The hoverfly genus *Eristalinus* Rondani, 1845 (Diptera: Syrphidae) in Hong Kong (Part 1)

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ABSTRACT

The hoverfly genus *Eristalinus* Rondani, 1845 in Hong Kong was studied. Literature on the local hoverfly fauna and a total of 406 observation records from both the author and iNaturalist were reviewed. Ten species were found to occur in Hong Kong, two of which have not previously been reported. A brief account of the morphology and ecology for each of these species was given.

Key words: *Eristalinus*, Syrphidae, Hong Kong

INTRODUCTION

The genus *Eristalinus* Rondani, 1845 is the most speciose among all hoverfly genera in Hong Kong. About one-sixth of the sixty-plus species mentioned in the literature belongs to this genus. It is characterized by maculation on the compound eyes, in the form of either apparently random spots or organized bands, plus a sinuate radial vein R4+5 on the wings. The latter is a common characteristic for the tribe Eristalini (Stubbs and Falk, 2002; Huang and Cheng, 2012), under the subfamily Eristalinae. The genus was erected by Rondani in 1845 as a subgenus of *Myathropa* (Evenhuis and Pape, 2022). He later changed the name to a secondary proposed usage in 1857 as a subgenus of *Eristalis*, with the first species assigned to it being *E. sepulchralis* (Linnaeus 1758) (O'Hara et al., 2011). In the following century, many species now assigned to this genus were often put under *Eristalis* (e.g. Nayar, 1968). Other generic names, e.g. *Lathyrophthalmus* Mik, 1897, *Eristalodes* Mik, 1897 or *Merodonoides* Curran, 1931, were created for various species with eye spots. Following Evenhuis and Pape (2022), all related taxa are now put under the genus *Eristalinus*, while others are either synonymized (e.g. *Lathyrophthalmus*) or treated as subgenera (e.g. *Eristalodes* and *Merodonoides*).

According to Thompson (2003), there are 100 species under *Eristalinus*, occurring naturally in the Palaearctic, Afrotropical and Oriental realms, as well as New Guinea and being introduced into the New World and the Australasian realms. A total of 87 out of 99 *Eristalinus* species listed in Evenhuis and Pape (2022) are stated as valid. Of these, 24 species have been recorded from the Oriental region where Hong Kong is located, and 11 in the Palaearctic realm (seven of these also occur in the Oriental), 18 in the Australasian realm (seven also in the Oriental) and 53 in the Afrotropical realm (three also in the Oriental). Only three species occur in the New World, one of which also occurs in the Oriental realm.

The taxonomy and the biology of *Eristalinus* species in Hong Kong has not been studied in detail. A few species were misidentified in the published literature, while the correct placement of scientific names for some other species is still debated (Ghorpadé, 2019). The present paper describes the Hong Kong *Eristalinus* species reported or observed to date and gives a brief account on their morphology and ecology.

MATERIALS & METHODS

Published records of hoverflies that occur in Hong Kong were collated and reviewed. These include publications from Hong Kong by expert (e.g. Lau, 2019) and amateur entomologists, faunal listings of Chinese regions (e.g. Huang and Cheng, 2012) and of the Oriental realm and other related academic journal articles on hoverfly distribution.

Hong Kong hoverfly records in the online observation database iNaturalist were gathered through the sorting and downloading functions of the website (iNaturalist, 2022). These were reviewed and tabulated to form a database of observation records, together with the author's personal records between 2006 and 2022. Only iNaturalist records with clear photos that allow unambiguous identification of species were used, otherwise the record was discarded. Each record was reviewed and an identity based on the initial checklist assigned, since the initial identity in the record may be incorrect. The date and the geographical location of each record were included in the database for further study. Where only an approximate location was specified, the geographical information of that particular record was discarded and not included in related analyses. Behaviours such as mating, oviposition and flower visiting were recorded.

The original species descriptions of the local hoverfly fauna were retrieved as much as possible to confirm the authenticity of the occurrence of the species in Hong Kong. Regional hoverfly accounts for nearby regions such as mainland China (Huang and Cheng, 2012), Taiwan (Steenis et al., 2021), Japan (Shiraki, 1930), India (Ghorpadé, 2019) and the Oriental region as a whole (e.g. Brunetti, 1908) were reviewed to facilitate species identification.

