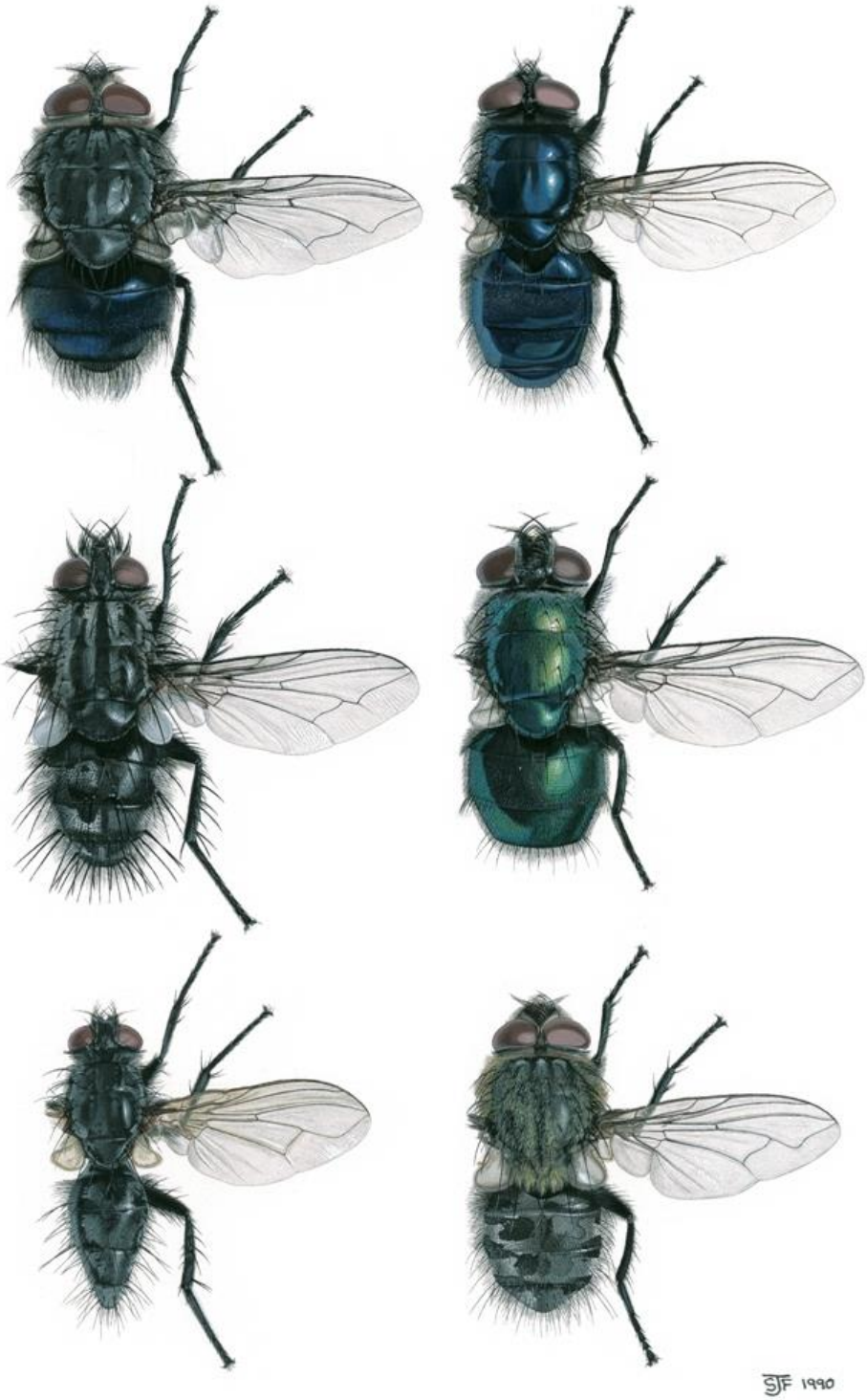
BRITISH BLOWFLIES (CALLIPHORIDAE) AND WOODLOUSE FLIES (RHINOPHORIDAE)

DRAFT KEY March 2016



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PREFACE

This informal publication attempts to update the resources currently available for identifying the families Calliphoridae and Rhinophoridae. Prior to this, British dipterists have struggled because unless you have a copy of the Fauna Ent. Scand. volume for blowflies (Rognes, 1991), you will have been largely reliant on Van Emden's 1954 RES Handbook, which does not include all the British species (notably the common *Pollenia pediculata*), has very outdated nomenclature, and very outdated classification - with several calliphorids and tachinids placed within the Rhinophoridae and *Eurychaeta palpalis* placed in the Sarcophagidae.

As well as updating keys, I have also taken the opportunity to produce new species accounts which summarise what I know of each species and act as an invitation and challenge to others to update, correct or clarify what I have written. As a result of my recent experience of producing an attractive and fairly user-friendly new guide to British bees, I have tried to replicate that approach here, incorporating lots of photos and clear, conveniently positioned diagrams. Presentation of identification literature can have a big impact on the popularity of an insect group and the accuracy of the records that result. Calliphorids and rhinophorids are fascinating flies, sometimes of considerable economic and medicinal value and deserve to be well recorded. What is more, many gaps still remain in our knowledge. We still do not know the biology of the common *Melanomya nana*, and biological information for our common *Pollenia* species is a mess due to unreliable past identification (with much information being uncritically assigned to *'P. rudis'*). Other species may be increasing or declining, and we (the entomological and conservation communities) need to keep an eye on this, particularly in the light of climate change and the impact that this could have on some of our boreal species in particular e.g. *Calliphora uralensis* and *Bellardia pubicornis*.

In addition to this publication, there is a wealth of useful information on Calliphoridae and Rhinophoridae available freely on the web and this has been listed in the References & further reading sections further on. This includes my own Flickr site, which furnishes many more photos of living calliphorids and rhinophorids plus carefully taken microscope shots designed to show key features. In essence it provides a virtual field experience plus a virtual museum collection covering almost every British species.

INTRODUCTION

Classification

The classification within individual families is discussed under those families, but at the highest level, calliphorids and rhinophorids sit within the the following hierarchy:

- **Order: Diptera**
- **Suborder: Brachycera**
- **Infraorder: Muscomorpha**
- **Subsection: Calyptratae**
- **Superfamily: Oestroidea**

The most closely related familes (i.e. the other families of the superfamily Oestroidea) are:

- **Mystacinobiidae** - represented by a single species, the New Zealand Bat Fly *Mystacinobia zelandica*, a wingless species associated with bats which is endemic to New Zealand.
- **Oestridae** - bot flies, warble flies and their relatives - winged and strong-flying species with vestigial mouthparts, their larvae developing as internal parasites of mammals. More closely related to some calliphorids than the family status would imply and with some life cycles that resemble those of calliphorid 'screwworms'.
- **Sarcophagidae** - a large and diverse family that includes fleshflies (with larvae that develop variously in carrion, excrement, living invertebrate hosts etc.) plus the satellite flies that are cleptoparasites and parasitoids of bees and wasps.
- **Tachinidae** - a huge and diverse family of parasitic flies, some closely resembling calliphorids. The larvae developing internally within other insect larvae e.g. caterpillars, or even adult bugs and beetles, depending on the species.

