ACTA ENTOMOLOGICA MUSEI NATIONALIS PRAGAE
Published 30.vi.2017 Volume 57(1), pp. 215–227 ISSN 0374-1036
http://zoobank.org/urn:lsid:zoobank.org:39A7C58B-162D-4DF9-9EBC-F6507445F73D
doi: 10.1515/aemnp-2017-0070

Micromorphology of egg and larva of *Eristalis fratercula*, with an updated key of *Eristalis* species with known third instar larvae (Diptera: Syrphidae)

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Abstract. The flower- or hoverflies (Syrphidae) and particularly the subfamily Eristalinae, are known by their importance as pollinators in both natural and agro-ecosystems. Similar to other saprophagous eristalines, the larvae of *Eristalis* Latreille, 1804 are characterized by an elongated anal segment and a telescopic breathing tube. These features have given them the common name of rat-tailed maggots and allow them to develop in liquid or semi-liquid media loaded with decaying organic material. This paper presents the first description of the egg and the third-instar larva of the boreal species *Eristalis fratercula* (Zetterstedt, 1838). Morphological studies are presented based on cryo-scanning electron microscopy (cryo-SEM). After comparison with all other known species of the genus *Eristalis* with described preimaginal morphology, we conclude that main diagnostic character of *E. fratercula* is the presence of long branched spicules located in the upper margin on the lateral lips. Finally, we provide an updated key that includes the 15 *Eristalis* species whose third larval stages have already been described.

Key words. Diptera, Syrphidae, *Eristalis*, hoverflies, preimaginal morphology, egg, larva, cryo-SEM, Norway, Palaearctic Region

Introduction

The hoverflies belonging to the subfamily Eristalinae are mainly known by their importance as pollinators. Drone flies (*Eristalis* spp.) mimic both honey and bumble bees in their size, shape and colour pattern but also in their foraging behaviour (Golding & Edmunds 2000, Golding et al. 2001, Howarth et al. 2004).

Some studies have shown how syrphids can compete directly against honeybees in pollination efficiency (Kumar et al. 1985, Nye & Anderson 1974) or how specifically the eristalines can be used for improving seed set in isolation cages and greenhouses under controlled conditions (Gladis 1997; Jarlan et al. 1997; Jauker et al. 2012; Kobayashi 1972; Ohsawa & Namai 1987, 1988; Okamoto et al. 2008; Schittenhelm et al. 1997; Takeda & Yanase 1990). The potential use of drone flies as pollinators has resulted in the development and improvement of protocols of artificial and mass-rearing of some *Eristalis* species, such as *E. tenax* (Linnaeus, 1758) or *E. cerealis* Fabricius, 1805 (Gladis 1994, 1997; Heal 1979; Kobayashi 1972, 1979; Rosso et al. 1994).

Eristaline larvae are associated with decaying organic material in liquid or semi-liquid media (Rotheray 1993). It has been proposed that these larvae could act as bio-decomposers, removing and filtering huge quantities of bacteria and decaying organic matter from the water bodies where they develop, thus releasing nutrients back into the media (Abou-el-Ela et al. 1978, Gilbert 1993, Hartley 1961).

Although it is well known that larval characters may be informative both at the specific and higher taxonomic levels, the larval morphology of only 14 species (less than 15% of the known species) of *Eristalis* has been described (Rotheray & Gilbert 1999).

Useful and detailed larval descriptions have been provided by Hartley (1961), who made the first identification key for the preimaginal stages, including *E. abusiva* Collin, 1931, *E. arbustorum* (Linnaeus, 1758), *E. intricaria* (Linnaeus, 1758), *E. nemorum* (Linnaeus, 1758), *E. pertinax* (Scopoli, 1763) and *E. tenax*. Later, Dolezil (1972) added to Hartley's key, including new characters for the species already described, and adding the descriptions of *E. horticola* (De Geer, 1776) and *E. rupium* Fabricius, 1805. A full description of the latter species was completed by Maibach & Goeldlin de Tiefenau (1991). Some other authors have carried out similar studies: Kuznetsov (1992) gave some information about the first-instar larva of *E. cryptarum* (Fabricius, 1794), and Kuznetsov & Kuznetsova (1994) described three boreal species, namely *E. anthophorina* (Fallén, 1817), *E. rossica* Stackelberg, 1958 and *E. vitripennis* Strobl, 1893 (but see Speight 2015 for discussion about the taxonomical status of this last species). Sasaki & Mikami (2007) have highlighted and described some diagnostic characters of *E. tenax*, *E. rossica* and *E. cerealis*. More recently, Pérez-Bañón et al. (2013) described *E. similis* (Fallén, 1817), comparing it with *E. tenax*. All these studies have increased the current information available, but preimaginal morphology of the genus is still poorly known.