RESULTS

Literature review

Hong Kong hoverfly records in recent decades are mainly reported in books on the local insect fauna.

There are hardly any mentions of hoverfly specimens collected in Hong Kong in the academic literature. In the first comprehensive book on Hong Kong insects, Hill et al. (1982) recorded *Eristalis* spp., *Syrphus* spp. and *Eristalinus* sp. as the only representatives of Hong Kong Syrphidae. This book was later re-published in 1985 in both Chinese and English versions, with colour illustrations added (Hill, 1985), but only *Eristalis* sp. and *Eristalinus* sp. were included. The photo captioned as the former is likely to be *Phytomia zonata*, and the latter is *Eristalinus arvorum*.

Yiu (2005) illustrated three hoverfly species, including *Eristalinus arvorum* (identified as *Eristalinus quinquestriatus* in the book). These are the first records of Hong Kong hoverflies identified to species level. In the following year, Yiu (2006) published another comprehensive book on the Hong Kong insect fauna, with species accounts of 13 hoverfly species including the three in Yiu (2005). Three of them belonged to *Eristalinus* spp., namely *E. arvorum*, *E. quinquestriatus* and *E. tarsalis*, the last being a misidentification (see discussion below). Fang (2006) gave species accounts of two hoverfly species, including *E. quinquestriatus* (identified as *Eristalinus* sp. in the book). In the first book specifically on the dipteran suborder Brachycera from Hong Kong, Wu (2010) gave a brief account of the Syrphidae and its three subfamilies (Syrphinae, Milesiinae and Microdontinae). Twenty-one species of hoverflies were illustrated, including two *Eristalinus* spp. that had previously been recorded (*E. arvorum* and *E. quinquestriatus*).

Huang and Cheng (2012) published the first comprehensive national account of Chinese hoverflies. The distribution of each species inside China was described in terms of provinces. Hong Kong, being a Special Administrative Region, was treated as a counterpart of the other provinces, and thus occurrence in Hong Kong was explicitly mentioned instead of being part of the adjoining Guangdong province. A total of nine species were mentioned from Hong Kong, including four *Eristalinus* spp., namely *E. arvorum*, *E. obliquus*, *E. quinquelineatus* and *E. laetus*. The latter three had not previously been mentioned in local publications Two of these four species records (*E. arvorum* and *E. quinquelineatus*) were from specimens collected in December 1932, while the sources of the remaining two were not mentioned. There was no mention of where the specimens were deposited. Neither of two earlier publications on Chinese Diptera (Xue and Chao, 1996) and on the hoverflies of the Qinling-Bashan region of China (Huo et al., 2003) mentioned the presence of hoverfly species in Hong Kong.

Yiu et al. (2014) illustrated 1,985 species of Hong Kong insects, of which 28 were hoverflies, including five *Eristalinus* spp. Two species, *E. quinquelineatus* and *E. quinquestriatus*, had previously been reported. New Hong Kong records included *E. paria* (a misidentification, see discussion in Part 2), *E. rufus* and *E. tarsalis*.

The Checklist of Insects of Hong Kong by Lau (2019) listed 9,060 species of insects. It included synonyms of each listed species and known host plants, and provided a very comprehensive basis for further studies. A total of 56 hoverfly species were listed, of which nine species belonged to *Eristalinus*.

Table 1 summarizes the Hong Kong *Eristalinus* species recorded in some key publications mentioned above.

Review of observation records

A total of 2,009 hoverfly observation records in Hong Kong between 2006 and 2022, including 1,607 records from iNaturalist and 402 records from the author's personal observation, were collated. Of these, 406 records were *Eristalinus* spp. Despite the fact that the majority of records were made haphazardly, some interesting phenomena can be seen in the statistics.