However, it should be noted that this is a disputed classification because the Calliphoridae does not appear to be monophyletic, and its evolutionary relationship is entwined with some of the above families, notably Oestridae (Rognes, 1997).

Collecting and recording

Collecting calliphorids and rhinophorids
There are essentially three approaches to recording flies such as calliphorids and rhinophords:

- **Active collecting/recording** - which can involve netting or visual identification in the field, the latter being possible for many species once experience has been gained.
- **Passive collecting/trapping** - using devices such as water traps (pan traps), malaise traps and bait traps to attract and automatically catch adults.
- **Rearing** - by taking items potentially containinng larval stages e.g. hosts such as snails, earthworms and woodlice, or carrion, and seeing what species

emerge. This technique can also be extended to get species to oviposit on bait traps or deliberately supplied hosts.

All three can be highly active and have attributes. Active collecting can be 'freeform', allowing you to interrogate all parts of a site and observe adult behaviour and distribution within a site. Trapping can provide hard numerical data and is a more standardised and replicable approach that can also save time. Rearing can elucidate larval requirements and relationships with host taxa.

The best type of net to use is a long-handled insect net with a 40cm diameter net frame bearing a white, nylon net bag. The best handles are fishing landing net poles which can be extended from 1.5 metres to perhaps 2.5-3 metres depending on the model. This type of net arrangement can be used both to spot-capture an individual fly or to sweep flowers, foliage and herbage to obtain specimens. Because many blowflies are skittish and fast-flying, a long handled net that keeps your body further away can be a lot more productive than a short-handled kite net, though kite nets can be useful in more confined settings, gardens etc.

Sweeping with a long-handled insect net

Because many blowflies are in regular contact with carrion or excrement, it is not advisable to pooter them up, unless you use a mechanical pooter. Netted flies are best transferred to glass tubes or to a killing jar. I generally grab them with my fingers and put them in a killing jar, because they can damage their wings or become damp (and discoloured) if kept in a small glass tube for any amount of time. But remember that your hand is then a potential health hazard, so keep it away from your face and any food or drink you have. If you have some water and antiseptic wipes, it is easy to clean your hands in the field following handling of blowflies.

The best killing agent is ethyl acetate but you can also employ the old-fashioned technique of using crushed Cherry-laurel leaves in a killing jar, or freezing your catch overnight.

Where and when to look

Some calliphorid and rhinophorid species are fairly habitat specific or geographically restricted, so you need to be in the right place before you can even contemplate searching for them e.g. submontane parts of the Scottish Highlands for species such as *Calliphora stelviana* or a coastal areas of NW Scotland for *C. uralensis*. But the vast majority of species are much more widespread and catholic in their habitat choice and can be encountered in many places.

Many calliphorids and rhinophorids like to sunbathe on foliage in sheltered spots, so scrutinising bramble foliage and the foliage of sunny woodland rides and hedges can be rewarding. Sunlit walls, tree trunks and rocks can be good too. Many species like to visit flowers, and umbellifers such as Hogweed, Angelica, Wild Carrot and Wild Parsnip can be particularly good, also composites such as Fleabane, ragworts, thistles, mayweeds and Oxeye Daisy. Autumn-flowering Ivy can be exceptionally good for *Calliphora* and *Pollenia* species where it is in warm sheltered spots. In spring, blossoming willows, Blackthorn, cherries, plums, apples and hawthorns are much used.

Ivy flowers in sheltered and sunny locations are one of the best places to see concentrations of blowflies representing a variety of species

Adult females usually require a proteinaceous meal to mature their eggs, and will visit fresh excrement and carrion specifically for this purpose. Carrion is also where you will find egg-laying females of *Calliphora*, *Cynomya*, *Lucilia* and *Protophormia* species.

Wetlands are the preferred habitat of species such as *Lucilia bufonivora*, *L. silvarum*, *Angioneura* species and several *Pollenia* species. *Calliphora subalpina*, *Lucilia ampullacea* and *Paykullia maculata* prefer woodland and denser scrub. Synanthropic species that can be regularly found indoors include *Calliphora vicina*, *Lucilia caesar* and *Melanophora roralis*.

The best period to find and record blowflies is between early spring (when the first blossoms appear) and autumn (when the Ivy is flowering). But blowflies can still be evident in winter, especially hibernating clusterflies or the occasional winter-active *Calliphora vicina*.

Remember that you can records blowflies in the field in other ways too. A toad parasitised by *Lucilia bufonivora* has fairly distinctive symptons. If you are an ornthologist licenced to study nesting birds, you may spot the maggots of *Protocalliphora azurea* attached to a nestling. But do not record it on the basis of pupae in a nest, because these could just as easily belong to a *Calliphora* species that has used a dead nestling.

Pinning specimens

There are several ways of doing this. The one I prefer is to side pin them onto Plastazote using a single micropin (which come in assorted sizes) through the side of the thorax. In this orientation it is easier to pull out the male genitalia, female ovipositor and mouthparts and ensure that they dry in an exposed position to allow easy checking. When the specimens are dry and 'set' (usually within a week), they can be staged. To do this, you take a short strip of Plastazote (perhaps 10mm x 3mm x 3mm depending on the size of the specimen) and place a long, headed pin (ideally 40mm) though one end and place your pinned specimen at the other end. A locality label can then be placed on the long pin. This approach is better than placing the main long pin directly through a specimen because once a specimen is brittle, any flex in the pin could damage it. It is also difficult to use long pins for tiny species such as *Angioneura* and *Melanomya* species or the smaller rhinophorids.

A staged Lucilia male (left). Part of the authors calliphorid collection, which is kept in storeboxes (right)

A variation upon the above theme is to pin specimen butterfly-style by placing the micropin through the top of the thorax to one side of the midline so that the bristles on at least one side of the thorax remain undamaged. The wings and legs can then be made to dry in the desired fashion using further micropins to hold them in place until they are set. This can create a very neat and nice-looking specimen, though it is almost impossible to get the genitalia to dry in an exposed position using this technique. The specimen is then staged as above, though a longer strip of Plastazote may be required.

Abroad, long pins are often used directly and inserted through the top of the thorax. If this approach is chosen, it is important that the storage container is lined with soft Plastazote rather than cork, because the pin is more likely to flex with the latter.

Storing specimens
Perhaps because of their size and odour, blowfly specimens are quite vulnerable to attack from pests such as *Anthrenus* carpet beetles (museum beetles), booklice and dust mites. It is therefore important that specimens are kept in tight-fitting containers. Wooden cabinets with good quality drawers or tight-fitting entomological storeboxes are best. It is important that these are kept away from direct contact with the floor (especially woollen carpets) and walls, because this will make it much more difficult for pests to gain access. Specimens should also be kept in fairly warm and dry locations, because damp will encourage mould, and this can quickly ruin a specimen.

