an orchard, an arboretum, an evolutionary garden, a wetland and experimental parcels for the students of the Université libre de Bruxelles (ULB). It is now managed by the “Brussels Environment“ (BIM, IBGE).

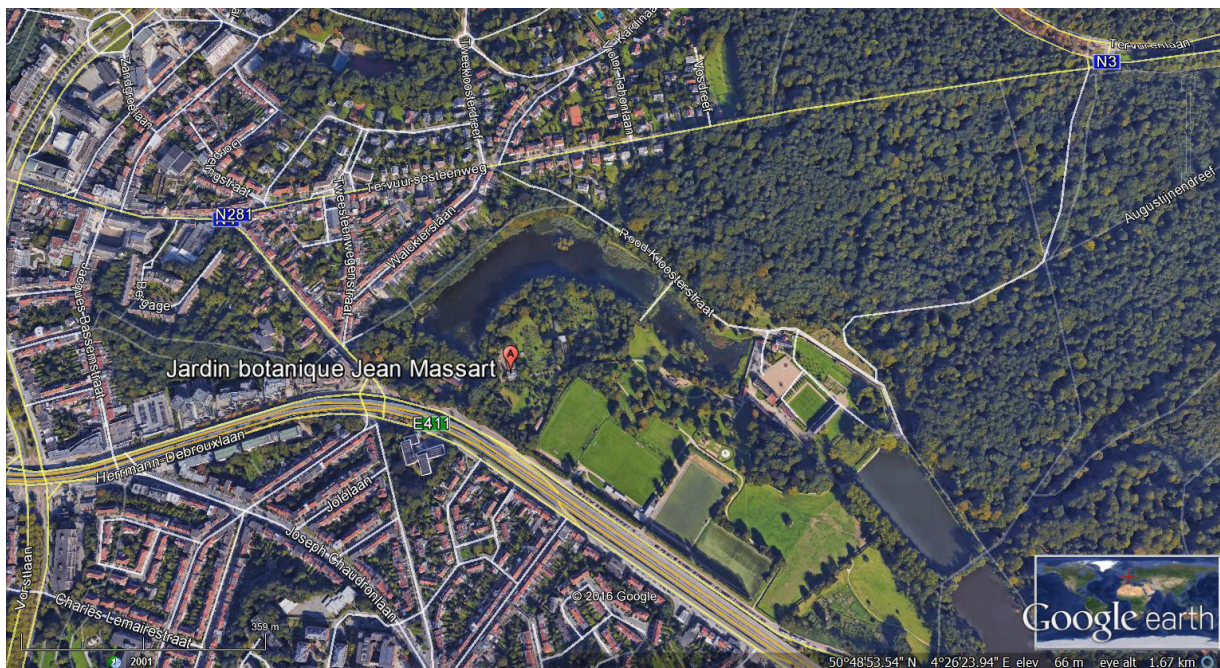


Fig. 1. Location of the Jardin botanique Jean Massart at the outskirts of Brussels (Google Earth).

Two Malaise traps operated from 7 May 2015 till 31 December 2015. Samples were weekly retrieved and all material is preserved in 70% ethanol. All specimens including the DNA extracted individuals are conserved in the collections of the Royal Belgian Institute of Natural Sciences, Brussels.

COI barcoding was done on all *Drapetis* species found in the samples according to the technique described in NAGY *et al.* (2013). The extracted specimens are conserved in box Entomo 010 and each specimen is kept in a separated tube marked with a barcode as e.g. AB42571650. The barcodes are given in Appendix 1.

Abbreviations: dfrel: dorsal fork of right epandrial lamella; lc: left cercus; lel: left epandrial lamella; ls1: left surstylus 1; ls2: left surstylus 2; rc: right cercus; rel: right epandrial lamella; vfre: ventral fork of right epandrial lamella.

Taxonomic account

Drapetis brusc cellensis sp. nov.

Figs 2-8

TYPE MATERIAL. Holotype ♂, BELGIUM, Auderghem, Jardin botanique Jean Massart, 1-8.VII.2015 (Malaise trap 2; leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS).

Paratypes: 4♂, Auderghem, Jardin botanique Jean Massart, 1-8.VII.2015 (Malaise trap 2; leg. A. Drumont, H. Raemdonck, A. Pauly; RBINS); 1♂, 15-22.VII.2015 (Malaise trap 2; leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS).

ETYMOLOGY. The specific epithet refers to the city of Brussels known for the many parks and the famous old Sonian forest at its eastern border where the Jardin botanique Jean Massart is situated, type locality of the new species.

DIAGNOSIS. Haltere white. Scape black, pedicel contrastingly orange brown, with ventral bristles longer than half the length of pedicel. Postpedicel dark brown. No pale upturned bristle on prothoracic episterna. Wing clear, veins pale brown, tip of R₁ and costa between R₁ and R₂₊₃ darker; R₄₊₅ slightly undulating tip turning up when reaching costa. Distance between cross veins r-m and m-m slightly shorter than half the length of basal portion of vein M₁₊₂ (upper cross vein beyond the middle of the second basal cell). Cerci thin rod-like, equally long with apices connected with a sclerotized bridge.

Male (Fig. 2)

Body length: 2.0 mm; wing 1.8 mm.

Head. Black in ground-colour. Frons narrower than scape, dusted; face narrower than frons, almost linear. All hairs and bristles on head brownish. Anterior ocellar bristles a little longer than postpedicel, crossing; median ocellars nearly as long, diverging; a few tiny posterior ocellars. A pair of long vertical bristles, at outside 2 shorter brown bristles. Occiput densely set with short bristles, becoming longer below. Antenna (Figs 2-3) with black scape, reddish brown pedicel and brown postpedicel; scape short, ring like; pedicel with a circlet of short brownish hairs that are ventrally longer than half the length of the pedicel; postpedicel 1.5 times as long as wide, triangular, with a long black apical stylus which is about 2.5 times as long as all antennal segments combined. Palpus short, elongate ellipsoid, brown in ground-colour, with a pale subterminal bristle. Proboscis brown.

Thorax mostly shining black, except for prothoracic episterna, upper part of mesopleuron, pteropleuron and metapleuron that are somewhat dusted and bear hairs; especially mesopleuron is densely set with short hairs. No turned up bristle on prothoracic episterna.