The humid spring months appear to be the prime time for hoverfly adults, with the maximum number of species recorded in April (55 species), followed by March and May (47 and 46 species respectively). The autumn / early winter months from October to December is another period when more species have been recorded,

Species	Authority	Yiu (2006)	Wu (2010)	Huang and Cheng (2012)	Yiu et al. (2014)	Lau (2019)
E. arvorum	(Fabricius, 1787)	✓	✓	✓		✓
E. laetus	(Wiedemann, 1830)			✓		
E. megacephalus	(Rossi, 1794)					✓
E. multifarius	(Walker, 1852)					✓
E. obliquus	(Wiedemann, 1824)			✓		✓
E. paria	(Bigot, 1880)				✓	✓
E. quinqueslineatus	(Fabricius, 1781)			✓	✓	
E. quinquestriatus	(Fabricius, 1794)	✓	✓		✓	✓
E. rufus	Goot, 1964				✓	✓
E. sepulchralis	(Linnaeus, 1759)					✓
E. tarsalis	(Macquart, 1855)	✓			✓	✓

Table 1. Hong Kong *Eristalinus* species recorded in selected publications.

with 37 species for each month. The lowest number of species were recorded in both late winter (January and February) and late summer (August and September), with 30 to 32 species in each of these months. As a comparison, most *Eristalinus* spp. have been recorded all year round, except for those species only recorded a handful of times. An overall comparison will be given in Part 2 of this article.

The total number of all hoverfly observations for each month also shows some interesting patterns. Observation records from October to December outnumbered all other months except the most species-rich month of April. The number of records in these periods is nearly double those of other months, which tally around 110 to 130 records. This pattern is disproportionate when considering the number of species recorded in each respective period. Records of the three commonest *Eristalinus* spp., i.e. *E. arvorum*, *E. megacephalus* / *E. quinquelineatus* (both names have been applied to the same species by different authors, see discussion in Part 2) and *E. quinquestriatus* demonstrated similar patterns with peak numbers in autumn and winter.

At least two *Eristalinus* species observed by the author have not been reported in the previous literature. A handful of observation records for one of the species were present in iNaturalist. Morphologically they are distinctly different from other species in Hong Kong. Details will be discussed in Part 2.

DISCUSSION

Table 2 lists the Hong Kong *Eristalinus* spp. recorded in the literature that are considered valid: it is noticeable that the Hong Kong species listed in the literature are either widely distributed in the Old World or in the Oriental realm (some also occur in Palaearctic / Australasian realms). One exception is *E. quinquelineatus*, which is listed as an Afrotropical-only species, but this may result from a confusion in the scientific names (discussed in Part 2). No other Afrotropical or New World species are known to occur in Hong Kong. Three species listed in the literature are considered synonyms in Evenhuis and Pape (2022): *E. laetus* (= *E. megacephalus*), *E. multifarius* (= *E. fasciatus*) and *E. rufus* (= *E. flavus*).

Together with the observation records from the author and iNaturalist, there are 10 *Eristalinus* species recorded in Hong Kong to date. Some may be different morphs of the same species and are not counted separately. These 10 species are divided into the following four categories:

(1) Species with known identity
(2) Species with uncertain placement of names
(3) Species unidentified
(4) Species not yet observed in the field by the author

A brief account of each species is given in the subsequent discussion, arranged in the order of the above four categories. Reference is made to the original descriptions and photos of the type specimens (if available), as well as articles on the genus (e.g. Hervé-Bazin, 1923) either to confirm the species designation for Category 1 and 2 or search for the identity of the unknown species of Category 3. I focus here on Category 1 species, while the remaining categories will be dealt with in Part 2.

Category 1: *Eristalinus* species with known identity

***Eristalinus arvorum* (Fabricius, 1787)** (Figs. 1-2)

This is by far the most widespread and common *Eristalinus* species in Hong Kong. Adults are recorded throughout the year, usually in open habitats on shrubs, grassland and flowering trees. The five creamy yellow bands on the scutum are of similar width, reaching the posterior edge. The abdomens of males are orange-yellow with brownish bands at the posterior edges of tergites, sometimes with a longitudinal brown vitta in the middle. There is also a pair of small, elongated orange-yellow marks on tergite 4. The abdomen of females are brownish in background, with a creamy yellow transverse band on each of the tergites from segment