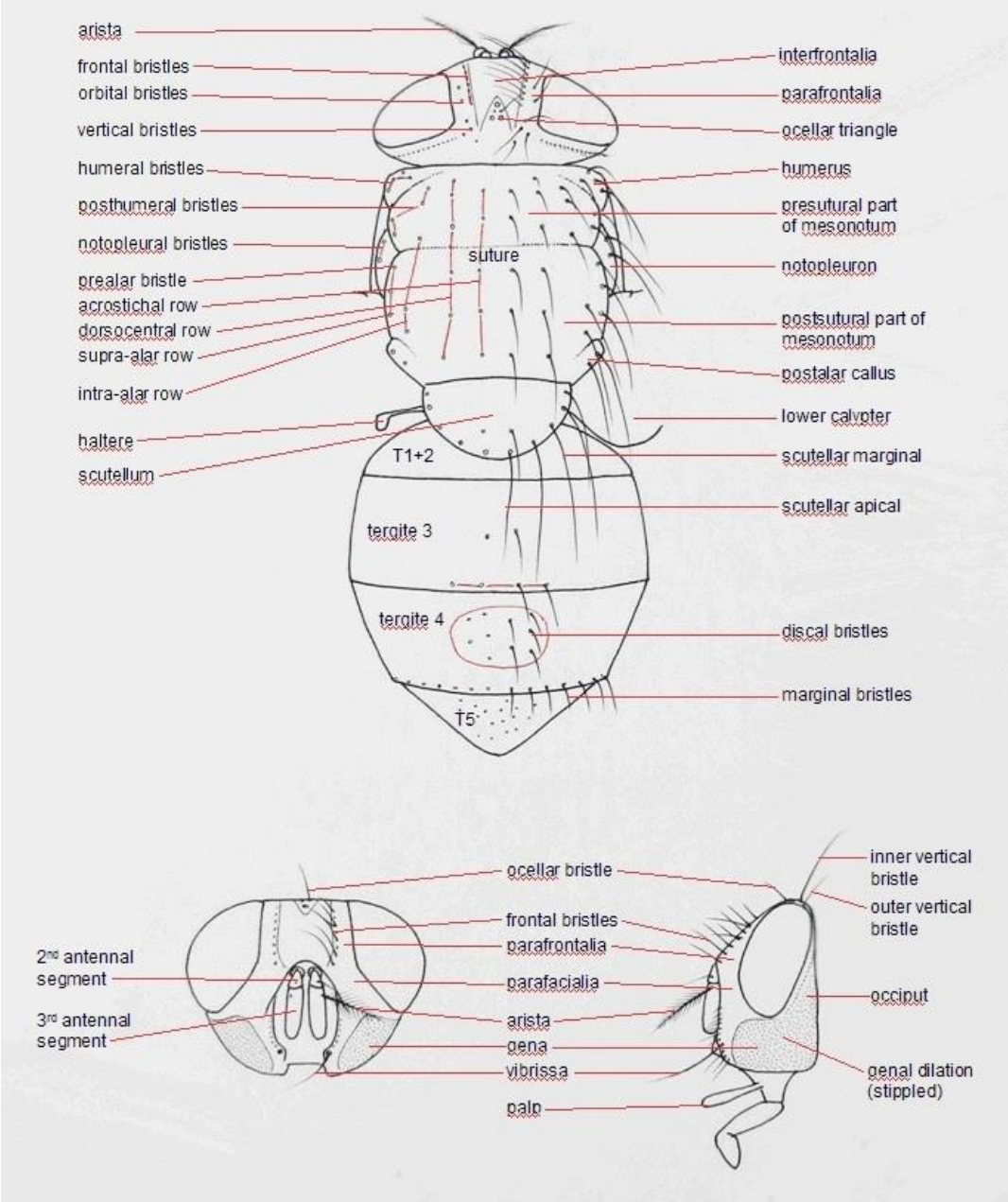
Body parts and glossary

The body is divided into three main sections, the head, thorax and abdomen. The thorax gives rise to a pair of wings, a pair of halteres, and three pairs of legs.

Head
This has a pair of large compound eyes on each side which are usually much more widely separated on top in females than males. They are separated at the top by the frons, which extends from the rear of the ocellar triangle (containing three small ocelli) to the lunule immediately above the antennal insertions. The frons comprises a pair of parafrontalia (orbits) immediately beside the eyes (usually silver-dusted) and a darker interfrontalia (frontal vitta) inbetween. The width of the frons and relative width of the parafrontalia and interfrontalia can be important in identification. Frontal bristles line the edges of the interfrontalia and several pairs of orbital bristles can be present along the parafrontalia. A pair of ocellar bristles arise from the ocellar triangle and an inner and outer vertical bristle is present close to the inner hind corner of each compound eye.

The back of the head is called the occiput and has a row of postocular bristles at the top and sides running parallel to the hind margin of the eye. The occiput merges into the genae (cheeks) below each compound eye, which contain a densely haired area called the genal (or occipital) dilation. The depth and colour of the genae can be important in identification. The sides of the face between the eyes and the facial ridges are called the parafacialia and are often heavily dusted. They can be bare, hairy or bristly. The oral opening at the bottom of the face has a pair of strong bristles called the vibrissae on either side at the front.

A pair of antennae arise from the top of the face immediately below the crescent-shaped lunule. Three major antennal segments are present, segment 1 (often termed the scape), segment 2 (often called the pedicel) and the long segment 3 (often called the first flagellomere). I have stuck to the most user-friendly terms here. The third segment bears a long arista which may be plumose (i.e. bearing long ray hairs),



Main body parts of a blowfly

pubescent (bearing short hairs) or virtually bear. The mouthparts bare a pair of palpi, the colour of which can be important for identification.

Thorax

This is a complex part of the body, but it is mostly the upper side that is used for identification, especially the arrangement of bristles here. The mesonotum dominates the top of the thorax and has a ridge (mesonotal suture) running across the middle that divides it into a presutural and postsutural area. Several bristle rows run down the mesonotum. The central two rows are called the acrostichals. A row of dorsocentrals is located on each side of the acrostichals and a row of intra-alars towards the sides of the mesonotum. Several supra-alars are present immediately above the wing bases, the front of which is called the prelalar. A swollen humerus (also known as a humeral callus) occurs at each front corner of the thorax and has three large humeral bristles and often several subsidiary anterior humeral bristles in front of these. On each side of

the mesonotal suture is another lobe called the notopleuron with a pair of large notopleural bristles. At each hind corner of the mesonotum is a narrow swollen lobe called the postalar callus which bears a pair of strong postalar bristles. The semicircular section of the thorax immediately behind the mesonotum is called the scutellum and has a pair of apical bristles and a variable number of strong marginal bristles around the edges, the number of which can be important in identification. The relative length of these can also be important in identification.

Abdomen

This is clearly segmented with tergites forming the top and wrapping themselves around the sides. The ventral sternites are located down the middle of the underside between the edges of those tergites. It is important be be aware that the first apparent tergite is actually a pair of fused tergites and is called tergite 1+2. This means that the apparent second, third and fourth tergites are actually tergites 3, 4 and 5. I have stuck with convention here to avoid conflict and confusion with other literature. Tergite 6 and sternite 6 onwards represents the genitalia. In the male this takes the form of a capsule that is retracted into the end of the abdomen and only unfolded during copulation. It contains a pair of cerci on either side of the anal opening and lateral claspers called the surstyli on either side of the cerci, the shape of both of which can be very important in species identification (see the diagrams for genera such as *Bellardia*, *Calliphora* and *Lucilia*). A single aedeagus is present (the equivalent of a penis), the shape of which is also useful for critical identification and taxonomy, though it has not been used in this work). It is important to ensure that the male genitalia dries in an exposed position when pinning and setting a male.