Mesonotum densely set with rather short yellowish hairs; acrostichals not distinct from other hairs except for a single pair anteriorly; a pair of brown prescutellar dorsocentrals, 3-4 distinct brown notopleurals, 2 pairs of scutellars with a pair of long brown apicals crossing; lateral scutellars shorter.

Legs yellow including fore and mid coxae but hind coxae brown. Mid femur ventrally with a brownish streak. Hind femur with a broad brown ring in middle. All tarsi dusky yellowish. Legs short haired only with few distinct bristles.



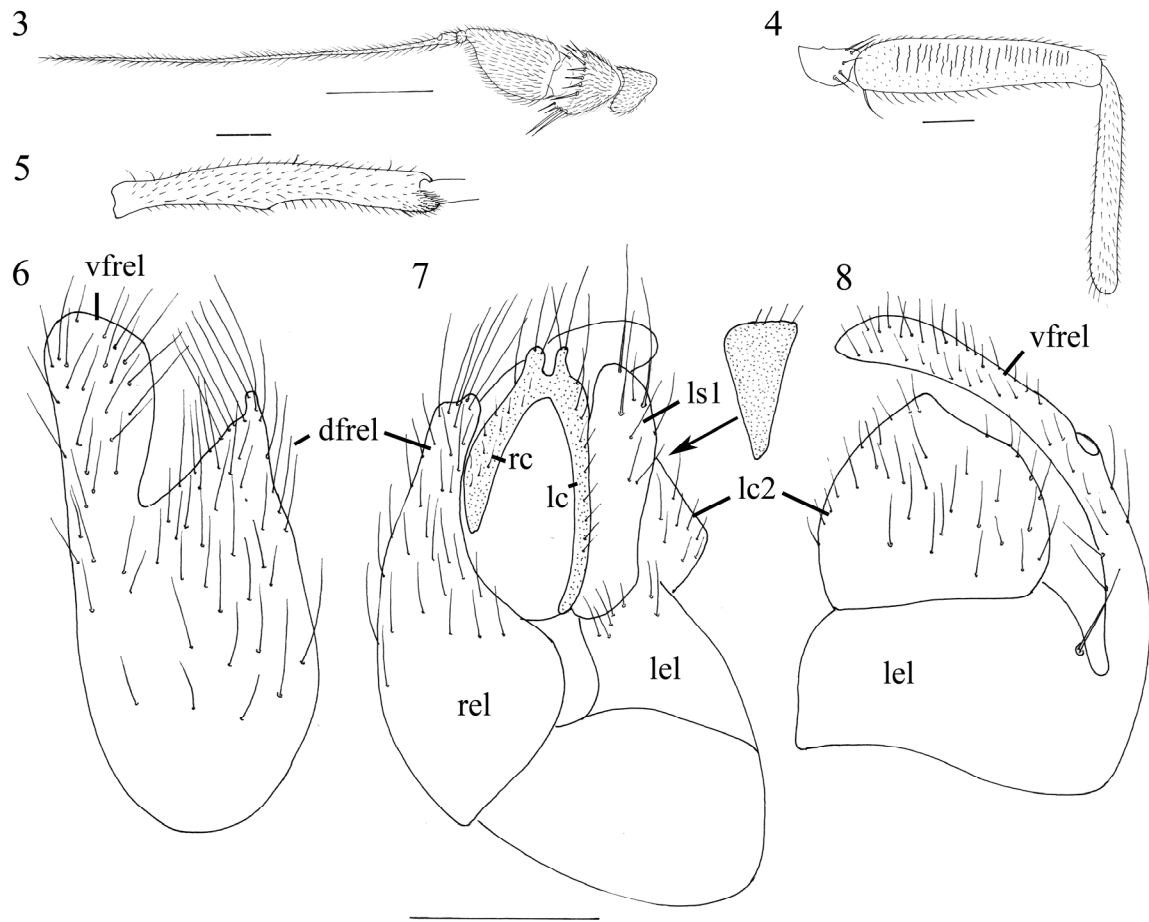
Fig. 2. *Drapetis bruscellensis* sp. nov. male habitus (photo Camille Locatelli).

Fore coxa set with short yellowish bristles; mid coxae with the exterior apical border black, anteriorly with long yellow apical bristles. Tip of hind coxa on inner side with a short tooth-like projection.

Fore femur thickened in middle with inconspicuous bristles. Mid femur narrower than fore femur, a short pale basal ventral bristle; washboard-like ribs on anterodorsal surface present (Fig. 4). Hind femur a little wider and much longer than mid femur, arched dorsoventrally, with a short pale anterior preapical, dorsally at base with about 4 not very long erect bristles, ventrally with only short inconspicuous hairs.

Fore tibia a little shorter than fore femur and half as wide as fore femur, with short pale apical bristles. Mid tibia shorter than mid femur. Hind tibia with a weakly pronounced anterior apical tooth and an elongated central posterior concavity that extends for about a third of the tibia length. The concavity is best seen when the tibia is viewed dorsally (Fig. 5). The surface of the concavity is pale brownish in contrast to the yellow tibia. Hind tarsomere 1 not thickened and nearly as long as the following tarsomeres together.

Wing (Fig. 2) hyaline, with pale brown veins. Only tip of vein R_1 and the section of the costa between R_1 and R_{2+3} seamed brownish. Vein R_{2+3} not distinctly bending up as usual, and reaching the costa in a wide angle; veins R_{4+5} and M_{1+2} gently diverging over their whole length and ending wide apart in costa, R_{4+5} with only a weak undulation and with a gently



Figs 3-8. *Drapetis bruscancellensis* sp. nov. male: 3. Antenna; 4. Mid femur and tibia anteriorly; 5. Hind tibia dorsal view; 6. Right epandrial lamella; 7. Epandrium dorsally with detail of sclerite behind ls1; 8. Left surstyli. Scale 0.1 mm.

upward flexion before reaching costa. Apical section of M_{1+2} with a weak undulation in basal third where the vein is weakly sclerotized. Upper crossvein (r-m) faintly sclerotized and ending much beyond middle in basal portion of vein M_{1+2} . Anal vein not present. Squama brown with numerous long pale hairs. Haltere completely white.

