

***Volucella* species: identifying them, finding them and a bit about their  
biology  
(Diptera: Syrphidae)**

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# ***Volucella* species: identifying them, finding them and a bit about their biology.**

## **(Diptera: Syrphidae)**

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### **Introduction**

Hoverflies of the genus *Volucella* spend much of their time on flowers, where they are easy to observe. They are also of reasonable size and brightly coloured, making them noticeable. Further, most of them are to be found during the summer, when maximum numbers of people are out and about in the countryside. As a component of Ireland's pollinator biodiversity, *Volucella* species, along with the rest of the syrphid fauna, are a focus of attention within the National Pollinator Programme. Among its various objectives, the Pollinator Programme includes the generation of distribution records for pollinators, an initiative which is both consolidating our knowledge of where in Ireland the various species occur and leading to the discovery of additional pollinators in Ireland. One of the most recently added species is *Volucella zonaria*, added as a product of the photo-id process, in which photos of the species taken at a recorded location in nature are used as a basis for identification, and then stored as reference material to substantiate the record. Some pollinators are more easily recognised from photos than others. The three *Volucella* species now known in Ireland, *V. bombylans*, *V. pellucens* and *V. zonaria*, are not difficult to distinguish from one another. But were additional *Volucella* species to occur this situation would change. In particular, one species, *Volucella inanis*, which is arguably as likely to occur in Ireland as is *V. zonaria*, could very easily be confused with *V. zonaria*. With the objective of reducing potential confusion between *Volucella* species, especially when they are being identified from photos, an illustrated key to their identification is presented here. The key also covers identification of collected specimens, whether dry-collected and pinned, or in alcohol. It treats all the European *Volucella* species, so it should be possible to use the key for identifying *Volucella* species both in Ireland elsewhere in Europe.

For those who might want to go looking for *Volucella* species, the key is followed by suggestions on how to find them and their larvae, together with information on their biology.

### **The general appearance of *Volucella* species**

A set of portraits of the European *Volucella* species precedes the key, to show their general appearance. In the portrait gallery, the species are illustrated in alphabetical order. There are two widely distributed European colour varieties of the bumble bee mimic, *Volucella bombylans*, shown in Figs.1 and 2. There are also more localised colour variants. One of them, observed in Ireland only on the Aran Islands (Co. Galway) is illustrated in Fig. 3. Colour varieties are also known in *Volucella zonaria*, which has one generally distributed variety and another apparently endemic to Corsica. The generally occurring variety is shown in Figs. 12, 13. The Corsican variety is shown in Fig. 14.

### **The illustrations**

For those who are interested, the photographic images used here have been produced using a tripod-mounted Olympus E-M1 digital camera, fitted with a Zuiko 60 f2.8 Macro lens, supplemented by a Marumi Macro 200 lens. Lighting for the portrait images has been supplied by a series of flash units, slaved to one attached to the camera, sometimes augmented by a ring-light attached round the barrel of the camera lens. For the images accompanying the key a purpose-made light box has mostly been used, in conjunction with a ring-light inverted within the light-box and surrounding the object being photographed. All of the photographic images are the product of focus-stacking, each of them integrating between 25 and 100 or more photos taken automatically by the camera, when set up to do so. For amalgamation of each set of stacked images the open access CombineZ software of Ian Hadley, downloadable from the internet at [alan@micropics.org.uk](mailto:alan@micropics.org.uk) has been employed. Editing of the final images has been carried out using Corel PaintShop Pro 2019. All the photographic images have been produced by the author.

Portrait gallery of European *Volucella* species



Figure 1: *Volucella bombylans* (male), variety *bombylans*  
(photo: M C D Speight)



Figure 2: *Volucella bombylans* (male) variety *plumata*  
(photo: M C D Speight)



**Figure 3: *Volucella bombylans* (male) Aran Islands (Galway) colour form**  
(photo: M C D Speight)



**Figure 4 : *Volucella elegans* (male)**  
(photo : M C D Speight)



**Figure 5 : *Volucella elegans* (female)**  
(photo : M C D Speight)



**Figure 6 : *Volucella inanis* (male)**  
(photo : M C D Speight)



**Figure 7 : *Volucella inanis* (female)**  
(photo : M C D Speight)



**Figure 8: *Volucella inflata* (male)**  
(photo : M C D Speight)



**Figure 9 : *Volucella inflata* (female)**  
(photo : M C D Speight)



**Figure 10 : *Volucella pellucens* (male)**  
(photo : M C D Speight)



**Figure 11 : *Volucella pellucens* (female)**  
(photo : M C D Speight)



**Figure 12 : *Volucella zonaria* (male)**  
(photo : M C D Speight)



Figure 13 : *Volucella zonaria* (female)  
(photo : M C D Speight)