Eristalis fratercula (Zetterstedt, 1838) is a boreal species (northern Norway, northern Sweden, Finland, northern Russia, Greenland, Alaska and Canada) associated with seasonally flooded grassland with standing water, in tundra and beside rivers in taiga (Nielsen 1998). The adults of this species can be found on mud at the edge of water bodies or close to flowers of *Caltha*, *Matricaria*, *Ranunculus* and *Salix*, primarily during June and July (Speight 2015).

The objectives of this paper are: 1) to describe the morphology of the egg and the larva of *E. fratercula*; 2) to highlight the diagnostic features of larval morphology of *E. fratercula*; 3) to provide an updated key to identify the species of *Eristalis* whose third-instar larvae have been described.

Table 1. Summary of the *Eristalis* species with described larval (preimaginal) morphology, L3 – third-instar; L1 – first-instar.

***Eristalis* species**	**Described preimaginal stages**		
	Egg	**Larva**	**Pupa**
E. abusiva Collin, 1931		Hartley (1961) (L3)	Hartley (1961)
E. anthophorina (Fallén, 1817)		Kuznetsov & Kuznetsova (1994) (L3)	Kuznetsov & Kuznetsova (1994)
E. arbustorum (Linnaeus, 1758)		Hartley (1961) (L3)	Hartley (1961)
E. cerealis Fabricius, 1805	Sasaki & Mikami (2007)	Sasaki & Mikami (2007) (L3)	
E. cryptarum (Fabricius, 1794)	Kuznetsov (1989)	Kuznetsov (1992) (L1)	
E. horticola (De Geer, 1776)	Dolezil (1972)	Dolezil (1972) (L3)	Dolezil (1972)
E. intricaria (Linnaeus, 1758)		Hartley (1961) (L3)	Hartley (1961)
E. nemorum (Linnaeus, 1758)		Hartley (1961) (L3)	Hartley (1961)
E. pertinax (Scopoli, 1763)		Hartley (1961) (L3)	Hartley (1961)
E. rossica Stackelberg, 1958		Kuznetsov & Kuznetsova (1994), Sasaki & Mikami (2007) (L3)	Kuznetsov & Kuznetsova (1994)
E. rupium Fabricius, 1805	Dolezil (1972)	Dolezil (1972), Maibach & Goeldlin de Tiefenau (1991) (L3)	Dolezil (1972), Maibach & Goeldlin de Tiefenau (1991)
E. similis (Fallén, 1817)		Pérez-Bañón et al. (2013)	Pérez-Bañón et al. (2013)
E. tenax (Linnaeus, 1758)		Hartley (1961), Pérez-Bañón et al. (2013) (L3), Sasaki & Mikami (2007)	Hartley (1961), Pérez-Bañón et al. (2013)
E. vitripennis Strobl, 1893 (= ?*E. obscura* Loew, 1866)		Kuznetsov & Kuznetsova (1994) (L3)	Kuznetsov & Kuznetsova (1994)

Material and methods

Eristalis fratercula eggs and larvae were obtained in captivity from a gravid female collected at Skogmo, North Norway by one of the authors (TRN). A female was fed with drops of diluted honey applied on a *Ranunculus* flower. A plastic dish with a solution of soil, water and cow manure was provided as rearing medium. After some days a number of larvae of different stages were killed in hot water and preserved in 70% alcohol (Nielsen & Svendsen 2014).

The micromorphology of third-instar larvae was studied using the cryo-scanning technique. This method has the advantage that the material is frozen so quickly that vulnerable biological structures are well preserved. The larvae were fixed on a holder with a layer of O.C.T. compound (Tissue-Tek O.C.T. Compound, Sakura Finetek), and were then frozen rapidly in liquid nitrogen for two minutes. Subsequently, the specimen holder was transferred to a system for cryo-SEM (Oxford CTI500). The specimen was freeze-etched, maintained under vacuum conditions, increasing the temperature from -150ºC to -90ºC for about two minutes to eliminate contamination by frost, and then a thin layer of gold was "sputtered" onto the material for five minutes. Finally, the sample was transferred to the cold stage of the SEM (S3000N Hitachi), kept at about -150ºC, and secondary electron images were observed and recorded at an accelerating voltage of 10 kV. These studies were conducted in the technical services at the Technical University of Valencia (UPV, Spain).