Species	Authority	Distribution					
		OR	PA	AU	AF	NE	NT
E. arvorum	(Fabricius, 1787)	✓	✓	✓	✓		
E. flavus	(Sack, 1926)	✓					
E. megacephalus	(Rossi, 1794)	✓	✓	✓	✓		
E. obliquus	(Wiedemann, 1824)	✓		✓			
E. quinquestriatus	(Fabricius, 1794)	✓	✓	✓			
E. sepulchralis	(Linnaeus, 1758)	✓	✓				
E. tarsalis	(Macquart, 1855)	✓	✓				
E. paria	(Bigot, 1880)	✓		✓			
E. quinquelineatus	(Fabricius, 1781)				✓		
E. fasciatus	(Macquart 1834)	✓			✓		

Table 2. Literature-recorded Hong Kong *Eristalinus* species considered valid by Evenhuis and Pape (2022) and their zoogeographical distribution. Distribution: OR – Oriental; PA – Palaearctic; AU – Australasian; AF – Afrotropical; NE – Nearctic; NT – Neotropical.

2 to segment 4, and a pair of oblique, elliptical creamy yellow spots on tergite 5. The femora are orange-brown, while the tibiae and the tarsi are creamy yellow, with the terminal tarsomere brownish black and the tarsal claws creamy yellow.

Distribution (from Evenhuis and Pape, 2022): Entire SE Asia; Australia (Queensland), Hawaii, Marianas, Micronesia; China, Japan; Seychelles.

***Eristalinus flavus* (Sack, 1926)** (Figs. 3-4)

This species was formerly known as *Eristalinus rufus* Goot 1964 in Hong Kong publications, but the name *rufus* is treated as a synonym of *Eristalinus flavus* by Evenhuis and Pape (2022). It has a distinctively lighter shade than other *Eristalinus* species in Hong Kong. The typical stripe patterns on the scutum of this species appears to be very faint. The tergites are predominantly yellowish orange with thin, black spots on the lateral one-third portion of the posterior edges. The legs are yellowish orange similar to the tergites, with about one-third of the end portion of the femora and tibiae black. Adults are recorded in spring / early summer and autumn.

Distribution (from Evenhuis and Pape, 2022): Indonesia to Philippines & Micronesia.

***Eristalinus obliquus* (Wiedemann, 1824)** (Figs. 5-6)

This is an uncommon species, mostly observed on vegetation at the boundary of swamps or ponds. It is recorded in Hong Kong from March to December. Females are readily recognizable by the three pairs of comma-like, creamy yellow spots on tergites 3 to 5, on top of nearly semi-circular black bands at the posterior edge of tergites. The black bands extend to the anterior end medially in the form of narrow vittae. The remainder of the tergites are orange. The abdomen of males is predominantly yellowish orange with the pair of characteristic comma-like creamy yellow spots on tergite 4. This looks like the males of *Eristalinus arvorum*, but can be distinguished by the shape of the spots and the narrower central creamy yellow stripe on the scutum. The legs are brown, except that the femora and the hind tibiae are black. Visits to mature spores of the fern *Cyclosorus interruptus* by females of *Eristalinus obliquus* have been observed (Rainbow Li, pers. comm.), perhaps indicating spore consumption for egg development, but more observation is required to confirm whether the hoverflies actually consume the spores.

Distribution (from Evenhuis and Pape, 2022): Southern Oriental Region; New Guinea, Kei Islands.

***Eristalinus quinquestriatus* (Fabricius, 1794)** (Figs. 7-8)

This is a common species found throughout the year, but more commonly observed during autumn and winter. It is characterized by chevron-like creamy yellow narrow bands in the middle of the tergites, with the most frontal one on tergite 2 (females) or tergite 3 (males) much shorter than the other bands. The femora and tibiae are black, except for the basal one-third of the tibiae being creamy yellow. The posterior edge of the tergites has an inverted T-shape black band on tergites 2 and 3, with the horizonal stroke thinner than the vertical median longitudinal stroke. In females this black band becomes triangular on tergites 2 and 3. The background of tergite 4 is brownish black. The remaining parts of the tergites are orange. The tarsi are brownish yellow except the apical tarsomeres, which are black. The tarsal claws are brownish yellow.