Abdomen shining black, but tergite 4 dull at sides. All hairs and bristles short, pale. Tergite 1 not sclerotized except for some lateral brown markings; tergite 4 long, black; tergite 5 short (Fig. 2). Sternite 1 very short, but normally sclerotized; sternite 2 complete, rectangular, basally swollen with a dark central dot; sternite 3 apically concave; sternite 4 divided into two lateral, half-moon shaped sclerites; sternites 5, 6 and 7 complete, rectangular. Sternites 5 and 6 with a basal non-sclerotized spot.

Male terminalia (Figs 6-8) short, dark brown. Right and left cercus equally long, brown, rod-like enveloping the epiproct and connected to each other by a small bridge just below apex (Fig. 7). Left surstylus 1 almost as long as cerci with a long apical and several long subapical bristles. Surstylus 2 oval, a little pointed at apex (Fig. 8). Right epandrial lamella forked; dorsal apex pointed and densely set with long hair-like bristles (Fig. 6, dfrel).

Female. Unknown.

REMARKS. There is a high variability in the colouration of the legs. The hind femora are generally partly brown, but all femora can be entirely brown. The halteres are always white, at most dusky, but never black as in *D. parilis*, *D. pusilla* or *D. exilis*.

The cerci in *D. pusilla* are similar to those of *D. bruscellensis* sp. nov. in that they are rod-like and equally long. However there is no sclerotized connection between the apices of the cerci in *D. pusilla* (Fig. 13). The left surstylus 1 (ls1) is much shorter, black with a thick apical bristle (Figs 13-14). Surstylus 2 (ls2) is very large (Fig. 14) and unique in *D. pusilla* is also the row of bristles along the apical border of the left epandrial lamella.

In the preliminary key to the western European *Drapetis* species (GROOTAERT *et al.*, 2010), *D. bruscellensis* sp. nov. runs to couplet 7 being a species with the cross veins r-m (upper cross vein) and m-m (lower cross vein) close together or in other words with the upper cross vein beyond the middle of the second basal cell.

Couplet 7 should be:

Species with white halteres *D. bruscellensis* sp. nov.
Species with black (darkened) halteres all the other species under couplet 7

***Drapetis assimilis* Fallén, 1815**

Drapetis assimilis Fallén, 1815: 8, 34.

MATERIAL EXAMINED. 1♂ (AB42571633), Auderghem, Jardin botanique Jean Massart, 27.VIII-4.IX.2015 (Malaise trap 2, leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS); 1♂ (AB42571650), dissected, not figured), Auderghem, Jardin botanique Jean Massart, 26.VI-1.VII.2015 (Malaise trap 2, leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS).

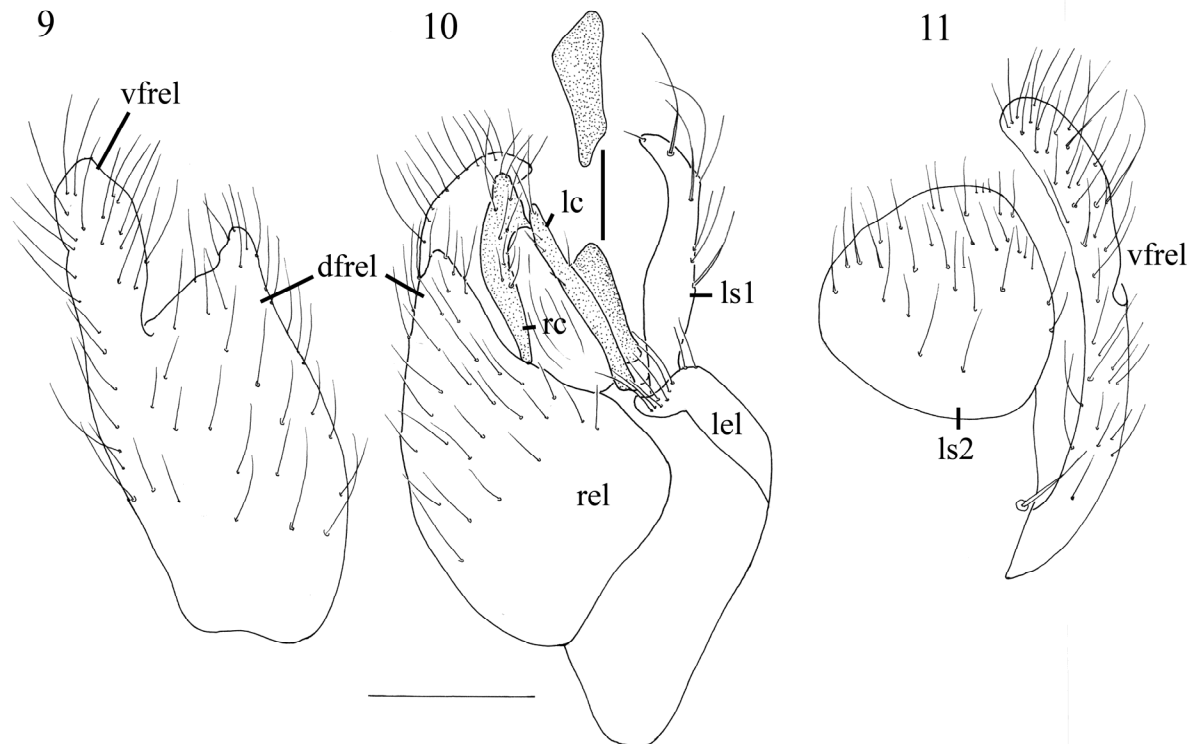
REMARKS. The male terminalia of the specimens examined here correspond entirely to the drawing given by COLLIN (1961: Fig. 12a) and are therefore not re-drawn here.

***Drapetis exilis* Meigen, 1822**

Drapetis exilis Meigen, 1822: 91.

MATERIAL EXAMINED. 1♂ (AB42571639), Auderghem, Jardin botanique Jean Massart, 15-22.VII.2015 (Malaise trap 2; leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS); 1♂ (AB42571621), Auderghem, Jardin botanique Jean Massart, 1-8.VII.2015 (Malaise trap 2; leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS).