There has been some controversy about the gender of the name *Eristalis* as masculine or feminine (see Speight 2015, Thompson 2003). The main reason was Opinion 1747 of the International Commission of Zoological Nomenclature (ICZN 1993), which treated *Eristalis* Latreille, 1804 as masculine. However, subsequent rulings of the ICZN have ruled that the gender of this name is feminine (Chandler et al. 2004). This decision must be followed, and species names used in this paper have been amended accordingly.

Results

Description of preimaginal morphology of *E. fratercula*

Egg. Length 1.57 ± 0.014 mm, maximum width 0.53 ± 0.023 mm (N = 2). White in colour when recently laid, brownish when stored in alcohol. The egg of *E. fratercula* is elongate oval in shape, rounded at both ends, and slightly tapering towards the anterior pole. The dorsal surface is convex, whereas the ventral surface is slightly flattened. The chorionic sculpturing shows a fine surface structure formed by star-shaped units (Fig. 1) whose centre is elongate-oval with a broad margin forming a ring-shape with a shallow centre, similar to a red blood cell. Encircling the central unit are numerous ramifications that connect together, creating a porous net.

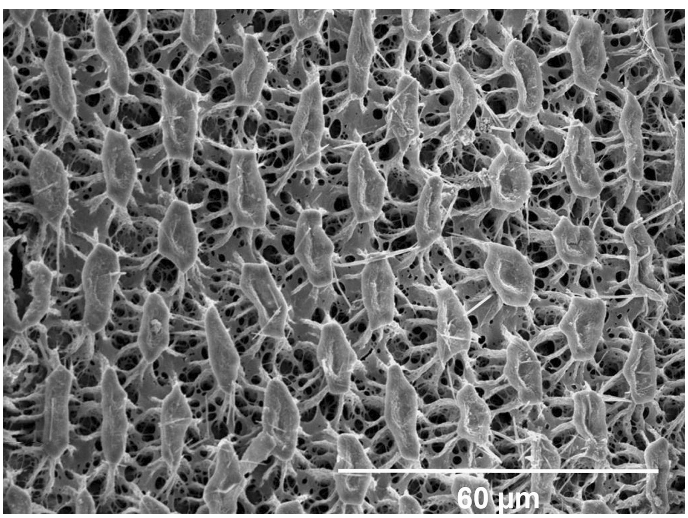


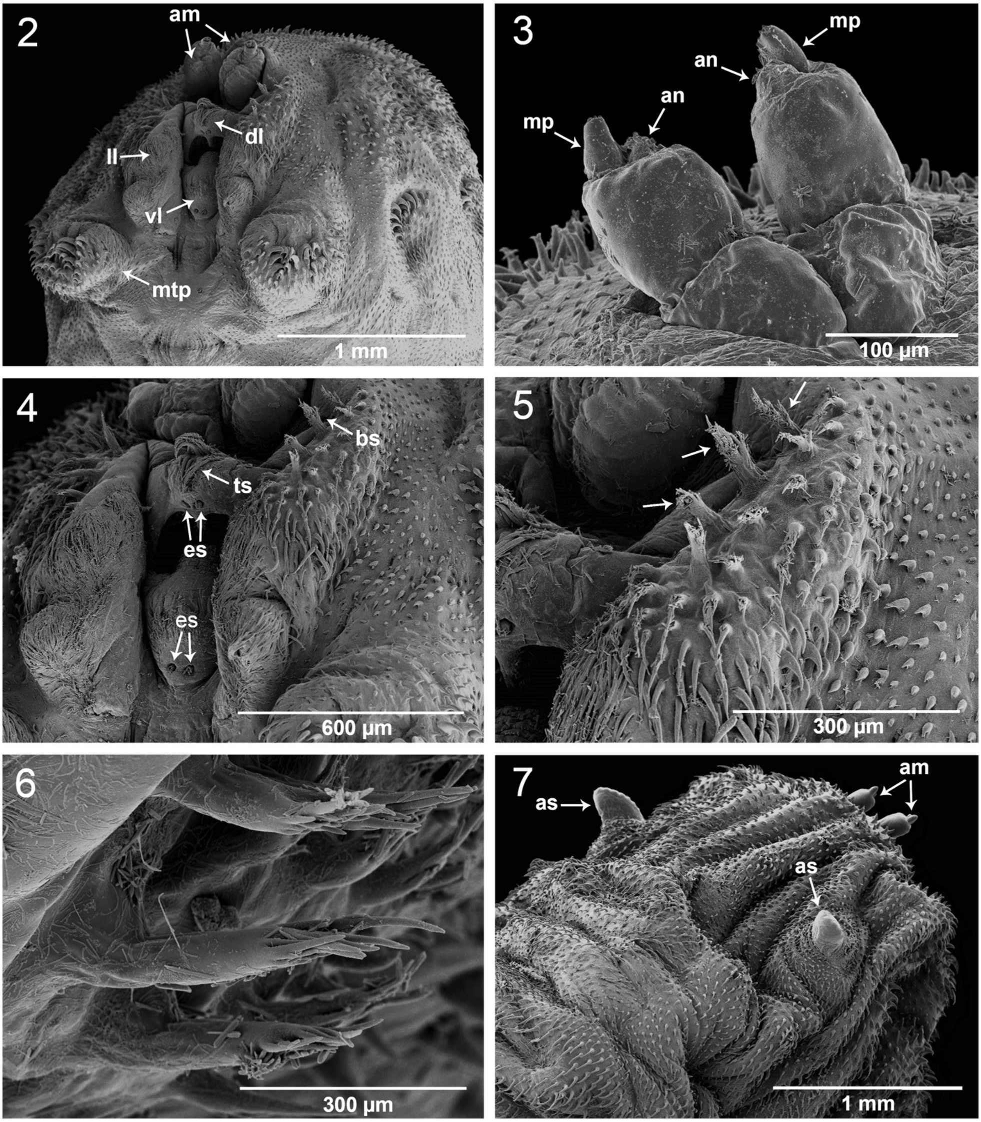
Fig. 1. *Eristalis fratercula* (Zetterstedt, 1838), surface of the egg with star-shaped pattern.