Figure 14: *Volucella zonaria* (male) variety *beckeri*, only known from Corsica  
(photo : M C D Speight)

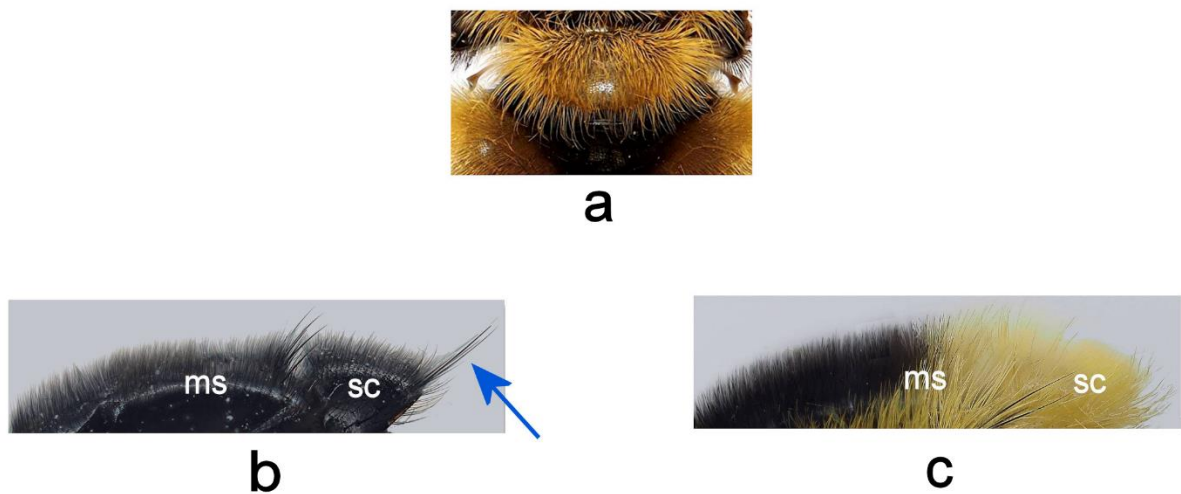
## The Identification Key

Where possible, the features used to distinguish *Volucella* species in the key are ones which are visible on either the dorsal or lateral surfaces of the insect. All of the features used in the key are illustrated in colour, in the accompanying figures. Use of technical terms for different parts of the insects has been kept to an unavoidable minimum. Each feature for which a technical term has been employed is identified by a label or arrow at least once in the figures. Some of the features can be seen with the naked eye, but others would require the degree of magnification which can be achieved when specimens are examined under the microscope, or photos have been transferred to a computer - assuming the photos have been taken at an adequate resolution. Specimens can be manipulated, to observe features visible from different angles, but photos cannot. For this reason, multiple features have been used in the key to distinguish the species which are more difficult to recognise, so that if one feature is not visible in a photo, others hopefully are. The likelihood of identifying a *Volucella* species from photos is increased if it is photographed both laterally and dorsally. Principal diagnostic features, which can be used to the exclusion of supplementary features, are stated first, in each half of the couplets of the key. Supplementary features, for use if the principal features cannot be seen, are italicised in the key and enclosed within squared brackets, after the principal features. Keys to colour varieties are provided following the key to species.

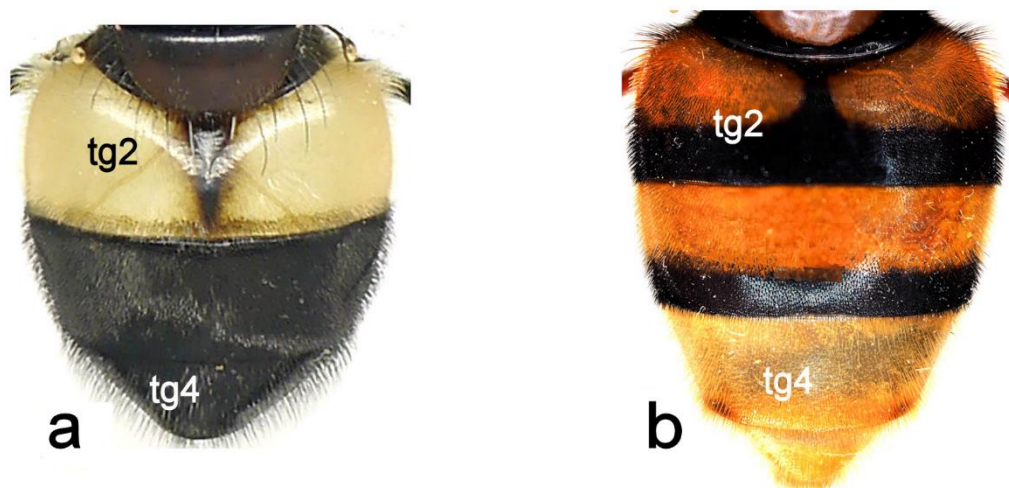
### Key to *Volucella* species, October 2023