Figures 9 and 10 illustrate an unknown *Eristalinus* sp. with very similar patterns of creamy yellow bands on the tergites, but the bands are narrower and the remaining parts darker than *E. quinquestriatus*. It is regarded as *E. tarsalis* in Yiu (2006), but this name should be applied to another species that also occurs in Hong Kong. It has been recorded in winter and early spring. It may possibly be a “melanic” form of *E. quinquestriatus* that spends the larval stage in cold weather, a situation not uncommon in hoverflies (Huo et al., 2003). Further study of specimens would be required to confirm the identity.

Distribution (from Evenhuis and Pape, 2022): Throughout Oriental Region; Buru; China, Japan.

***Eristalinus tarsalis* (Macquart, 1855)** (Figs. 11-12)

This species was only recorded in Sha Lo Tung in November for two consecutive years in 2012 and 2013. The body is largely black (including the scutum, tergites and legs) and covered with whitish hairs, except for the two pairs of creamy white fasciae on tergites 3 and 4, the creamy white basal one-fourth of the tibiae, and two thin white lines sometimes visible on the scutum.

Distribution (from Evenhuis and Pape, 2022): China, Taiwan, India, Nepal, Japan.

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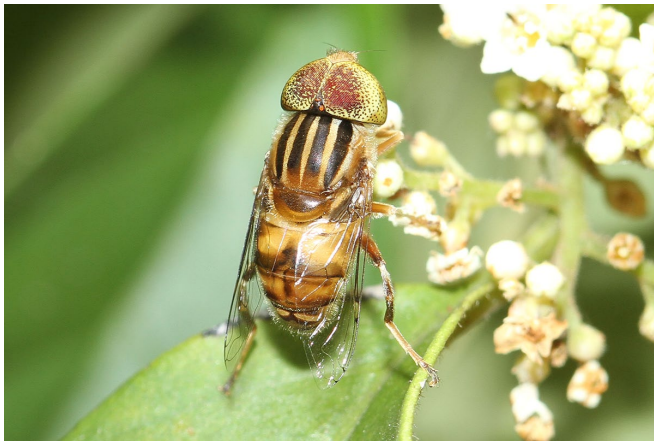

Figure 1. *Eristalinus arvorum* male. Photo by author.

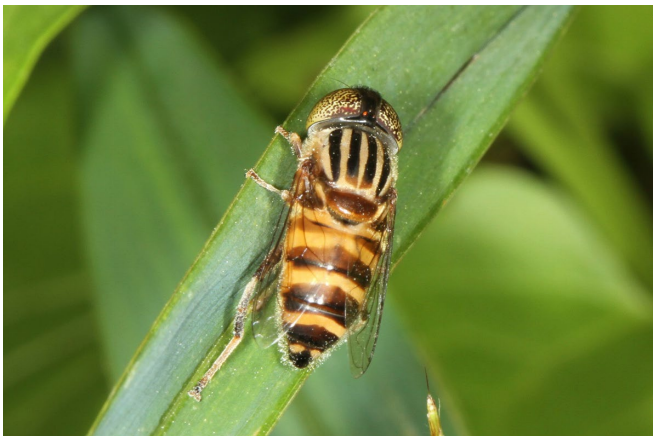

Figure 2. *Eristalinus arvorum* female. Photo by author.

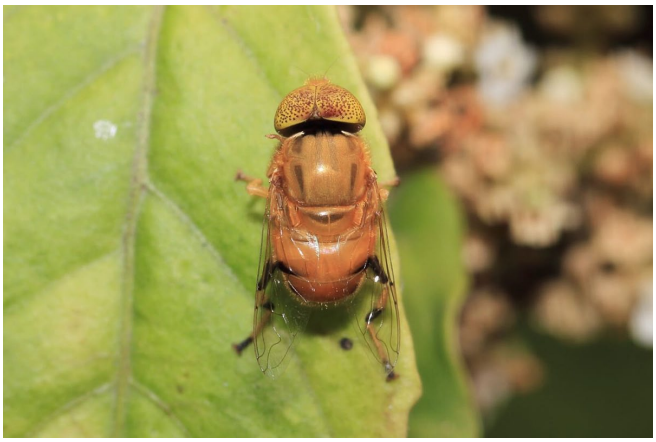

Figure 3. *Eristalinus flavus* male. Photo by Cheung Che-Man.