Third larval stage. ***Overall appearance.*** A "long-tailed" larva with internal mouth-hooks and a retractile anterior spiracle. Sub-cylindrical in cross-section with a flattened ventral surface, truncated anteriorly, and tapering posteriorly. Cuticle translucent when alive, cream to off-brown after fixation. Dorsal body surface coated in pubescence backwardly directed and slightly sclerotized on the terminal body segment. Setae on ventral surface are backwardly directed, shorter and less sclerotized than the dorsal surface, except for the anal segment. Prolegs bear crochets in two main rows, the first row bigger than the second. A photograph of the living larva is provided by Nielsen & Svendsen (2014).

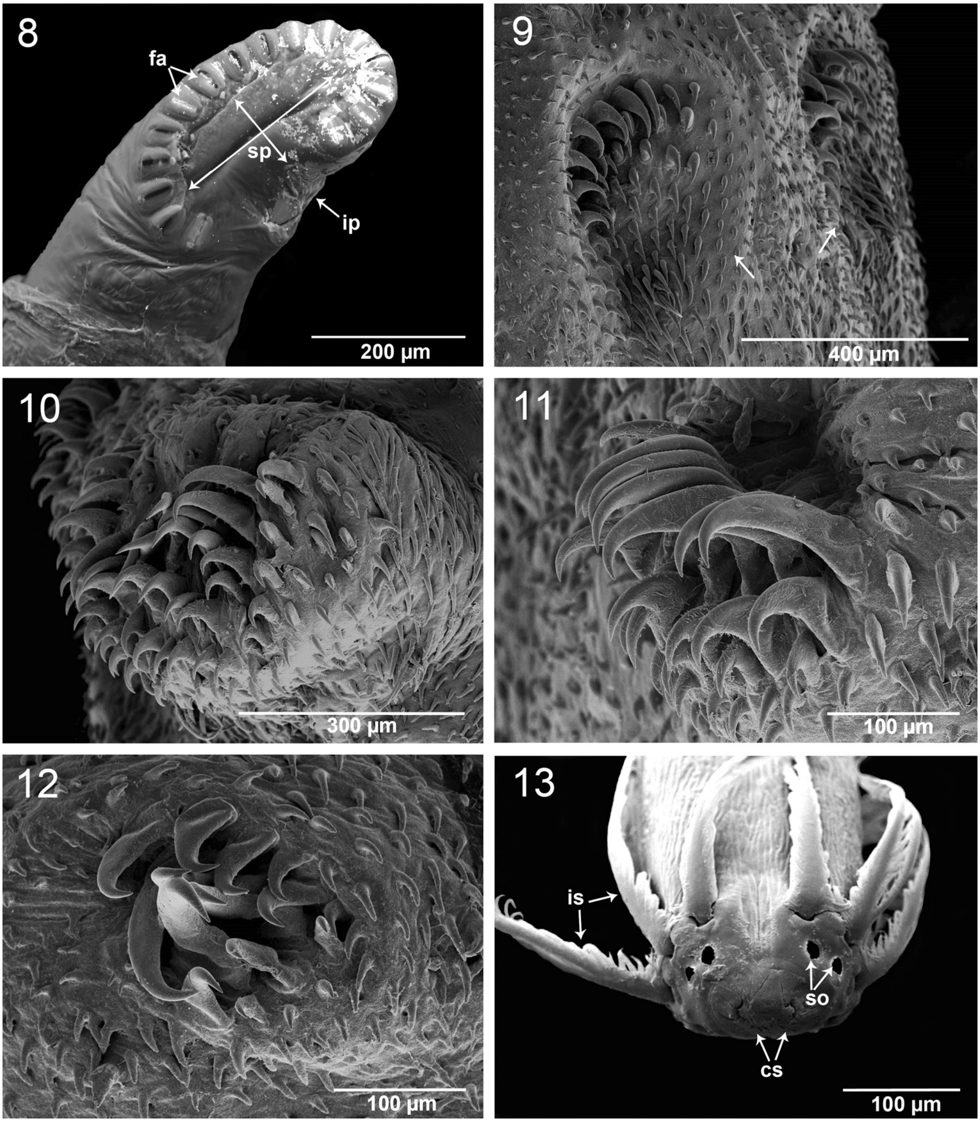
Head (pseudocephalon). Mandibles and mandibular lobes internal, mandibles supporting expanded mandibular lobes [mouthparts adapted for filter-feeding (*sensu* Roberts 1970)]. Antennomaxillary organs well developed, located between mouth and dorsal surface of prothorax (Fig. 2). These organs consist of two pairs of cylindrical-shaped structures tipped with different types of sensilla. Antenna easily identified by the presence of antennal sensory cone. Antennal segment at the base of the antennal cone and on the maxillary palp with several satellite sensilla. Antennomaxillary organs with mechano- and chemoreceptors bearing fleshy basal papilla with three sections. Basal section of the papilla supporting antennomaxillary organs divided medially almost to the base (Fig. 3). Dorsal lip (a projection between the mouth and the antennomaxillary organs) broad, lacking a medial groove and covered with a conspicuous tuft of long setae. One pair of sensilla located above the mouth and below the tuft of setae. Ventral lip well developed with one pair of sensilla and covered with small sclerotized spicules (Fig. 4).