REMARKS. The male terminalia of the specimens examined here correspond entirely to the drawing given by Collin (1961: Fig. 14a) in that the spatulate tip of the forked right epandrial lamella is not so broad as in *D. infitialis* Collin. In addition the right cercus is longer than the left cercus but not so long and slender as the right cercus in *D. infitialis* (COLLIN, 1961: Fig. 14b).



Figs 9-11. *Drapetis parilis* Collin: 9. Right epandrial lamella; 10. Epandrium with cerci dorsally and detail of left surstylus 3; 11. Left surstylus 2 (ls2) and ventral fork of the right epandrial lamella (vfrel). Scale 0.1 mm.

***Drapetis parilis* Collin, 1926**

Figs 9-11

Drapetis parilis Collin, 1926: 146.

MATERIAL EXAMINED: 1♂ (AB42571640), Auderghem, Jardin botanique Jean Massart, 4-10.VI.2015, (Malaise trap 2, leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS); 3♂ (respectively: AB42571634, AB42571628, AB42571616), 1♀ (AB42571622), Auderghem, Jardin botanique Jean Massart, 1-8.VII.2015 (Malaise trap 2; leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS).

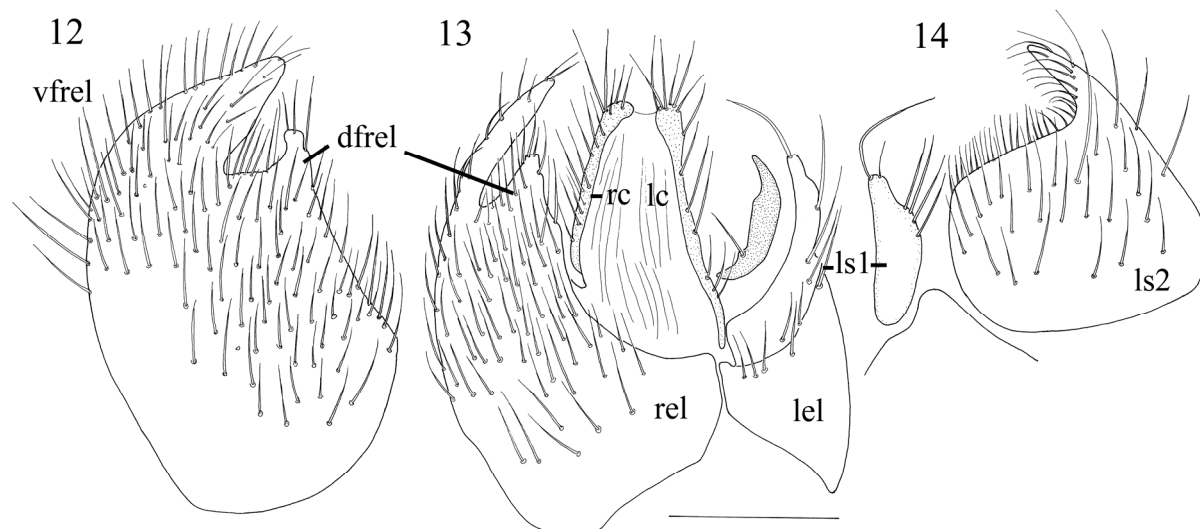
REMARKS. The left cercus is distinctly shorter than the right cercus (Fig. 10) and the left surstylus 1 is longer than the cerci. In *D. bruscellensis* sp. nov. the cerci are equally long and the left surstylus 1 is a little shorter than the cerci. The bristling on the outer side of the dorsal fork of the right epandrial lamella is not so dense and long in *D. parilis* as is in *D. bruscellensis* sp. nov.

***Drapetis pusilla* Loew, 1859**

Figs 12-14

Drapetis pusilla Loew, 1859: 42 (female).

MATERIAL EXAMINED: 1♂ (AB42571609, genitalia figured), Auderghem, Jardin botanique Jean Massart, 26.VI-1.VII.2015 (Malaise trap 2, leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS); 1♂ (AB42571610), Auderghem, Jardin botanique Jean Massart, 1-8.VII.2015 (Malaise trap 2, leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS); 1♀ (AB42571627), Auderghem, Jardin botanique Jean Massart, 27.VIII-4.IX.2015, (Malaise trap 2, leg. A. Drumont, H. Raemdonck, A. Pauly; I.G.: 33.004, RBINS)



Figs 12-14. *Drapetis pusilla* Loew male 12. Right epandrial lamella; 13. Epandrium with cerci dorsally; 14. Left surstyli. Scale 0.1 mm.

REMARKS. The male genitalia of the specimens examined here (Figs 12-14) correspond entirely to the drawing given by COLLIN (1961: Fig. 15a). However, as can be seen in Fig. 13 the apical connection between the right and left cercus is membranous and not sclerotized as in *D. bruscellensis* sp. nov. (Fig. 4).