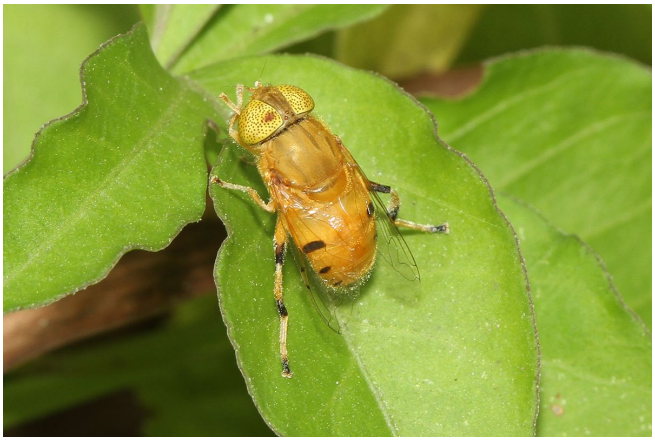

Figure 4. *Eristalinus flavus* female. Photo by author.

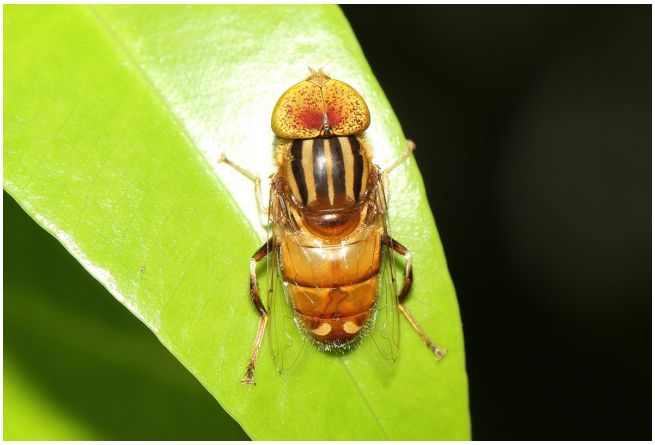

Figure 5. *Eristalinus obliquus* male. Photo by author.

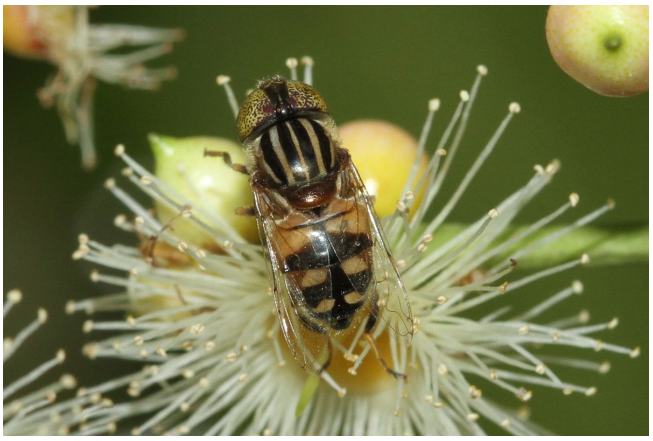

Figure 6. *Eristalinus obliquus* female. Photo by author.

Figure 7. *Eristalinus quinquestriatus* male. Photo by author.

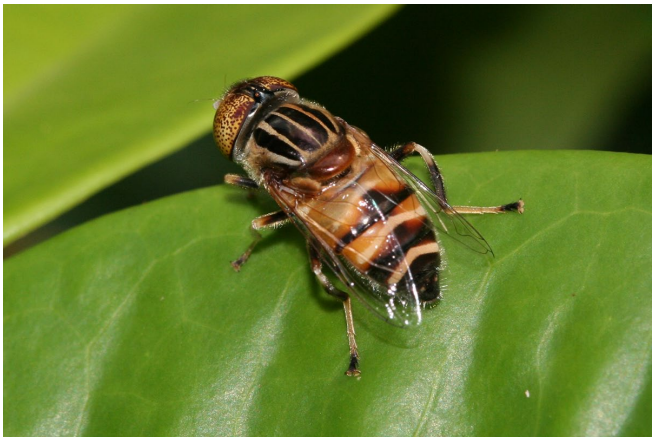

Figure 8. *Eristalinus quinquestriatus* female. Photo by author.