Thorax. Lateral lips well developed, rounded, inner upper margin with long branched spicules (Figs 5–6) and inner inferior margin base coated in long, fine, and densely aggregated setae. Dorsal surface of prothorax with 6 longitudinal grooves. Anterior fold with a broad band of backwardly directed, slightly hooked, and sclerotized spicules, which become progressively shorter posteriorly (Fig. 7). Dorsal surface of prothorax with a pair of anterior spiracles about two times longer than broad, stout, dark brown in colour, sclerotized, with rounded, slightly recurved tips, and completely retractile within inverted integumental pockets (Fig. 8). Spiracular openings situated on a clear area, also known as the spiracular plate, weakly sclerotized of the ventral surface, extending along the distal four-fifths of spiracle length. Spiracular plate between two and three times longer than broad, with a fold in the middle of its length. Lower part of spiracular plate not widened, all facets visible from any one position. Facets (13–16) arranged in one row around the edge of the unsclerotized area. Lateral margins of the mesothorax with two patches of sclerotized spicules (Fig. 9) arranged as follows: a group between 28 and 30 spicules immediately anterior to the 4th pair of sensilla and another group with 30–34 spicules located in front of the 5th pair of sensilla. Mesothorax bearing well developed prolegs with more than 80 crochets arranged in multiple rows (Fig. 10).