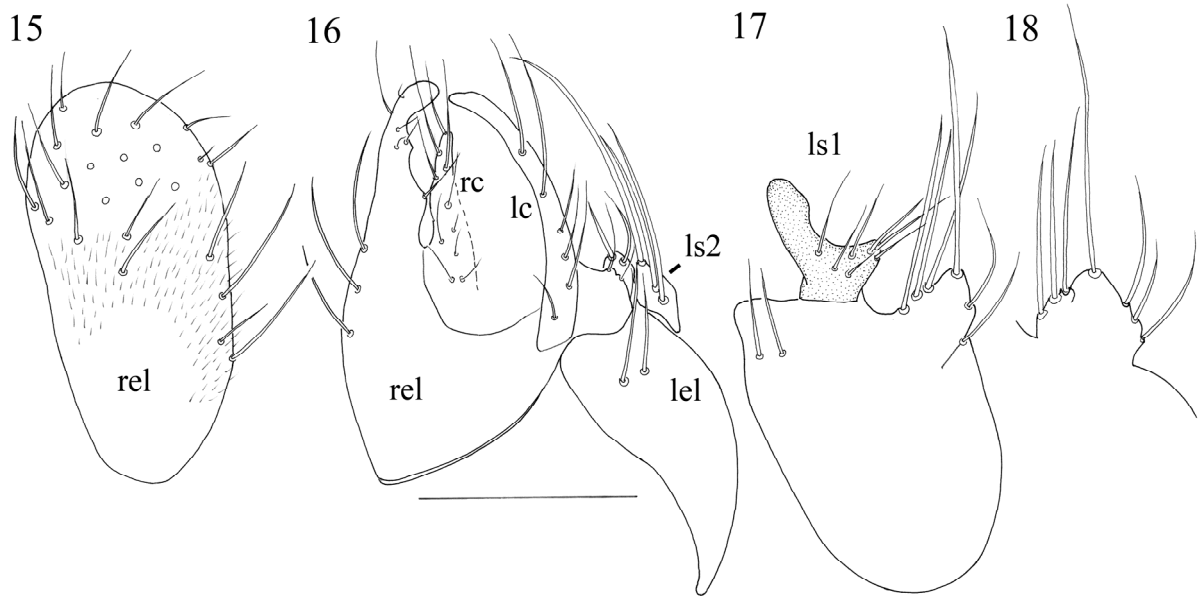
Drapetis subparilis Raffone, 2013

Figs 15-18

Drapetis subparilis Raffone, 2013: 49 (Fig. 5).

MATERIAL EXAMINED. Holotype ♂: ITALY: Toscana, Grosseto, Lago di Burano, 7.VI.1983 (Phragmitetum) leg. Munari (coll. Museo Civico di Storia Naturale di Venezia).

REMARKS. The male terminalia of the holotype were re-examined and re-drawn in detail (Figs 15-18). Although the species received the name *subparilis* the male terminalia do not resemble at all the terminalia of *D. parilis*, *D. bruscellensis*, *D. exilis* nor *D. pusilla* in that the second lobe of the left surstylus is not a large lamella (cf. Figs 8, 11, 14). Instead the left surstylus is composed of two small tubercles both bearing strong bristles. The second lobe bears 4 strong bristles and one bristle is even longer than the left cercus (Fig. 16). The right epandrial lamella is not forked like in the others. The right cercus is weakly sclerotized and shorter than the left cercus (Fig. 16). The left epandrial lamella bears 2 distinct bristles in the dorsal apical corner.



Figs 15-18. *Drapetis subparilis* Raffone 15. Right epandrial lamella; 16. Epandrium with cerci dorsally; 17. Left surstyli; 18. Detail surstylus 2. Scale 0.1 mm.

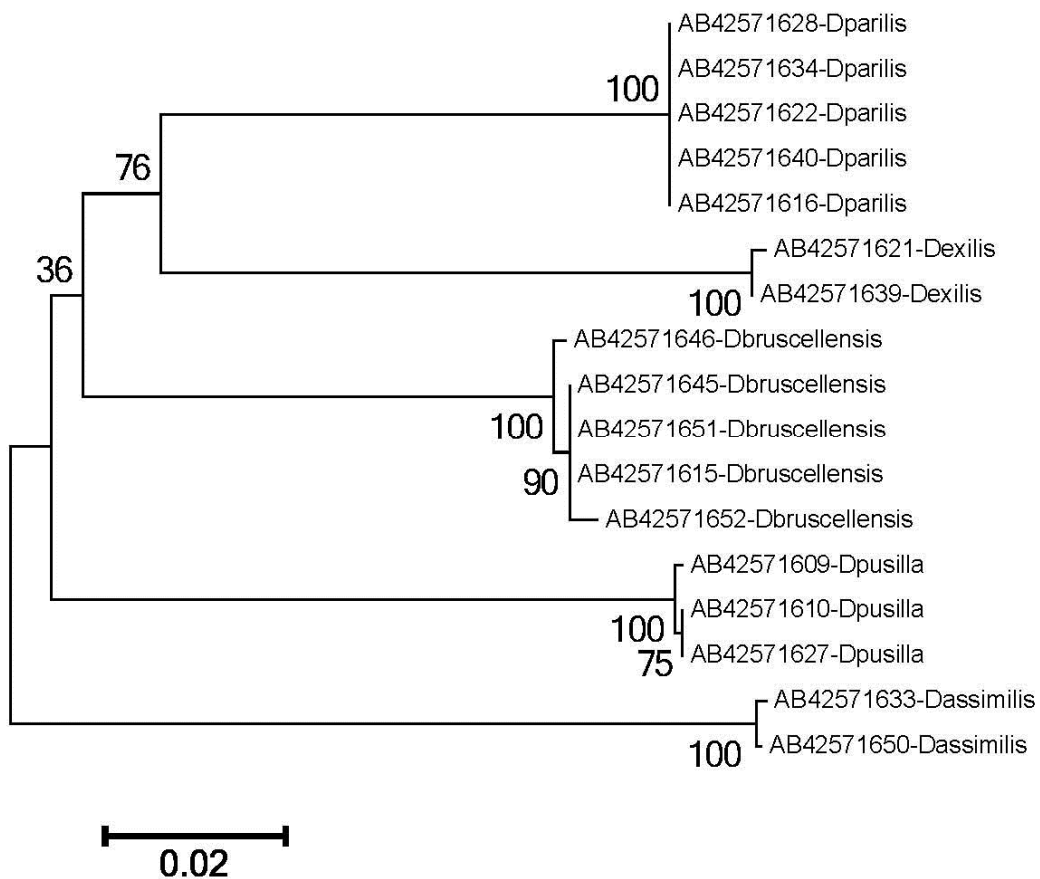


Fig. 19. Neighbour-joining tree of five *Drapetis* species found in the Jardin botanique Jean Massart in Brussels.

General discussion

As can be seen in Table 1 the pairwise distances of the COI gene of *D. bruscellensis* sp. nov. with the related species are quite large: with *D. parilis* between 10.9 – 12.2%, with *D. exilis* 12.9 – 13.2%, with *D. pusilla* 12.6 – 12.9% and with *D. assimilis* 14.6 – 14.9%. Fig. 19 is a Neighbour-joining tree showing that the relationships between the species are not supported by bootstrap values. More conservative genes are needed to show deeper relationships.