- 1** Hairs and general body surface colouration providing no resemblance to bumblebees (*Bombus*): Figs. 4 - 14; posterior margin of the scutellum with long bristles: Figs. 15b, 18d, 18e, 20c, 20e, 22b ..... **2**  
---- general body surface covered in long, dense hair, exhibiting colour patterns providing a close resemblance to bumblebees: Figs. 1 - 3; posterior margin of the scutellum without bristles: Figures 15a, 15c ..... **bombylans**
- 2** Abdomen with tergite 4 entirely black: Figs. 16a, 18d, 18e (also Figs. 8 - 11) ..... **3**  
---- tergite 4 extensively pale brownish yellow: Figures 4, 5, 6, 7, 12, 13, 14, 16b, 19d, 19f, 22c ..... **4**
- 3** The hairs on the dorsal surface of the abdomen are all brownish yellow: Figs. 8, 9, 18d; male: the dorsal surface of the thorax (mesoscutum and scutellum) is covered in long, tawny-brown hairs; female: the eyes are hairy and the frons is broad, the distance between the anterior margin of the frons and the ocellar triangle is less than 3 times the width of the frons where it reaches the anterior ocellus: Fig. 18b [*head, in side view: frons projecting forwards as much, or almost as much, as the facial prominence and facial prominence located at level of ventral margin of eye: Figs. 17a, 17b; tergite 2 is mostly pale orange/yellow-brown: Figs. 8, 9, and 18d; sternite 2 has a large, median black mark, anteriorly, with the rest of the sternite pale yellow: Fig. 18a; eyes hairy in the male*] ..... **inflata**  
---- the hairs on abdominal tergites 3 and 4 are all black: Figs 10, 11, 16a, 18d; male: the thorax is dorsally covered in black or dark brown hairs, with or without short, pale grey hairs intermixed: Figure 15b; female: the eyes are bare and the frons is narrow, the distance between the anterior margin of the frons and the ocellar triangle is more than 4 times the width of the frons where it reaches the anterior ocellus: Fig. 18c [*head, in side view: frons projecting forward only about half as far as the facial prominence and facial prominence located distinctly above ventral margin of eye: Figs. 17c, 17d; tergite 2 almost entirely milky white and sternite 2 entirely milky white; male with hairy eyes*] ..... **pellucens**
- 4** The third article of the antenna is less than twice as long as deep: Fig. 19b; ventral surface of the abdomen with sternite 2 partly or entirely black: Figs. 19e, 19f, 22c, 22d [*length of the scutellum hardly more than half of its width, shiny, its dorsal surface almost flat, with distinct margins: Figs. 20d, 20e, 22a, 22b; wings with, or without, distinct brown blotches*] ..... **5**  
----the third article of the antenna is more than twice as long as deep: Fig. 19a; sternite 2 is entirely pale brownish-yellow: Figs. 19c, 19d [*length of the scutellum almost two thirds of its width, its dorsal surface dull, convex, without defined margins anteriorly or laterally, making it globular in appearance: Figs. 20b, 20c; wing membrane with a distinct brown blotch usually present close to the wing tip: Figs. 6, 7, 20a, and with or without another blotch approximately half way from the base of the wing, close to its anterior margin: Fig. 20a, this second blotch being confined within the anterior third or less of the wing surface; male: the median distance between the anterior margin of the frons and the eyes is distinctly longer than the distance the eyes are in contact: Fig. 21a; female: at the location of the ocellar triangle the distance between the eyes is less than 3 times the width of the ocellar triangle: Fig. 21d; tergite 5 of the female usually with a fringe of black, bristly hairs along its posterior margin: Fig. 7*] ..... **inanis**