Abdomen. A pair of discs (primordia of pupal spiracles) on the dorsal surface of first abdominal segment. Six pairs of ventral prolegs on segments 1–6. Prolegs well developed, in frontal view, having a circular-shape with two main rows of apically brown crochets, which are broader at the apex than the base in ventro-lateral view. About 7–8 long and slender primary crochets, with distal third sclerotized, and larger than the posterior ones. Arrangement of crochets varies from abdominal segments 1–6, with a few crochets facing sideways out



Figs 2–7. Third instar larva of *Eristalis fratercula* (Zetterstedt, 1838). 2 – head and thoracic segments (pro- and mesothorax), ventral view; 3 – antennomaxillary organs; 4 – details of the cephalic region and lips; 5–6 – long branched spicules in the upper margin on the lateral lips; 7 – longitudinal grooves and anterior spiracles, dorsal view. Abbreviations: am – antennomaxillary organs; an – antenna; as – anterior spiracles; bs – branched spicules; dl – dorsal lips; es – extra pair of sensilla; ll – lateral lips; mp – maxillary palp; mtp – mesothoracic prolegs; ts – tuft of long setae; vl – ventral lips.



Figs 8–13. 8 – anterior spiracle. 9 – two patches of sclerotized spicules. 10 – mesothoracic proleg; 11 – first abdominal proleg; 12 – sixth abdominal proleg; 13 – posterior breathing tube. Abbreviations: cs – central scars; fa – facets; ip – incurved plate; is – interspiracular setae; so – spiracular openings; sp – spiracular plate.

from the body in segment 1 (Fig. 11), to most facing sideways out from the body in segment 6 (Fig. 12). Rows of crochets of paired prolegs on abdominal segments 1–6 separated by a distance greater than their individual length. Sensilla 4 aligned horizontally with sensilla 5 and 6 on segment 7. Dorsal surface of anal segment covered with long, dense setae. Anal segment extended, with three pairs of weakly developed lappets. Second and third pairs of lappets together at the end of the anal segment, with the first pair about halfway along its length. Posterior breathing tube (prp) shiny, sclerotized, brown in colour, with three pairs of spiracular openings arranged around fused central scars. Four pairs of long interspiracular setae present (Fig. 13).

Chaetotaxy. Prothorax with 12 pairs of sensilla; mesothorax and metathorax with 9 pairs; abdominal segments 1–7 with 11 pairs; anal segment with 3 pairs of sensilla (sensilla 9, 10 and 11) and three pairs of lappets.

Key to third instar larvae of known species of genus *Eristalis*

The following key is based on the keys of Hartley (1961) and Dolezil (1972), but with additional species and the amendment of several characters previously considered diagnostic but later shown to be shared among several species. The key has been updated to include the morphological studies of this paper. All known larval descriptions of *Eristalis* species are listed in Table 1.

1 Cuticle on dorsum with reticulate or mesh-like pattern of brown patches. .... ***E. nemorum*** (Linnaeus, 1758)

– Cuticle without reticulate or mesh-like pattern of brown patches. 2

2 Primary crochets strong, broad, markedly bent, their length scarcely exceeding their width at base; distal 2/5 of crochets darkly pigmented (see Hartley 1961: Fig. 74). .... ***E. tenax*** (Linnaeus, 1758)

– Primary crochets long and thin, slightly bent, almost twice as long as their width at the base; distal 1/4 (exceptionally 1/3) of crochets more or less pigmented (see Hartley 1961: Fig. 73). 3

3 Long spicules located in the upper margin on the lateral lips branched (Figs 5–6). .... ***E. fratercula*** (Zetterstedt, 1838)

– Long spicules located in the upper margin on the lateral lips simple, not branched (see Pérez-Bañón et al. 2013: Fig. 2A). 4

4 Pubescence of dorsal and lateral parts of abdomen more or less spinose, at least slightly pigmented brown (particularly at bases of spines). 5

– Pubescence of dorsal and lateral parts of abdomen more or less fine, longer, hairs pale, without pigmentation. 6

5 Anterior spiracle light brown and shinning, spiracular plate about 1.5–2 times as long as wide, stout and shortly conical; with a broadly truncate apex (see Hartley 1961: Fig. 79). .... ***E. intricaria*** (Linnaeus, 1758)

– Anterior spiracle brown, spiracular plate about 3.6–4 times as long as wide (see Kuznetsov & Kuznetsova 1994: Fig. 34). .... ***E. rossica*** Stackelberg, 1958