Table 1. Pairwise distances of the COI barcodes of 5 species of *Drapetis*.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 AB42571616-Dparilis | | | | | | | | | | | | | | | | |
| 2 AB42571640-Dparilis | 0.000 | | | | | | | | | | | | | | | |
| 3 AB42571622-Dparilis | 0.000 | 0.000 | | | | | | | | | | | | | | |
| 4 AB42571628-Dparilis | 0.000 | 0.000 | 0.000 | | | | | | | | | | | | | |
| 5 AB42571634-Dparilis | 0.000 | 0.000 | 0.000 | 0.000 | | | | | | | | | | | | |
| 6 AB42571645-Dbruscellensis | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | | | | | | | | | | | |
| 7 AB42571651-Dbruscellensis | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.000 | | | | | | | | | | |
| 8 AB42571615-Dbruscellensis | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.000 | 0.000 | | | | | | | | | |
| 9 AB42571646-Dbruscellensis | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.003 | 0.003 | 0.003 | | | | | | | | |
| 10 AB42571652-Dbruscellensis | 0.122 | 0.122 | 0.122 | 0.122 | 0.122 | 0.003 | 0.003 | 0.003 | 0.006 | | | | | | | |
| 11 AB42571621-Dexilis | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.129 | 0.129 | 0.129 | 0.129 | 0.132 | | | | | | |
| 12 AB42571639-Dexilis | 0.122 | 0.122 | 0.122 | 0.122 | 0.122 | 0.128 | 0.128 | 0.128 | 0.128 | 0.131 | 0.002 | | | | | |
| 13 AB42571610-Dpusilla | 0.146 | 0.146 | 0.146 | 0.146 | 0.146 | 0.126 | 0.126 | 0.126 | 0.126 | 0.129 | 0.149 | 0.147 | | | | |
| 14 AB42571627-Dpusilla | 0.146 | 0.146 | 0.146 | 0.146 | 0.146 | 0.126 | 0.126 | 0.126 | 0.126 | 0.129 | 0.149 | 0.147 | 0.000 | | | |
| 15 AB42571609-Dpusilla | 0.146 | 0.146 | 0.146 | 0.146 | 0.146 | 0.126 | 0.126 | 0.126 | 0.126 | 0.129 | 0.149 | 0.147 | 0.002 | 0.002 | | |
| 16 AB42571633-Dassimilis | 0.149 | 0.149 | 0.149 | 0.149 | 0.149 | 0.146 | 0.146 | 0.146 | 0.144 | 0.149 | 0.166 | 0.164 | 0.158 | 0.158 | 0.158 | |
| 17 AB42571650-Dassimilis | 0.147 | 0.147 | 0.147 | 0.147 | 0.147 | 0.146 | 0.146 | 0.146 | 0.144 | 0.149 | 0.167 | 0.166 | 0.157 | 0.157 | 0.157 | 0.002 |

Acknowledgements

The present paper is an output of the project “Objectif 1000”. This project deals with an inventory of the insects of the Jardin botanique Jean Massart sponsored by the Brussels Institute for the Environment (now called Brussels Environment). Therefore we thank especially Mrs Céline Fremault, Brussels Minister for the Environment, Mr Olivier Beck (project manager) and Mr Guy Rotsaert (permits) for their encouragement in obtaining the project. Mr Alain Drumont, Mr Hugo Raemdonck and Mr Alain Pauly (RBINS) did the weekly collecting. The enthusiastic and very helpful staff of the Jardin botanique Jean Massart, especially Mr Thierry Bruffaerts, is much appreciated. We are very grateful to Mr Gontran Sonet (JEMU, RBINS) who did the barcoding of the specimens. We also thank Ms Camille Locatelli for the stacked colour photo. Dr Marco Uliana was so kind to send the holotype of *D. subparilis* for examination. Finally Dr Isabella Van de Velde made numerous suggestions on the manuscript.

References

- CHVÁLA M., 1975. - *The Tachydromiinae (Dipt. Empididae) of Fennoscandia and Denmark*. Fauna entomologica scandinavica 3: 336 pp.
- COLLIN J.E., 1961. - *British Flies 6. Empididae*, 782 pp. Cambridge.
- GROOTAERT P., SHAMSHEV I. & STARK A., 2010. - *Drapetis flavipes* Macquart (Diptera, Hybotidae) new for the Belgian fauna, with a re-description of the species and a preliminary key to the West-European species of *Drapetis*. *Bulletin S.R.B.E./K.B.V.E.*, 146: 110-115.
- KOVALEV V.G. 1972. - Diptera of the genera *Drapetis* Mg. and *Crossopalpus* Bigot (Diptera, Empididae) from the European part of the USSR. *Entomologicheskoe Obozrenie*, 51, 173-196 [in Russian].
- NAGY Z.T., SONET G., MORTELMANS J., VANDEWYNKEL C. & GROOTAERT P., 2013. - Using DNA barcodes for assessing diversity in the family Hybotidae (Diptera, Empidoidea). In: NAGY Z. T., BACKELJAU T., DE MEYER M., JORDAENS K. (Eds) DNA barcoding: a practical tool for fundamental and applied biodiversity research. *ZooKeys* 365: 263–278. doi:10.3897/zookeys.365.6070
- RAFFONE G., 2013. - Description of three new species of *Drapetis* Meigen, 1822 from Tuscany (Italy), with key to species of the genus from western Europe (Insecta, Diptera, Hybotidae). *Bollettino del Museo Civico di Storia Naturale di Venezia* 64: 45-50.

Appendix 1. COI barcodes.