The female ovipositor takes the forms of a telescopic tube. It can be important in critical identifications and taxononic work but is only used for the separation of *Lucilia caesar* from *L. illustris* here. It is most easily examined in material stored in preservative.

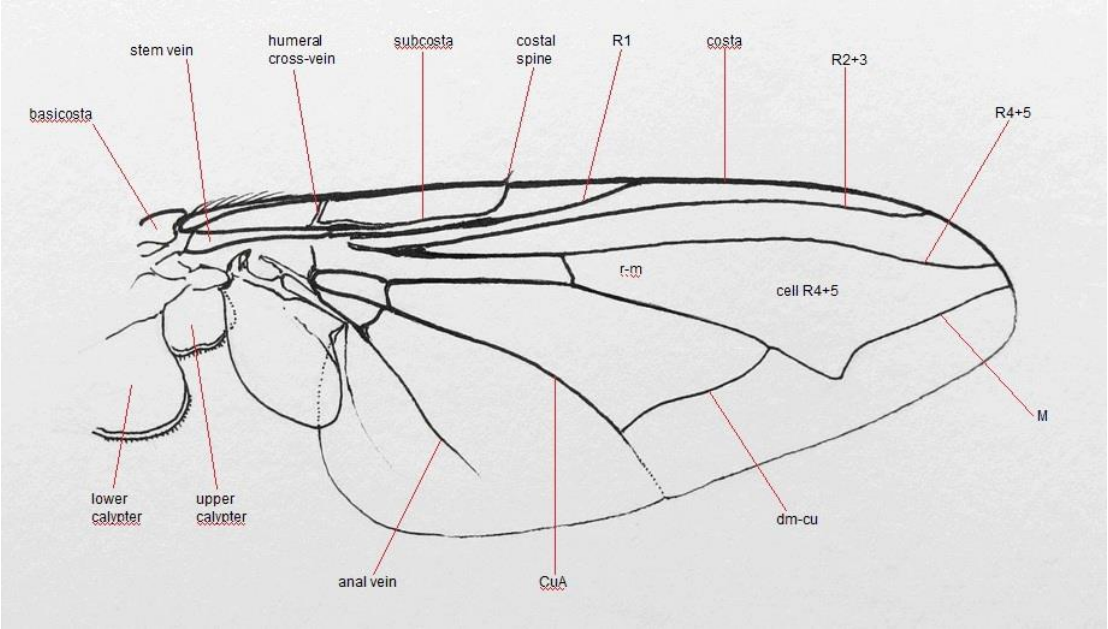
Wings

The wings of calliphorids and rhinophorids follow a standard oestroid pattern, with the final section of vein M (the section after cross vein dm-cu tending to be sharply upturned towards the wing tip. Exceptions occur in assorted rhinophords (and some tachinids) where vein M meets vein R4+5 before the wing tip to create a petiolate or stalked condition (see wing diagrams of species such as *Melanophoria* and *Stevenenia* later on). Some foreign rhinophorids (plus a number of British tachinids) have vein M straight which can invite confusion with flies of the family Muscidae and Anthomyiidae or even acalypterate flies). Various features of identification value can be present on the wings, including wing vein details, certain hairs, bristles and spines, plus patterns on the wing membrane. The shape of the lower calypter and its colour and presence of any hairs on its upper surface can also be valuable.

Legs

These comprise the usual components of fly legs i.e. a coxa, trochanter, femur, tibia and 5 tarsal segments terminating in a pair of claws. Features of value include the presence of certain bristles, leg coloration and the length and relative proportions of individual segments. Bristle orientation is named following a strict convention. If a leg was theoretically stetched to the side of the body, a dorsal bristle would face up, a ventral one down, an anterior one to the front and a posterior one to the rear. A

'posteroventral' bristle (e.g. those on the front tibiae of *Bellardia pandia*) is one that falls between a ventral and posterior orientation, and this rule can also be applied to posterodorsal, anterodorsal or anteroventral bristles.



Main features of a typical oestroid fly wing

Identifying oestroid families

1 Mouthparts vestigial, any oral opening less than one-tenth the head width.…….....….**Oestridae**
- Mouthparts obvious and oral opening at least one-fifth the head width.....…..2
2 Hypopleural bristles either absent or with hairs/weak bristles immediately below the hind spiracle.....**Muscoidea (Anthomyiidae, Fanniidae, Muscidae & Scathophagidae)**
- Hypopleural bristles strong and arranged as a neat row (Fig 1)...….....…..……3
3 Subscutellum (a convex pad below the scutellum) well formed (Fig 2).....**Tachinidae (except *Lithophasia*)**
- Subscutellum not well differentiated…….....…….……4
4 Inner edge of lower calypter diverging away from the sides of the scutellum when viewed from above (Fig 4)…….....……..…….....…....5
- Lower calypter with inner edge hugging the sides of the scutellum when viewed from above (Fig 3)..…….....……..…….....….9
5 Upper side of stem vein hairy along hind margin (p18, Fig 1). Species either metallic or with a strongly protruding lower face (p18, Fig, 2). Cell R4+5 always open.....**Calliphoridae in part**
- Upper side of stem vein bare. Species never metallic. Lower face never protruding except for *Rhinophora lepida* which has R4+5 stalked.....6
6 Cell R4+5 never open, vein R4+5 either stalked or meeting vein M at the wing margin (p 73, Figs 2-4).....7
- Cell R4+5 at least narrowly open (p 18, Figs 6-8).....8
7 A small, stout, shiny black species without any bristles on the tergites. R4+5 long-stalked. Wings clear.....***Litophasia hyalinipennis* (Tachinidae)**

- Slimmer species with obvious bristles on the tergites, at least marginals on tergites 3-5. R4+5 either short or long-stalked. Wings clouded or marked in some species.....**Rhinophoridae**

8 Scutellum yellowish apically. Tibiae, genae and at least tip of antennal segment 2 reddish.....**some *Tricogena rubricosa***