6 Anterior spiracles with the lower part of the spiracular plate not widened (see Hartley 1961: Fig. 82). 7
– Spiracular plate widened, encircling part of the perimeter of the spiracle (see Hartley 1961: Fig. 80). 10
7 Spiracular plate of anterior spiracle about 2.5–2.8 times longer than wide; the plate incurved approximately above the proximal third (distal part of plate about twice as long as proximal) (see Dolezil 1972: Fig. 3). 8
– Spiracular plate of prothoracic spiracle between 1.5–2 times longer than wide; proximal and distal parts approximately the same length (plate incurved approximately in the middle) (see Dolezil 1972: Fig. 4). 9
8 Number of facets in anterior spiracle from 13 to 16. Number of facets between the plate incurved and the apex of the anterior spiracle, less than 5 (see Dolezil 1972: Fig. 3). .... ***E. horticola*** (De Geer, 1776)
– Number of facets in anterior spiracle from 25 to 27. Number of facets between the plate incurved and the apex of the anterior spiracle, more than 5 (see Kuznetsov & Kuznetsova 1994: Fig. 61). . ***E. vitripennis*** Strobl, 1893 [sensu Kuznetsov & Kuznetsova 1994]
9 Anterior spiracles with the higher part of the spiracular plate widened, measuring more than the diameter of two facets (see Dolezil 1972: Fig. 4). .... ***E. rupium*** Fabricius, 1805
– Anterior spiracles with the higher part of the spiracular plate narrowed, measuring less than the diameter of two facets (see Kuznetsov & Kuznetsova 1994: Fig. 41). .... ***E. anthophorina*** (Fallén, 1817)
10 Spiracular plate encircling three-fourths or more of the perimeter of spiracle; anterior spiracle with the lower part of facet band running horizontally around the spiracle for half the circumference; spiracle abruptly narrowed above the facets band and curved outwards; face of spiracle generally rounded, apex straight (see Hartley 1961: Fig. 80). .... ***E. pertinax*** (Scopoli, 1763)
– Spiracular plate encircling less than three-fourths of the perimeter of spiracle; anterior spiracle with the lower part of facet band acutely angled with the upright part, lower band only extending around for about one-third of the circumference (see Hartley 1961: Fig. 81). 11
11 Lowest part of spiracular plate very wide, measuring like the diameter of more than two facets (see Pérez-Bañón et al. 2013: Fig. 5D). 12
– Lowest part of spiracular plate narrower, measuring about the diameter of two facets (see Pérez-Bañón et al. 2013: Fig. 2B). .... ***E. similis*** (Fallén, 1817) and ***E. cerealis*** Fabricius, 1805[1)]
12 Pubescence on dorsum of abdomen and between prolegs grouped into short transverse lines of two or three spinules. .... ***E. abusiva*** Collin, 1931[2)]
– Pubescence not grouped. .... ***E. arbustorum*** (Linnaeus, 1758)

1) We have not studied material of *E. cerealis* present throughout the Oriental Region and the Far East, but *E. similis* is mainly a West Palaearctic species.
2) We have not studied material of *E. abusiva*, but both *E. abusiva* and *E. arbustorum* have been included following the key of Hartley (1961). Dolezil (1972) considered that both species are doubtfully distinguishable.

Discussion

The egg structure and the star-shaped pattern of *E. fratercula* described in this paper fits well with previous descriptions of other species of genus *Eristalis* (*E. rupium, E. horticola, E. cerealis* and *E. cryptarum*: Dolezil 1972, Kuznetsov 1989, Sasaki & Mikami 2007).

Following Rotheray & Gilbert (1999), larvae of *Eristalis* can be distinguished from other long-tailed syrphid larvae by the following characters: prolegs with crochets in three rows with spicules gradually becoming smaller below; abdominal segments 2–6 with lateral sensillum 4 above 5 and 6; last pair of prolegs with curved tips of most of the primary crochets facing out to the lateral margins of the larva; without a transverse row of spicules just in front of the last pair of prolegs. As would be expected, all these features fit with the description of *E. fratercula* presented here. It shows similarities with other congeneric species, but close examination reveals diagnostic differences.