>AB42571633- *D. assimilis*

TACATTATATTTTTATTTTTGGGGCTTGAGCAGGAATAATCGGAACCTCTTTAAGTATACTAATTCGAACAGAACT
TGGTCACCCAGGATCATTAATTGGAGACGATCAAATTTATAATGTAATCGTCACAGCTCATGCATTTATTATAAT
TTTTTTTATAGTAATACCAATTATAATTGGAGGGTTTGGGAACTGACTAGTACCCCTAATACTAGGAGCCCCAGA
TATAGCTTTCCCCCGAATAAATAATATAAGATTTTGAATACTACCCCTCTATTACTTTACTCTTAGCAAGTAG
CATAGTAGATAGAGGAGCAGGAACAGGATGAACTGTTTACCCTCCTCTTTCATCTAATATCGCCACAGAGGTGC
ATCAGTAGATTTAGCTATTTTTTCTCTTCATTTAGCTGGAATTTCTCTATTCTAGGGGCTGTAAATTTTATTAC
AACAGTAATCAATATACGGTCTCCCGGAATTACTTTTGACCGTATACCTTTATTTGTCTGATCTGTAGTAATTAC
AGCTTTACTTCTTTTACTTTCTCTCCAGTTTTAGCTGGAGCAATTACAATATTATTAAGTACCGAAATTTAAA
TACCTCTTTTTTTGACCCAGCAGGAGGGGGTGATCCGATTCTCTACCAACACTTATTT

>AB42571650- *D. assimilis*

TACATTATATTTTTATTTTTGGGGCTTGAGCAGGAATAATCGGAACCTCTTTAAGTATACTAATTCGAACAGAACT
TGGTCACCCAGGATCATTAATTGGAGACGATCAAATTTATAATGTAATCGTCACAGCTCATGCATTTATTATAAT
TTTTTTTATAGTAATACCAATTATAATTGGAGGGTTTGGGAACTGACTAGTACCCCTAATACTAGGAGCCCCAGA
TATAGCTTTCCCCCGAATAAATAATATAAGATTTTGAATACTACCCCTCTATTACTTTACTCTTAGCAAGTAG
CATAGTAGATAGAGGAGCAGGAACAGGATGAACTGTTTACCCTCCTCTTTCATCTAATATCGCCACAGAGGTGC
ATCAGTAGATTTAGCTATTTTTTCTCTTCATTTAGCTGGAATTTCTCTATTCTAGGAGCTGTAAATTTTATTAC
AACAGTAATCAATATACGGTCTCCCGGAATTACTTTTGACCGTATACCTTTATTTGTCTGATCTGTAGTAATTAC
AGCTTTACTTCTTTTACTTTCTCTCCAGTTTTAGCTGGAGCAATTACAATATTATTAAGTACCGAAATTTAAA
TACCTCTTTTTTTGACCCAGCAGGAGGGGGTGATCCGATTCTCTACCAACACTTATTT

>AB42571646- *D. brucei*

AACATTATATTTTTATTTTTGGAGCTTGAGCAGGAATAGTTGGTACTTCACTAAGTATACTTATTCGCACAGAATT
AGGTCATCCTGGATCTCTTATTGGAGATGATCAAATTTATAATGTAATTGTTACAGCTCATGCCTTTATTATAAT
TTTTTTTATAGTAATACCTATTATAATCGGAGGATTTGGGAAATTGATTAGTACCCCTAATACTAGGAGCCCCAGA
TATAGCTTTTCCCTCGAATAAATAATATGAGTTTTTGAATATTACCTCCTTCCCTATCTCTCCTTTTAGCAAGAAG
AATAGTAGAAAGAGGAGCAGGACTGGATGAACTGTTTACCCCTCCTTCTCTGGAATTGCTCATAGAGGAGC
CTCCGTTGATTTAGCTATTTTTTCTCTTCATTTAGCTGGAATTTCTCTATTCTATTAGGTGCTGTAAATTTTATTAC
AACTGTAATTAATATGCGATCACCTGGTATTACTTTTGACCGTATGCTTTTATTTGTATGATCAGTAGTAATTAC
TGCTTTATTATTACTTCTTTTATTACCTGTTTTAGCCGGAGCAATTACAATACTTTTAACTGACCGAAATTTAAA
TACTTCCTTTTTTTGACCCCGCAGGAGGTGGAGACCTATTTTTATACCAACATTTATTC

>AB42571645- *D. brucei*

AACATTATATTTTTATTTTTGGAGCTTGAGCAGGAATGGTTGGTACTTCACTAAGTATACTTATTCGCACAGAATT
AGGTCATCCTGGATCTCTTATTGGAGATGATCAAATTTATAATGTAATTGTTACAGCTCATGCCTTTATTATAAT
TTTTTTTATAGTAATACCTATTATAATCGGAGGATTTGGGAAATTGATTAGTACCCCTAATACTAGGAGCCCCAGA
TATAGCTTTTCCCTCGAATAAATAATATGAGTTTTTGAATATTACCTCCTTCCCTATCTCTCCTTTTAGCAAGAAG
AATAGTAGAAAGAGGAGCAGGACTGGATGAACTGTTTACCCCTCCTTCTCTGGAATTGCTCATAGAGGAGC
CTCCGTTGATTTAGCTATTTTTTCTCTTCATTTAGCTGGAATTTCTCTATTCTATTAGGTGCTGTAAATTTTATTAC
AACTGTAATTAATATGCGATCACCTGGTATTACTTTTGACCGTATGCTTTTATTTGTATGATCAGTAGTAATTAC
TGCTTTATTATTACTTCTTTTATTACCTGTTTTAGCCGGAGCAATTACAATACTTTTAACTGACCGAAATTTAAA
TACTTCCTTTTTTTGACCCCGCAGGAGGTGGAGACCTATTTTTATACCAACATTTATTC

>AB42571652- *D. brucei*

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TTTTTTTATAGTAATACCTATTATAATCGGAGGATTTGGGAAATTGATTAGTACCCCTAATACTAGGAGCCCCAGA
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CTCCGTTGATTTAGCTATTTTTTCTCTTCATTTAGCTGGAATTTCTCTATTCTATTAGGTGCTGTAAATTTTATTAC
AACTGTAATTAATATGCGATCACCTGGTATTACTTTTGACCGTATGCTTTTATTTGTATGATCAGTAGTAATTAC
TGCTTTATTATTACTTCTTTTATTACCTGTTTTAGCCGGAGCAATTACAATACTTTTAACTGACCGAAATTTAAA
TACTTCCTTTTTTTGACCCCGCAGGAGGTGGAGACCTATTTTTATACCAACATTTATTC