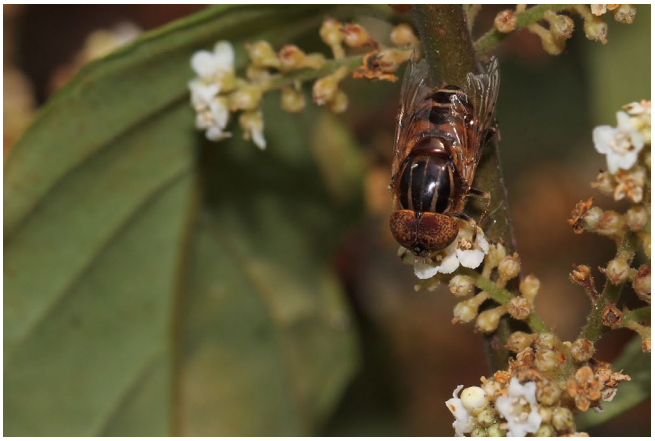

Figure 9. Possibly melanic form of *Eristalinus quinquestriatus* male. Photo by Cheung Che-Man.

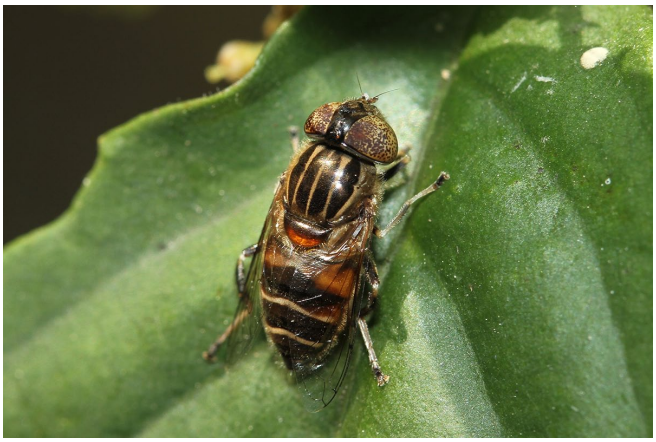

Figure 10. Possibly melanic form of *Eristalinus quinquestriatus* female. Photo by author.

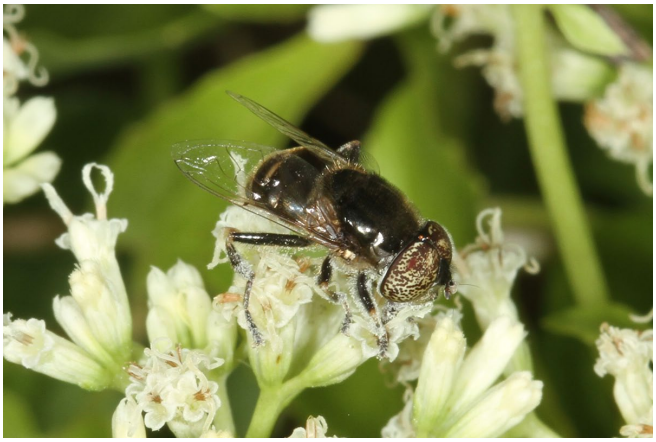

Figure 11. *Eristalinus tarsalis* male. Photo by author.

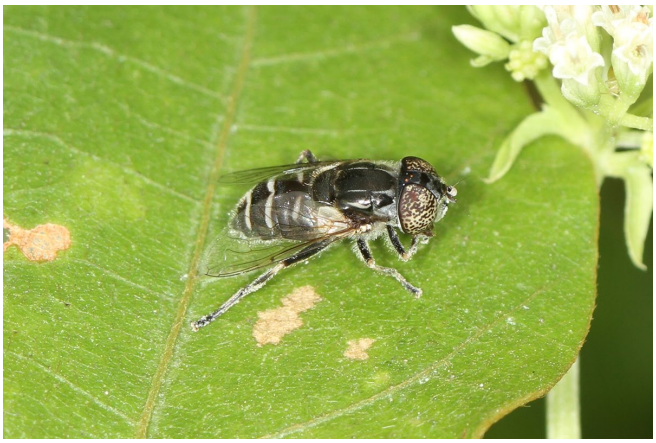

Figure 12. *Eristalinus tarsalis* female. Photo by author.