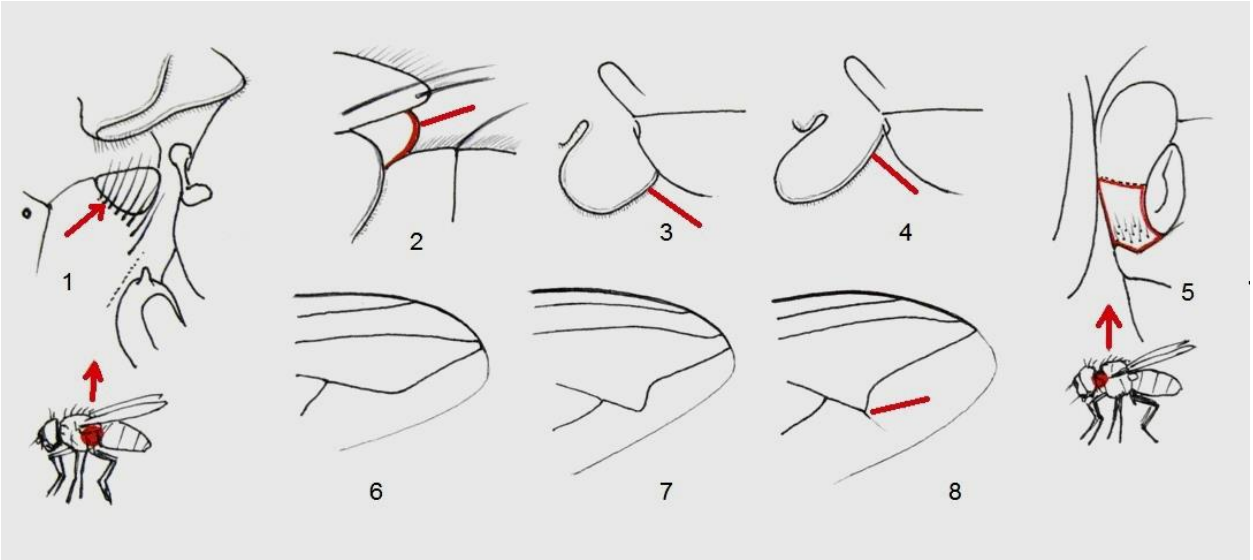
- Scutellum never yellowish apically. Tibiae, genae and antennae black.....**Calliphoridae in part**

9 Thorax with wavy golden or straw-coloured hairs somewhere on its surface, often rubbed off the dorsal surface but in this instance visible somewhere on the pleurae…….....…..….***Pollenia* (Calliphoridae)**

- No such hairs present anywhere on the thorax…….....…..8

10 Proepisternal depression setulose (Fig 5). Prosternum (the small chitinous plate between the base of the front coxae) hairy in most species (like p19, Fig 1). Vein M without a fold or appendix at the point of its upturn, the bend obtuse in some species and the upturned section either curved or straight (Figs 6 & 7). Some species metallic blue or green, at least on tergites.....**Calliphoridae in part**

- Proepisternal depression bare. Prosternum usually bare. Vein M sharply upturned and usually with a fold or small appendix at the bend, the uptuned section nearly always distinctly curved at the bottom (Fig 8). Never metallic..…**Sarcophagidae**



The flies most likely to be confused with blowflies in the field are other metallic-green or metallic-blue members of the families Muscidae and Tachinidae. Our two *Neomyia* species (Muscidae) are strikingly similar to *Lucilia* greenbottles and very common in pastoral habitats. Look out for the shiny green frons and the straighter upturned section of vein M. Another common muscid, the metallic-green *Eudasyphora cyanella* is somewhat less convincing due to the stripes on the mesonotum and the gently curved vein M. Our other *Eudasyphora*, *E. cyanicolor* is deep metallic blue and resembles a *Melinda* species in the field but has the same gently curved vein M as *E. cyanella* and a characteristic stripe of white dusting at the front of the mesonotum. The metallic-green tachinid *Gymnocheta viridis* is much more bristly than a *Lucilia*, and a rather different shape, with a smaller head and longer legs. It can be common sunbathing on tree trunks in spring.

Greenbottle look-alikes

The muscid Neomyia viridescens male (left and female (right) look very Lucilia-like but have a metallic-green frons that is especially obvious in the female.

The muscid Eudasyphora cyanella (left) has stripes at the front of the thorax unlike any Lucilia and vein M is more gently curved. The tachinid Gymnocheta viridis (right) is an altogether bristlier fly with longer legs than a Lucilia, and vein M more strongly curved.

Bluebottle look-alikes

The muscid Eudayphora cyanicolor male (left) and female (right) resembles a Melinda species but has a whitish median dust stripe at the front of the thorax and vein M gently curved.

CALLIPHORIDAE – BLOWFLIES

An extremely diverse family of flies that in Britain includes familiar bluebottles, greenbottles and cluster-flies plus some very different forms such as the rhinophorid-like genera *Angioneura*, *Eggisops* and *Melanomya* and the *Sarcophaga*-like *Eurychaeta*. Appearances can become even more striking abroad and it worth comparing our British fauna with that found in Australia, where *Calliphora* 'bluebottles' become non-metallic 'goldbottles' and some stunning metallic and patterned species can be found (see the *Brisbane Insects* website cited in the References).

In fact, there is general agreement that current concept of Calliphoridae is not a natural grouping with a single (monophyletic) origin, but is polyphyletic with several potentially good families e.g. Polleniidae, Helicoboscidae and Bengaliidae within a classification entwined with what remains of a monophyletic Calliphoridae plus the bot fly and warble fly family, Oestridae. Oestrids are are essentially specilaised calliphorids adapted to a parasitic lifestyle (Knut Rognes, 1997 and Systema Dipterorum). Concensus is currently lacking on how to resolve this conundrum. One option would be to be place the current concept of Calliphoridae within the Oestridae (an older family name), but this would have major nomenclatural implications for many economically and medically important species.

In the current polyphyletic arrangement recognised by the Global Biodiversity Information Facility (GBIF) the family contains nearly 1900 species in almost 200 genera with a distribtion that stretches from the arctic to various subantarctic islands. Diversity is highest in the Old World and a significant proportion of the New World fauna comprises introduced Old World species of genera such as *Chrysomya* and *Pollenia*. The British and Irish list currently comprises 38 species in 14 genera and 7 subfamilies (see Checklist at end). There has been considerable instability in British calliphorid nomenclature historically and this is untangled in the Name Change Navigator at the end.

Calliphoridae biology

Within the British fauna, life cycles fall mostly into one of three categories:

- **Carrion feeders and facultative myiasis agents**: *Calliphora*, *Cynomya*, *Lucilia* and *Protophormia*. These typically use carrion but will exploit wounds in living mammals (a phenomenon known as myiasis). Some of these species are a serious source of sheep fly-strike (myiasis of sheep). Others are important species in forensic entomology and medicinal maggot therapy.
- **Snail predators and parasites**: *Angioneura*, *Eggisops*, *Eurychaeta*, *Melinda* and possibly *Melanomyia*
- **Earthworm predators and parasites**: *Bellardia* and *Pollenia*

In addition to these, *Lucilia bufonivora* is an obligate internal parasite of amphibians (typically toads), *Protocalliphora azurea* has larvae that suck blood from bird nestlings and *Stomorhina lunata* has larvae that develop in locust egg pods. Most

species are oviparous but *Bellardia*, *Eggisops* and *Eurychaeta* are larviparous (viviparous). Much more information on the biology of British blowflies is provided by Erzinçlioglu (1996).

Many extra life cycles occur in foreign species, including species associated with ant nests and termite nests. Screwworms are the blowflies that cause subcutaneous myiasis of mammals including humans in warmer climes and use living rather than necrotic tissue. They include the Old World Screwworm *Chrysomya bezziana* in tropical and subtropical parts of Asia and Africa and the New World 'Primary' Screwworm *Cochliomyia hominivorax* of the New World tropics.