>AB42571621- *D. exilis*

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 AGGACATCCCGGTTCCCTTAATTGGTGATGATCAAATTTATAATGTAATTGTAAGTCTCATGCTTTTATTATAAT
 TTTTTTTATAGTAATACCCATTATAATTGGAGGATTTGGAAATTTGATTAGTTCCCTCTTATATTAGGAGCTCCAGA
 CATAGCCTTCCCTCGAATAAATAATATAAGTTTTTGAATATTACCTCCCTCTTTATCTCTTCTTTTAGCAAGAAG
 TATAGTTGAAAGTGGAGCAGGAAGTGGATGAACTGTATAACCCCCACTTTCTTCAGGAATTGCTCATAGAGGAGC
 CTCTGTTGATTTAGCTATTTTTCTCTTCATTTAGCTGGAATTTTATCTATTTTTGGGGCTGTAAATTTTATTAC
 AACCGTTATTAATATACGATCTCCTGGAATTACATTTGACCGAATACCTCTTTTTGTTTGTATCTGTTGTAATCAC
 CGCTTTATTACTTCTTCTTTCTTTACCAGTATTAGCAGGTGCTATTACTATATTATTAAGTATCGAAATTTAAA
 TACATCTTTTTTTGATCCTGCAGGAGGAGGTGACCCAATTTTATATCAACATTTATTT

>AB42571639- *D. exilis*

AAC TTTATACTTCATTTTCGGAGCTTGAGCAGGAATAGTTGGAACATCCCTTAGAATATTAATTCGAACAGAATT
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 TTTTTTTATAGTAATACCCATTATAATTGGAGGATTTGGAAATTTGATTAGTTCCCTCTTATATTAGGAGCTCCAGA
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 TATAGTTGAAAGTGGAGCAGGAAGTGGATGAACTGTATAACCCCCACTTTCTTCAGGAATTGCTCATAGAGGAGC
 CTCTGTTGATTTAGCTATTTTTCTCTTCATTTAGCTGGAATTTTATCTATTTTTAGGGGCTGTAAATTTTATTAC
 AACCGTTATTAATATACGATCTCCTGGAATTACATTTGACCGAATACCTCTTTTTGTTTGTATCTGTTGTAATCAC
 CGCTTTATTACTTCTTCTTTCTTTACCAGTATTAGCAGGTGCTATTACTATATTATTAAGTATCGAAATTTAAA
 TACATCTTTTTTTGATCCTGCAGGAGGAGGTGACCCAATTTTATATCAACATTTATTT

>AB42571616- *D. parilis*

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 TTTTTTTATAGTAATACCAATTATAATCGGAGGATTTGGAAATTTGACTAGTACCCCTAATATTAGGAGCACCAGA
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 AATAGTTGAAAGAGGAGCTGGTACAGGATGAACTGTTTACCCCCACTTTCTTCTGGAATTGCTCATAGCGGAGC
 TTCTGTTGACTTAGCTATTTTTCTTTACATTTAGCAGGTATTTCCCTCCATTTTAGGAGCTGTAAATTTTATTAC
 AACTGTAATTAATATACGCTCTCCTGGAATTACTTTTGTATGATGATCTGTAGTAATTAC
 AGCTTTACTTTTACTTCTTTCTTTACCTGTATTAGCAGGAGCTATTACTATACTTTTAAACAGATCGAAATCTGAA
 TACCTCTTTTTTTGACCCTGCAGGAGGAGGTGACCCAATTTTATATCAACATCTATTT

>AB42571609- *D. pusilla*

AAC TTTATATTTTCAATTTTGGTGCTTGAGCAGGGATGGTAGGCACATCATTAAGAATACTAATTCGAACACTGAATT
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 TTTTTTTATAGTAATGCCATTATAATTGGTGATTTGGTAACTGATTAGTTCCCTTTAATACTAGGAGCCCCAGA
 TATAGCTTTCCCTCGTATAAATAATATAAGATTTTGAATACTTCCCTCTTCTATCACTTCTTTTAGCTAGAAG
 TATAGTAGAAAGAGGAGCAGGAACAGGATGAACTGTGTACCCACCTCTTCTTCCGGAATCGCTCATAGAGGGGC
 TTCTGTTGATTTAGCGATTTTTTCCCTTCATTTAGCTGGAATTTCTTCTATTTTAGGAGCTGTAAACTTTATTAC
 AACTGTAATTAATATACGAGCACCAGGTATTAATTTTGGACCGTATGCCTCTTTTTGTATGATCAGTAGTAATTAC
 AGCTTTACTTCTTTTACTTTCTCTCCCTGTCTTAGCAGGAGCAATTACTATACTTTTAAACAGATCGTAATTTAAA
 TACTTCATTTTTTTGACCCAGCAGGTGGAGGAGACCCTGTCTTATACCAACATTTATTT

>AB42571610- *D. pusilla*

AAC TTTATATTTTCAATTTTGGTGCTTGAGCAGGGATGGTAGGCACATCATTAAGAATACTAATTCGAACACTGAATT
 AGGCCACCCTGGTTCTCTTATTGGAGACGATCAAATCTATAATGTAATTGTTACAGCTCATGCTTTTGTATAAT
 TTTTTTTATAGTAATGCCATTATAATTGGTGATTTGGTAACTGATTAGTTCCCTTTAATACTAGGAGCCCCAGA
 TATAGCTTTCCCTCGTATAAATAATATAAGATTTTGAATACTTCCCTCTTCTATCACTTCTTTTAGCTAGAAG
 TATAGTAGAAAGAGGAGCAGGAACAGGATGAACTGTGTACCCACCTCTTCTTCCGGAATCGCTCATAGAGGGGC
 TTCTGTTGATTTAGCGATTTTTTCCCTTCATTTAGCTGGAATTTCTTCTATTTTAGGAGCTGTAAACTTTATTAC
 AACTGTAATTAATATACGAGCACCAGGTATTAATTTTGGACCGTATGCCTCTTTTTGTATGATCAGTAGTAATTAC
 AGCTTTACTTCTTTTACTTTCTCTCCCTGTCTTAGCAGGAGCAATTACTATACTTTTAAACAGATCGTAATTTAAA
 TACTTCATTTTTTTGACCCAGCAGGTGGAGGAGACCCTGTCTTATACCAACATTTATTT