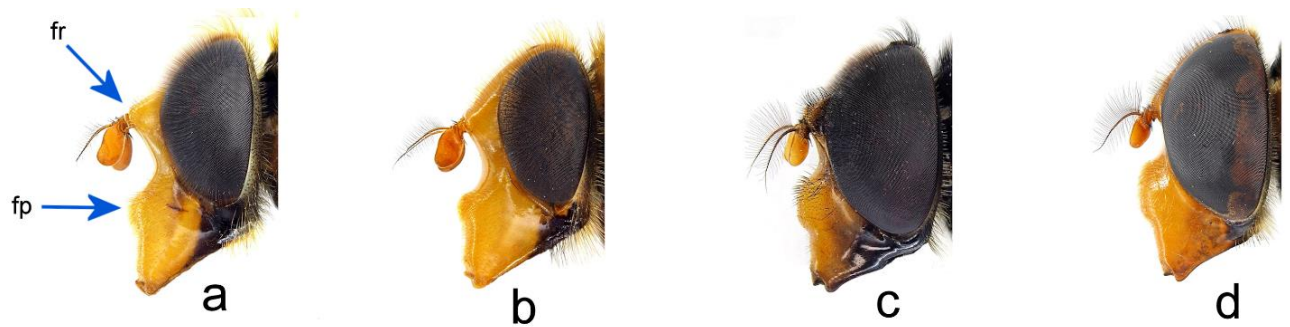
5 Middle of the wing without a brown blotch: Figs. 12 - 14 (though usually the membrane is mostly yellow/yellow-brown in the female and narrowly brown along the wing veins in the male) [male: the median distance between the anterior margin of the frons and the eyes is distinctly longer than the distance the eyes are in contact: Fig. 21b; female: at the location of the ocellar triangle, the distance between the eyes is 3 times the width of the ocellar triangle: Fig. 21e; tergite 5 yellow haired, without a fringe of black, bristly hairs along its posterior margin: Figs. 13, 16b] ..... **zonaria**  
 ---- wing membrane with a large, distinct brown blotch centrally, extending from the anterior margin of the wing to within the posterior half of its surface; apically, the wing membrane is only slightly darker than its surrounding pale, grey-brown colour: Figs. 4, 5 [male: the median distance between the anterior margin of the frons and the eyes is shorter than the distance the eyes are in contact: Fig. 21c; female: at the location of the ocellar triangle the distance between the eyes is slightly less than 3 times the width of the ocellar triangle: Fig. 21f] ..... **elegans**



**Figure 15**  
**a** = *Volucella bombylans*, scutellum, dorsal view; **b** = *V. pellucens*, male, mesoscutum and scutellum, lateral view; **c** = *V. bombylans*, male, mesoscutum and scutellum, lateral view  
 [ms = mesoscutum; sc = scutellum]

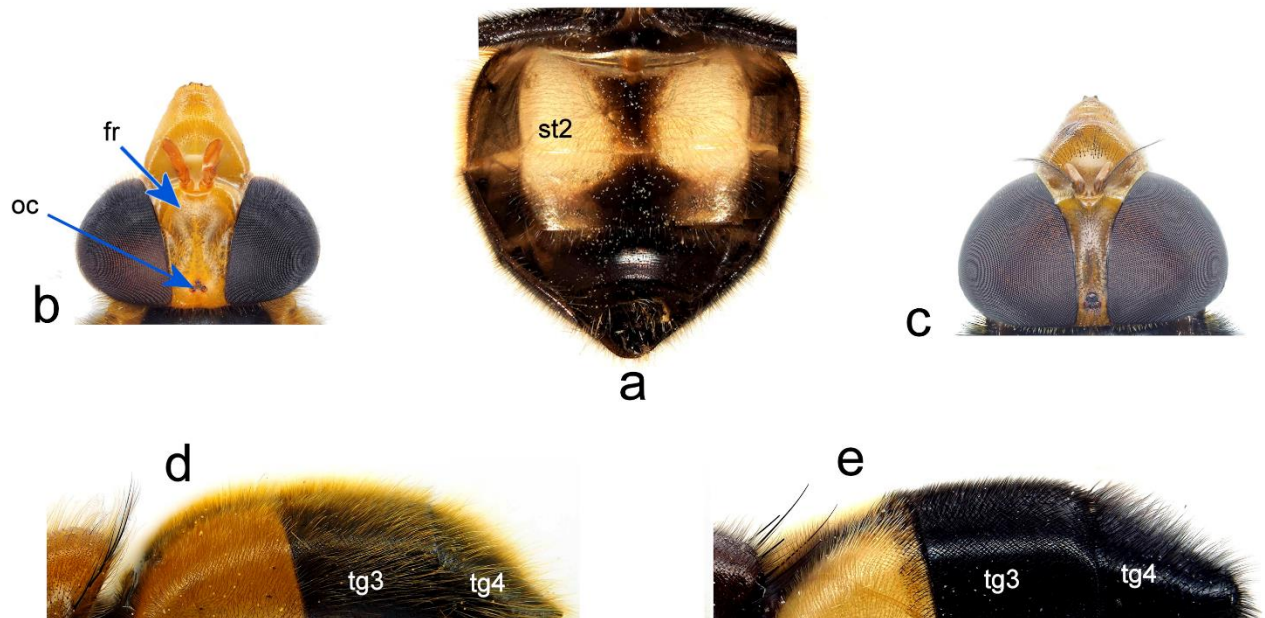


**Figure 16**  
**a** = *Volucella pellucens*, abdomen, dorsal view; **b** = *V. zonaria*, abdomen, dorsal view  
 [tg2 = tergite 2; tg4 = tergite 4; arrow indicates bristles on posterior margin of scutellum]