Erzinçlioglu (1989) discusses the origins of vertebrate parasitism (myiasis) in blowflies, arguing that it arose from saprophagous origins but has been much influenced by stock-farming and animal husbandry, with calliphorid myiasis being much rarer in truly wild mammal populations, but relatively frequent in domesticated stock and zoo animals, and involving facultatively parasitic calliphorid species that rarely attempt myiasis in more natural ecosystems.

Sheep fly-strike

Sheep fly-strike (also known as sheep-strike or blowfly strike) is the infection of live sheep by blowfly maggots. It can take place in an existing wound or can result from larvae burrowing into non-infected skin, especially where wool is badly soiled and contains skin flakes. Considerable loss of condition and even death can result and financial loss to sheep farmers can be considerable, so sheep fly-strike has been subject to considerable research. The main blowfly species involved in Britain are (in order of importance) *Lucilia sericata*, *L. caesar* and *Calliphora vomitoria*. Treatment is through the use of registered chemicals such as synthetic pyrethroids. As well as sheep, blowflies can occasionally infect other stock species plus pet species.

Lucilia species ovipositing on wool (Photo: Chris Raper)

Blowflies and forensic entomology

Human corpses can start to attract blowflies within hours of death. The process of maggot-assisted composition that then ensues can act as a biological clock, providing vital clues as to when a death occurred (the postmortem interval) plus other information that can assist an investigation. Analysis is not straightforward as variables such as temperature, weather and location all need to be accounted for. There is a huge amount of literature on the forensic use of blowflies.

Greenbottles, bluebottles and muscids on a fresh Wild Boar corpse (Photo: Olga Retka)

Maggot therapy using blowflies

The majority of blowflies that cause myiasis in mammals use necrotic rather than living tissue and it had been common practice in some cultures such as Australian Aborigines and Mayan Indians to dress septic wounds with such maggots to prevent the spread of gangrene. The maggots not only eat and remove the necrotic tissue but also produce anti-bacterial secretions that can reduce or eliminate the infection. In World War 1, maggot therapy was used in a deliberate fashion as a quick and cost-effective technique for treating infected wounds. But maggot therapy remains important today (including within Britain where it is available through the NHS), especially as some antibiotic-resistant strains of bacteria are difficult or expensive to treat in any other way. Maggot therapy is especially useful for pressure ulcers, diabetes-related foot ulcers and infected burns. The main blowfly species used are *Lucilia sericata* and *Protophormia terraenovae*. The maggots are disinfected before use and are usually kept in the wound using a bag that prevents escape of the maggots whilst still allowing oxygen to reach them. Treatment typically lasts a few days, is relatively cheap and can often be undertaken at home rather than in a hospital.

Calliphoridae identification

The keys presented here only cover the British species. However, it is useful to be aware of species that occur in Europe or synanthropic species in other parts of the world. There is a good chance that some of these species will arrive and maybe even establish in Britain. A number of widespread North American blowflies appear to be European imports, and there is no reason why some of theirs (e.g. *Calliphora livida*) might not end up here establishing populations around airports. Maybe they have arrived already. How often are the blowfly populations of ports and airports screened? Useful foreign accounts include:

- Fennoscandia and Denmark: Rognes (1991)
- Netherlands, Belgium and Germany: Huijbregts (2002) - a useful list but no keys
- Norway: Rognes online account
- European species of forensic importance: Szpila online (undated)
- Middle East: Akbarzadeh et. al. (2015)
- North America generally: Whitworth (2006)
- Eastern Canada specifically: Marshall et.al. (2011)

Key to calliphorid genera

1 Stem vein with long hairs above along rear edge (hairs pale in *Stomorhina* so easily overlooked) (Fig 1). Lower calypters with inner edge diverging away from the sides of the scutellum (Figs 3 & 4)…….....2

\- Stem vein bare above. Lower calypters with inner edge usually hugging the sides of the scutellum (Fig 5)…….....……..……..5

2 A non-metallic species with lower face strongly produced (Fig 2) and mesonotum strongly striped with grey and black. Male second and third tergites with large orange patches laterally...…….....……..***Stomorhina lunata***

\- Metallic blue or green species without a strongly produced lower face. Mesonotum not dusted as above…….....……..……..……3

3 Acrostichals barely differentiated from the hairs of the mesonotum. Calypters smoky grey-brown with darker brown rims. Body dark metallic blue in both sexes without any obvious dusting..……..……***Protophormia terraenovae***

\- Acrostichals well differentiated. Calypters whitish or yellowish-grey, usually without much darker rims (though the hair fringe these give rise to may be darker). Mesonotum usually with obvious pale dusting, at least at the front when viewed from behind, the body either dark metallic blue or with green-turquoise reflections…….....…….4

4 Inner edge of lower calypters diverging strongly from scutellum when viewed from above (Fig 3). Acrostichals longer, mostly equal to the length of the scutellum. Antennae, basicostae and anterior thoracic spiracles blackish or brownish. Male eyes separated by about 1.5 times the width of a third antennal segment…….....…..***Protocalliphora azurea***

\- Inner edge of lower calypter not diverging so strongly from the scutellum when viewed from above (Fig 4). Acrostichals shorter, mostly about half the length of the scutellum. Basicostae and anterior thoracic spiracles pale brown or orange, the

antennae also partly reddish. Male eyes separated by about half the width of a third antennal segment.……..…….…..….***Phormia regina***

5 Final section of vein M with a conspicuous sharp bend of about 70-110 degrees within the basal third of its length, the final section either straight, or curved so as to create a concavity within cell R4+5 (Figs 6 & 7). Species robustly built, some with tergites metallic green, blue or bronze….....6

- Final section of vein M with a more gently curved or obtuse bend of about 130 degrees, which is near the middle (Fig 8). Slim, non-metallic, small or very small species.…….....13

6 Tergites obviously metallic green or blue...……..……...……...7

- Tergites not obviously metallic but always strongly patterned by dusting.....11

7 Both thorax and abdomen strongly metallic green, bronze or turquoise with any dusting weak and barely obscuring the underlying coloration. Suprasaquamal ridge with a sclerite bearing a tuft of setae (Fig 9, best seen when wings are open)….....……..…….***Lucilia***

- At least thorax with some obvious dusting and never strongly reflective. Tergites either undusted (*Cynomya*) or with shifting areas of dusting. Suprasquamal ridge without such a tuft of setae.....….....8

8 Lower calypters bare above. Depth of genae no more than one-third the height of an eye (Fig 10). Face, frons, genae and antennae (excluding any dusting) always dark. Tergites metallic blue…….....….....……..……..***Melinda***

- Lower calypters with long hairs on upper surface (Figs 5 & 16). Depth of genae usually at least two-fifths the height of an eye (Figs 11 & 12). Antennae, face, frons and genae often extensively yellow, orange or reddish. Tergites metallic blue or green.....….…..……9

9 Only one pair of postsutural acrostichals, the prescutellar pair (Fig 13). Tergites entirely undusted and brightly shining blue or turquoise. Face, genae and much of frons yellow or orange. Male genitalia large with long curved surstyli (Fig 15). Female with hind margin of tergite 4 and entire surface of tergite 5 bearing very strong bristles…….....……..***Cynomya mortuorum***