According to Hartley (1961) and Dolezil (1972) the morphology of the anterior spiracle (shape of spiracular plate and arrangement of facets) is a diagnostic character among *Eristalis* species. This character is useful to separate *E. fratercula* from the group of species with the spiracular plate of the anterior spiracles widened in the lower part (*E. abusiva*, *E. pertinax*, *E. arbustorum*, *E. cerealis* and *E. similis*). *Eristalis fratercula* has its spiracular plate not widened in the lower part, as occurs in *E. nemorum*, *E. tenax*, *E. intricaria, E. horticola, E. rupium*, *E. anthophorina* and *E. rossica*. The larval morphology of the species described in this paper differs from *E. nemorum* because this last species bears brown mesh-like pattern on dorsal cuticle. The crochets of *E. tenax* are stouter and shorter than *E. fratercula* which has 7–8 primary crochets on the prolegs, which are long and slender (length more-or-less three times the width at the base). *E. horticola* shows a pair of anterior spiracles longer than *E. fratercula*, almost three times longer than broad rather than twice, and in addition the length of the primary crochets is twice the width in *E. horticola* and three times in *E. fratercula*. The larvae of *E. fratercula* can be distinguished from *E. intricaria* and *E. rossica* by dorso-lateral abdominal pubescence, which is more or less spinose and at least slightly pigmented brown, whereas the abdominal pubescence of *E. fratercula* consist of more or less fine, rather long, unpigmented hairs. There are also differences in the number of facets located in the anterior spiracles, 24 facets in *E. intricaria* and 13–16 facets in *E. fratercula*. Another useful diagnostic feature is the width of the spiracular plate in the anterior spiracles. *Eristalis fratercula* shows a spiracular plate between two and three times longer than broad, between 1.5–1.7 times in *E. rupium* and *E. anthophorina*, and almost four times longer than wide in *E. rossica*. Finally, *E. fratercula* can be distinguished from *E. vitripennis* (sensu Kuznetsov & Kuznetsova 1994, see also Speight 2015) by the shape of the spiracular plate: *E. fratercula* shows a similar width from the base to the apex, whereas that of *E. vitripennis* gradually narrows from the base to the apex. In addition, there is a difference in the number of facets: *E. fratercula* has between 13 and 16 facets, while *E. vitripennis* has between 25 and 27.

Above all, the primary diagnostic character of *E. fratercula* compared with all other known species of *Eristalis* is the series of long branched spicules located in the upper margin on the lateral lips.

In the previous keys (Dolezil 1972, Hartley 1961), *E. rossica* could be confused with *E. intricaria* because both species have a more or less spinose pubescence on the dorsal and lateral parts of the abdomen; however, their anterior spiracles are very different in shape and size. The spiracular plate of the anterior spiracle of *E. rossica* is about 3.6–4 times as long as wide, but only 1.5–2 times as long as wide in *E. intricaria*. *Eristalis anthophorina* and *E. rupium* are also quite similar in the previous keys, but these two species differ in the width of the higher part of the spiracular plate, which is narrowed in *E. anthophorina* (less than the diameter of two facets) and widened in *E. rupium* (more than the diameter of two facets). *E. fratercula* can be distinguished easily from the rest of the species by its diagnostic character, the long branched spicules in the upper margin on the lateral lips.

According to published larval descriptions, *E. similis* and *E. cerealis* share their main diagnostic features (see Pérez-Bañón et al. 2013, Sasaki & Mikami 2007), and indeed they are similar in having the lower part of the spiracular plate widened, like *E. pertinax*, *E. arbustorum* and *E. abusiva.* Nevertheless, the first two new species have the lowest part of the spiracular plate narrowed, measuring less than the diameter of two facets, while in *E. arbustorum* and *E. abusiva* this area is very wide, the diameter of two facets or more. Finally, *E. pertinax* shows a spiracular plate encircling three fourths of the perimeter of the whole spiracle, more than any of the other species. Before the advent of detailed comparative studies of the larval morphology of *E. similis* and *E. cerealis*, it is important to note that their geographical distributions do not overlap, since *E. similis* is mainly a West Palaearctic species whereas *E. cerealis* is present throughout the Oriental Region and the Far East (Bankowska 2000, Speight 2015).

Interestingly, Speight (2015) noted that features of the larva of an *Eristalis* species identified as *E. vitripennis* were described by Kuznetzov & Kuznetzova (1994), but without any discussion of the basis upon which the species was named as *E. vitripennis*. *Eristalis vitripennis* Strobl, 1893 was recognised as a junior synonym of *E. rupium* by Hippa et al. (2001), and the correct name for the taxon *E. vitripennis* var. *pseudorupium* is *E. obscura* Loew, 1866 (Hippa et al. 2009). He concluded that "there is need for re-examination of the adults of the material upon which Kuznetzov & Kuznetzova (1994) based their description of "*E. vitripennis*" larvae, before it can be decided to which species the description belongs". From our comparative work, the larvae described by Kuznetsov & Kuznetsova do not fit with the *E. rupium* larval description, and hence could be *E. obscura* (which to date remain undescribed).

Acknowledgements

We are greatly indebted to Professor Hitoshi Sasaki (Rakuno Gakuen University) for providing useful information about his work on preimaginal descriptions of *Eristalis cerealis* and other drone flies.

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