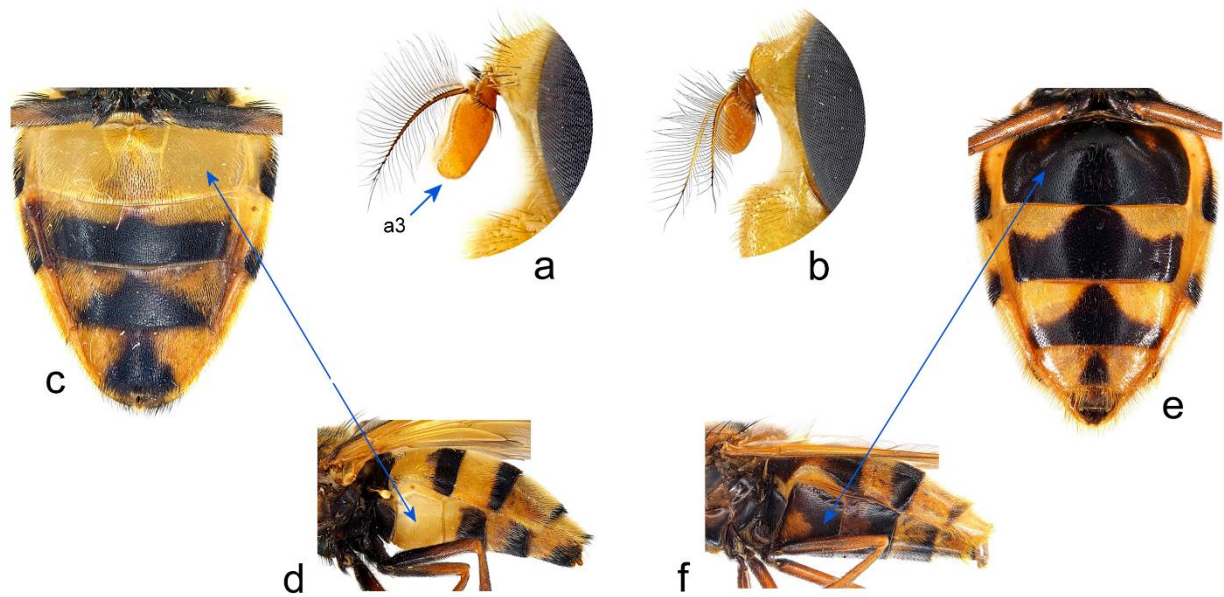
**Figure 17**

**a, b** = *Volucella inflata*, male (**a**) and female (**b**), head, lateral view; **c, d** = *V. pellucens*, male (**c**) and female (**d**), head, lateral view [fp = facial prominence; fr = frons]



**Fig. 18**

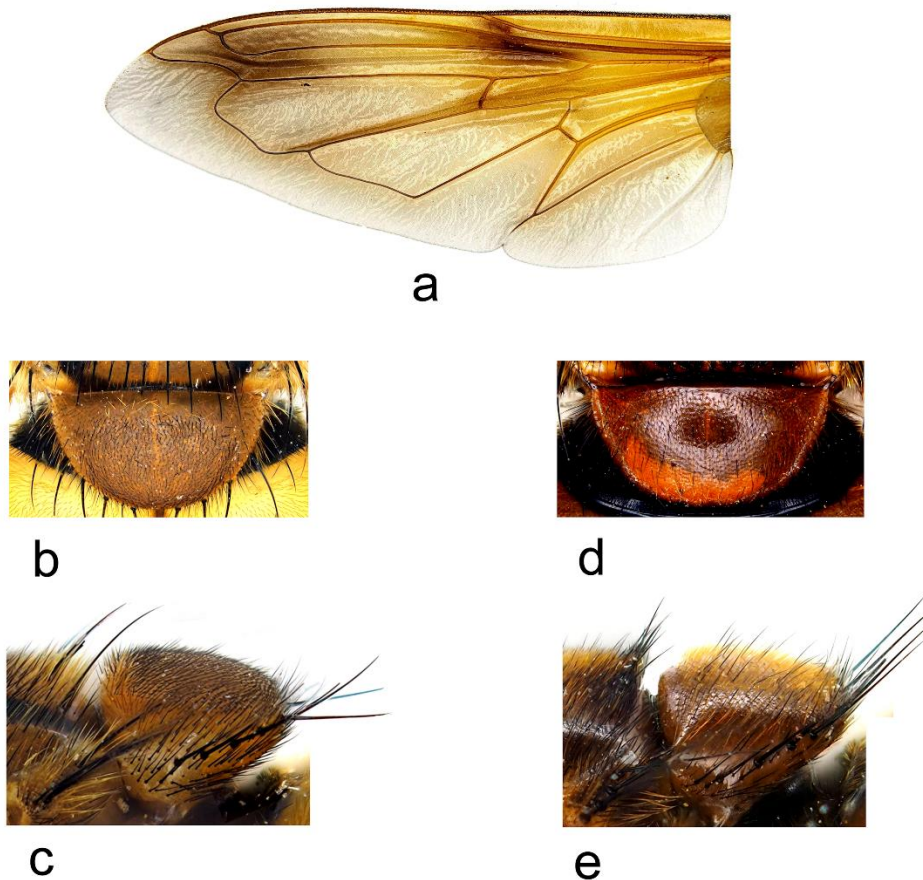
**a** = *Volucella inflata*, abdomen, ventral; **b** = *V. inflata*, female, head, dorsal; **c** = *V. pellucens*, female, head, dorsal; **d** = *V. inflata*, male, tergites, lateral; **e** = *V. pellucens*, male, tergites, lateral  
[fr = frons; oc = ocellar triangle, with one anterior ocellus and two posterior ocelli; st2 = sternite 2; tg3 = tergite 3; tg4 = tergite 4]