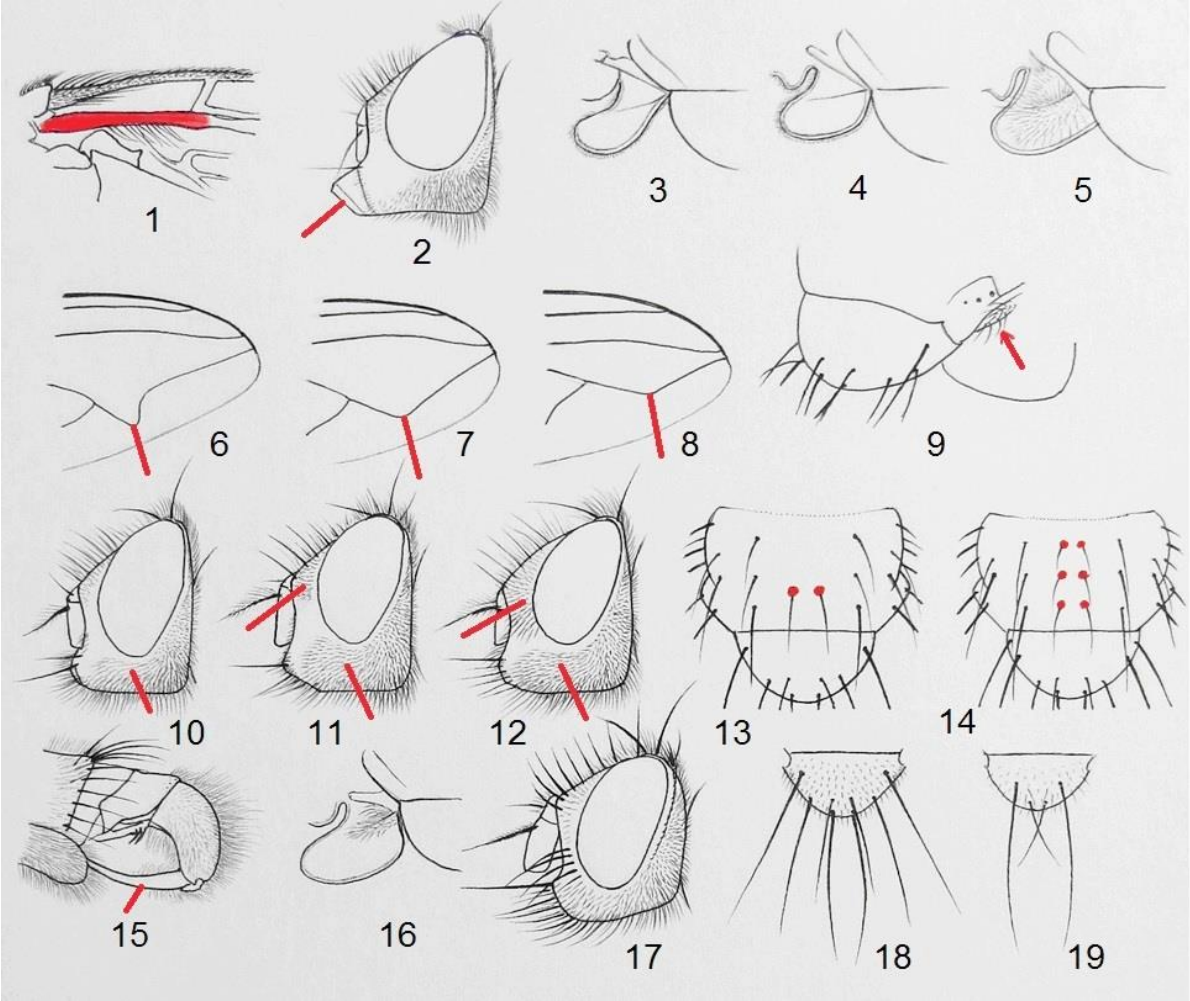
- Three pairs of postsutural acrostichals (Fig 14). Tergites in most species with obvious dusting (in *Calliphora stelviana* best seen when viewing abdomen from behind)…….....……..10

10 Tergites metallic-blue. Parafacialia only hairy on upper part (hairs not extending much lower than a level equivalent to the aristal insertion point, Fig 11). Lower calypters often hairy over most of their upper surface (Fig 5). Third antennal segment 3-5 times as long as wide and often extensively red or orange. Face, frons and genae often extensively yellow, orange or reddish….....…..***Calliphora***

- Tergites metallic-green, turquoise or bronze. Parafacialia hairy over much of length (hairs extending down to a level equivalent to the mid point of the third antennal segment or beyond (Fig 12). Lower calypters only hairy over about one-third of their upper surface, broadly bare around their margins (Fig 16). Third antennal segment 2-2.5 times as long as wide, at most red at extreme base. Face, frons and genae entirely or mainly dark.....***Bellardia* (ex *B. pubicornis*)**

11 Thorax with wavy golden or straw-coloured hairs somewhere on its surface, often rubbed off the dorsal surface but in this instance visible somewhere on the sides....……..……..…..……...***Pollenia***

- Thorax never with such hairs…….....……..12



12 Lower part of parafacialia with some very long and strong bristles (Fig 17). Mesonotum and tergites with exceptionally long and strong bristles. Costal bristle barely differentiated. Closely resembling a *Sarcophaga* species…..…..***Eurychaeta palpalis***

\- Lower part of parafacialia without long and strong bristles. Bristles of mesonotum and tergites not exceptionally long or strong. Costal bristle much longer than cross vein r-m…..……..***Bellardia pubicornis***

13 Two pairs of strong scutellar marginal bristles in addition to the apicals (Fig 18). Propleural depression and lunula setulose. Notopleuron with fine hairs in addition to the two bristles. Larger (wing length 4.5-6mm)……..…..***Eggisops pecchiolii***

\- Only one pair of scutellar marginals in addition to the apicals, these being much longer than the apicals (Fig 19). Propleural depression and lunula without setae. Notopleuron bare apart from the two bristles. Smaller species (wing length up to 4mm)…….…….….14

14 Arista plumose. Parafacialia finely setulose. Prealar bristle much stronger than the hind notopleural. Halteres dark…….……***Melanomya nana***

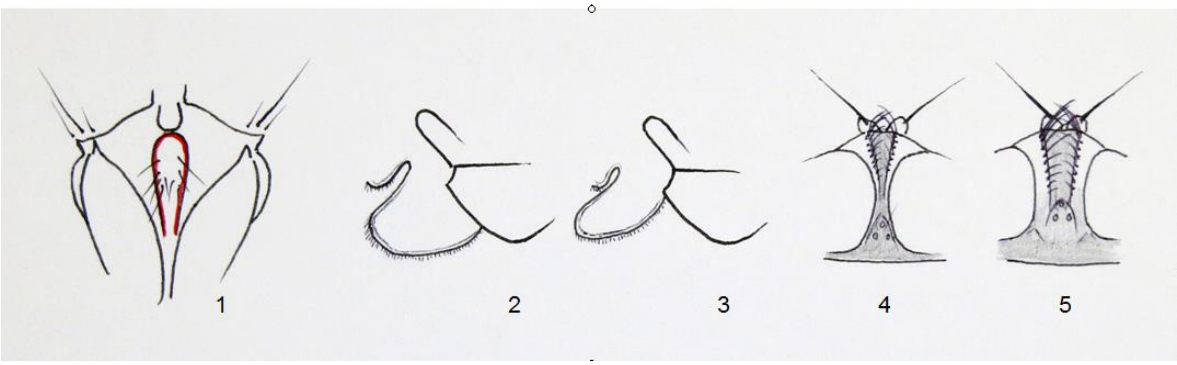
\- Arista pubescent. Parafacialia bare. Prealar no longer than the hind notopleural. Halteres yellow…….……..……***Angioneura***