**Figure 19**

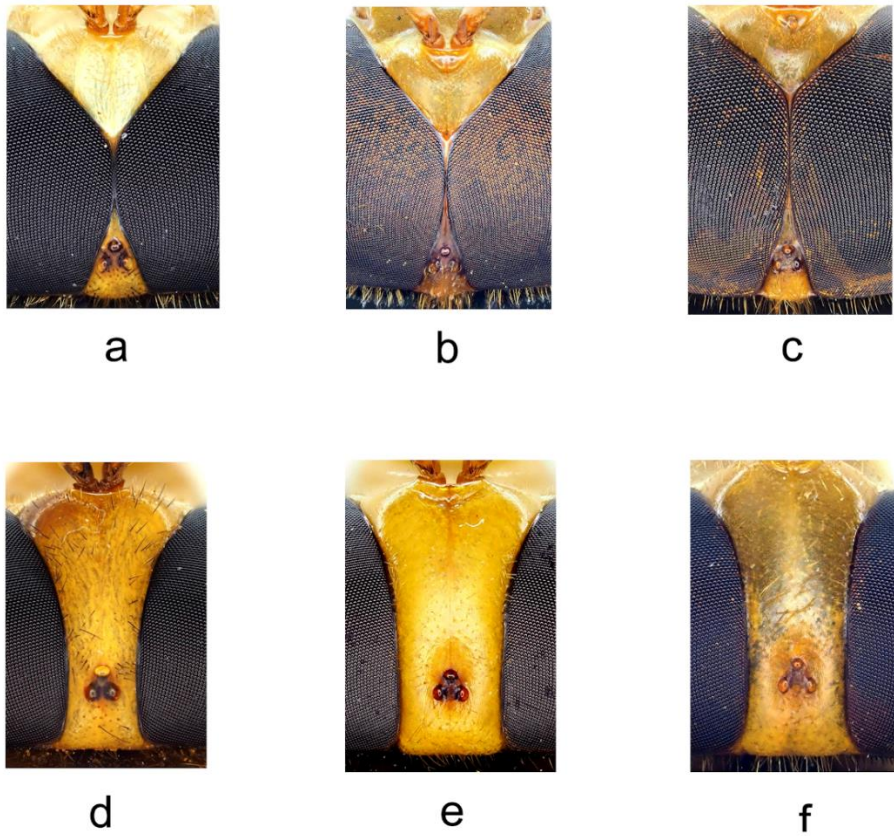
**a** = *Volucella inanis*, male, antenna and anterior part of face and frons; **b** = *V. zonaria*, male, antenna and anterior part of face and frons; **c, d** = *V. inanis*, abdomen, ventral (**c**), and lateral (**d**); **e, f** = *V. zonaria*, abdomen ventral (**e**) and lateral (**f**)

[a3 = third article of the antenna; arrows on **c, d, e** and **f** indicate sternite 2]



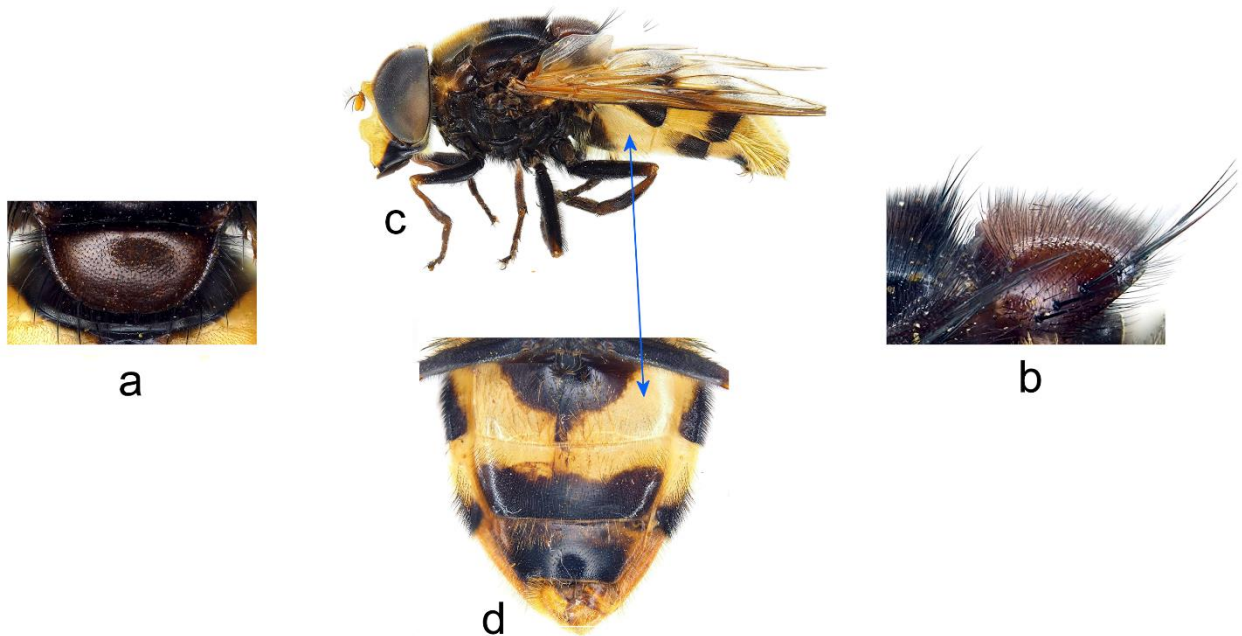
**Figure 20**

**a** = *V. inanis*, wing variant with antero-median brown blotch; **b** = *V. inanis*, scutellum, dorsal; **c** = *V. inanis*, scutellum, lateral; **d** = *V. zonaria*, scutellum, dorsal; **e** = *V. zonaria*, scutellum, lateral;



**Figure 21**

**a** = *V. inanis*, male, central part of head, dorsal view; **b** = *V. zonaria*, male, central part of head, dorsal view; **c** = *Volucella elegans*, male, central part of head, dorsal view; **d** = *V. inanis*, female, central part of head, dorsal view; **e** = *V. zonaria*, female, central part of head, dorsal view; **f** = *V. elegans*, female, central part of head, dorsal view



**Figure 22**

**a – d** = *Volucella elegans*; **a** = scutellum, dorsal view; **b** = scutellum, lateral view; **c** = male, lateral view; **d** = male, abdomen, ventral view

### Colour forms of *Volucella bombylans*

**A** Thorax black haired; abdomen without a pair of yellow markings on tergite 2: Figs. 1, 3 ..... **B**  
---- thorax laterally yellow-haired; tergite 2 with a pair of yellow markings: Fig. 2 ..... *bombylans* var. *plumata*

**B** Tergites 2 and 3 black haired; tergite 4 mostly orange-haired: Fig. 1 ..... *bombylans* var. *bombylans*  
---- at least tergite 4 and part of tergite 3 pale brownish-yellow haired and often tergite 2 partly pale brownish-yellow haired also: Fig. 3 ..... *bombylans* colour form recorded on the Aran islands and sporadically elsewhere in Europe

### Colour forms of *Volucella zonaria*

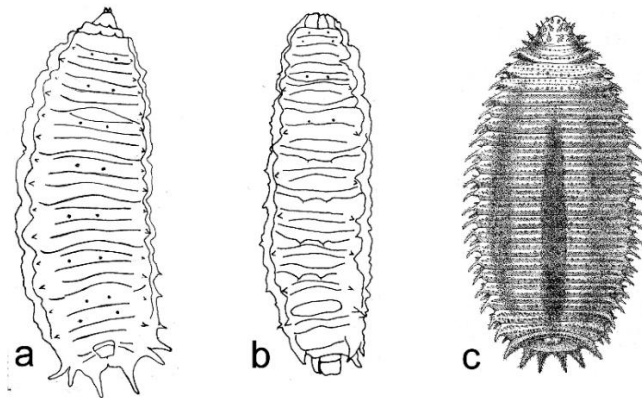
The black band across tergite 3 occupying less than half the length of the tergite: Figs. 12, 13, and with its anterior margin usually straight (there may be a small, triangular, median extension) ..... *zonaria* var. *zonaria*  
---- the black band across tergite 3 occupying more than half the length of the tergite and its anterior margin with a broad, median extension which reaches the anterior margin of the tergite: Fig. 14 ..... *zonaria* var. *beckeri*

### Finding *Volucella* species

As adult flies, *Volucella* species visit the flowers of a wide range of small trees, shrubs and herbaceous plants. Most of the flowers they visit produce nectar, as well as pollen, though they are known to visit some pollen-only flowers, like the dog rose (*Rosa canina*). *Volucella inflata* is an insect of deciduous forest and in flight during the Spring, it is primarily a visitor to the flowers of trees and shrubs. But it can also be found at sap runs on old, broad-leaved trees. The other *Volucella* species don't visit sap runs and are more frequently seen on the flowers of tall herbaceous plants, like umbels and thistles, as well as bramble (*Rubus fruticosus*) and shrubs like *Buddleia*. *Volucella inanis* shows a preference for pink or blue flowers, such as *Epilobium*, *Eupatorium*, *Knautia*, *Mentha*, *Scabiosa*, *Succisa* and *Valeriana*. Both *Volucella inanis* and *V. zonaria* can occur quite late in the year, to be seen together on the flowers of ivy (*Hedera*).

Finding *Volucella* larvae is more difficult. The larva of the Iberian species, *Volucella elegans*, remains unknown. The larvae of all but one of the other European species inhabit the nests of wasps (*Vespula*), hornets (*Vespa*) or bumble bees (*Bombus*). The exception is *Volucella inflata*, which is not known in Ireland but has scattered records from southern England, whose larvae occur under the bark of oak trees, in sap-enriched debris and frass in the tunnels of goat moth caterpillars and other accumulations of fermenting sap and sap runs. While it is believed that the larvae of *V. inflata* remain microphagous detritivores throughout their development, the other *Volucella* larvae, even if initially scavengers in the debris on the floor of the nest cavity of their hosts, become more predatory as they develop towards maturity, feeding on the larvae of their hosts. By the time this happens it is late in the year and the nests of their hosts are becoming moribund. It is shortly after the wasps or bumble bees inhabiting a nest have all died that *Volucella* larvae are most easily found, by sifting through the remains of the nest. The literature on which aculeates host *Volucella* larvae in their nests has been comprehensively reviewed in Barkemeyer (1997). The *Volucella* species that inhabits bumble bee nests is the bumble bee mimic *V. bombylans*. Among the European bumble bee species known in Ireland, it has been found (in continental Europe and Britain) with *B. jonellus*, *B. lapidaries*, *B. muscorum*, *B. pascuorum*, *B. ruderatus* and *B. sylvarum*. There are no references to its occurrence in *Bombus lucorum/magnus* nests. *Volucella pellucens* larvae occur in the nests of the wasps *Vespula germanica*, *V. rufa* and *V. vulgaris*. The larva of *Volucella zonaria* is known to occur in nests of the wasps *Vespula germanica* and *V. vulgaris*, and in nests of the European hornet, *Vespa crabro*. As an adult insect *Volucella zonaria* has a vague resemblance to the European hornet, though neither in its flight nor behaviour does it mimic the hornet. *Volucella zonaria* and *V. inanis* are the only European *Volucella* species known to inhabit the nests of *Vespa crabro* as a larva, but neither of them appears to be dependent on the hornet as its larval host, so an absence of the European hornet from Ireland is unlikely to limit their occurrence here. *Volucella inanis*, which occurs widely in southern England, has not yet been found in Ireland, but its occurrence might be anticipated. It occurs in the nests of both *Vespula germanica* and *V. vulgaris*, as well as with the hornet. It shows a preference for using nests of *V. germanica* that are high off the ground, for instance in the attics of houses, and in consequence is a hoverfly of suburbia, as well as more rural habitats. The larva of *Volucella inanis* is the most consistently predatory of European *Volucella* larvae, feeding on wasp larvae in their larval nest cells during most of its development. Unlike the larvae of other *Volucella* species inhabiting wasp or bumble bee nests, the larvae of *V. inanis* are smooth-bodied and cylindrical, as can be

seen in the photo provided in Ball and Morris (2013). The others are rather flattened and, particularly in the case of *V. pellucens* and *V. zonaria* larvae, covered in spikes (as shown in Figure 19c). The spikes can entrap a coating of debris, making the larva less noticeable. At maturity, larvae of *V. zonaria* reach 26 mm in length, and, when extended, almost 3.0 cm. Photographic records of *Volucella inanis* larvae would seem quite possible, given their characteristic appearance. *Volucella bombylans* likewise, coupled with knowledge of their source in a *Bombus* nest. Identification of the larvae of *Volucella pellucens* and *V. zonaria* from photos would be considerably more difficult, given the minute morphological differences which separate them (see Rotheray, 1999) – only the largest larvae could probably be consigned to *V. zonaria*.



**Figure 23:** *Volucella* larvae, dorsal view; **a** = *V. bombylans*; **b** = *V. inflata*; **c** = *V. pellucens/zonaria* (the larvae of these two species are only distinguishable using features not visible at this magnification).  
(Figs. 23a and 23b after Rotheray, 1999; Fig. 23c after Fraser, 1946)

#### Thanks

The comments of Thomas Lebard and Gaël Pétremand greatly improved the key, during course of its development.

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