Angioneura – least blowflies

Small, non-metallic, somewhat muscid-like blowflies with an obtuse bend about half way along vein M (as in *Melanomya* and *Eggisops*). The aristae are pubescent rather than plumose and the parafacialia bare. The scutellum has a pair of rather short apicals flanked by a pair of much longer marginals. This is a holarctic genus with perhaps 8 species worldwide depending on how the limits of the genus are defined. Some are known to be oviparous snail parasitoids. Represented in Britain by two very rare species, with a third species, *A. fimbriata*, known from the near continent.

Key to species

- Prosternum (the narrow chitinous plate between the base of the front coxae) usually setulose (Fig 1). Lower calypters viewed from above broadening posteriorly with their inner edges hugging the sides of the scutellum (Fig 2). Parafacialia with a few setulae in upper half. Tergites completely dusted. Anal vein only extending about half way to the wing margin. Male eyes separated by about the width of a third antennal segment (Fig 4). A grey species with completely dusted tergites.....*acerba*
- Prosternum bare. Lower calypters viewed from above with their inner edge diverging away from the scutellum (Fig 3). Parafacialia bare. Anal vein almost extending to the wing margin. Male frons about one-quarter the width of the head (Fig 5). A darker species with tergites mostly (male) or entirely (female) blackish….....*cyrtoneurina*



***Angioneura acerba* (Meigen, 1838)** **Pale Least Blowfly**

Description & similar species WL 3-3.5mm. A tiny greyish species that could easily be overlooked as a small anthomyiid or muscid until the upturned vein M is spotted. The mesonotum and tergites have inconspicuous shifting markings with the humeri a little paler. The lower calypters broaden posteriorly, their inner edge hugging the side of the scutellum. The male frons is about the width of a third antennal segment. That of the female is about one-third the width of the head.
Variation The prosternum can occasionally lack bristles.
Flight season May to October in Fennoscandia, with British records for June, July and August.

Habitat & biology Clearly associated with wetlands, perhaps especially spring- or seepage-fed marsh with shallow calcareous water. Presumed to be a parasitoid of snails.
Status & distribution Rare, with records confined to Oxford, Oxfordshire (1966), Kennet Floodplain, Berkshire (2003), Godmanchester, Cambridgeshire (2007) and Stoney Moors, New Forest (2008). Quite numerous at the last-mentioned site.

Male Angioneura acerba (left, Photo: Hedy Van Pratternburg) and pinned female (right). Notice the narrow frons of the male.

***Angioneura cyrtoneurina* (Zetterstedt, 1859)** **Dark Least Blowfly**

Description & similar species WL 3-3.5mm. The blackish thorax and abdomen and smaller, strongly divergent lower calypters allow easy separation from *A. acerba* and it could be confused with *Melanomya nana* though the pubescent rather than plumose aristae, clearer wings and less elongate build should allow ready distinction. Males have grey dust patches on the sides of tergites 3-5 and the frons is about one-quarter the width of the head. That of the female is about one-third the width of the head.

Pinned male Angioneura cyrtoneurina (left) with detail of head and thorax (right). Photos: Ian Andrews. Notice the broad frons of the male.

Variation None noted.
Flight season June to August.
Habitat & biology A species of marshy areas such as water meadows and seepage-fed marsh, usually whewre base-rich waters are present. Reared from the snail *Oxyloma sarsii* (= *Succinea elegans* of older literature).
Status & distribution Rare, with records from Wick, Hampshire (1945), Westbere, Kent (1966), Horning Ferry, Norfolk (1928-1952), Chippenham Fen, Cambridgeshire (1983), Minsmere RSPB Reserve, Suffolk (2001), Kennet Floodplain, Berkshire (2003) and a site in the Yorkshire Wolds (2015). Also rare in Europe.

Bellardia – emerald-bottles

Medium-sized, rather robustly-built blowflies, usually with the tergites glossy greenish (sometimes bronze or turquoise-blue) but with a shifting dust pattern that mutes the colour. The thorax is more heavily grey-dusted with shifting stripes on the mesonotum but usually retains a trace of metallic colour. The lower calypters of most species have long upright hairs on basal section of the upper surface. The head capsule and antennae typically have an entirely dark ground colour (a little red can be present on the antennae) and never exhibit the extensive reddish or orange areas of many *Calliphora* species, and the antennae are much shorter. *B. pubicornis* (formerly *Pseudonesia puberula*) is aberrant in various respects, lacking metallic reflections, lacking hairs on the top of the lower calypters and having a rather protruding mouthedge.

The biology is only known for a few species. Females are viviparous and the larvae develop as internal parasitoids of earthworms. *B. bayeri* appears to specifically select earthworms under loose bark of fallen trees and other dead wood. Most other species occur in a variety of habitats but *B. pubicornis* is strongly boreal and only found in the north and west of Scotland. Adults are occasional flower-visitors but are more likely to be seen on foliage.

This is a Palaearctic genus with over 50 described species. A number of further species occur on the near continent (see Rognes, 1991 and Huijbregts, 2002) and *B. bayeri* is a fairly recent discovery in Britain. In addition to the potential for further *Bellardia* species to turn up, attention should also be drawn to *Onesia floralis* (also found on the near continent). It looks almost identical to a *Bellardia* in the field but has a no presutural intra-alar bristle but three postsutural ones (*Bellardia* species have a presutural one and two postsutural ones) and broader parafacialia.

Male *Bellardia* are relatively easy to identify using genitalia (safer than using chaetotaxy) and checking genitalia is the best way to spot any extra species, including *O. floralis*.

Key to species

1 Tergites not obviously metallic-green, turquoise or bronze (at most a hint of bronze). Lower calypters usually without erect hairs on upper surface. Viewed from side, mouth edge clearly protruding further than the frons (Fig 1). Upcurved section of vein M relatively straight. Male genitalia Fig 6.....***pubicornis***

- Tergites obviously metallic-green, turquoise or bronze. Lower calypter with erect dark hairs on upper surface, at least basally. Viewed from side, mouth edge not, or barely, protruding further the frons (Fig 2). Upcurved section of vein M usually distinctly curved..... ……...2

2 Front tibiae with two strong posteroventral bristles. Section of costa between the end of the subcosta and R1 with some ventral-facing hairs on lower surface (best seen by viewing the wing directly from the front). Male genitalia Fig 7…...***pandia***

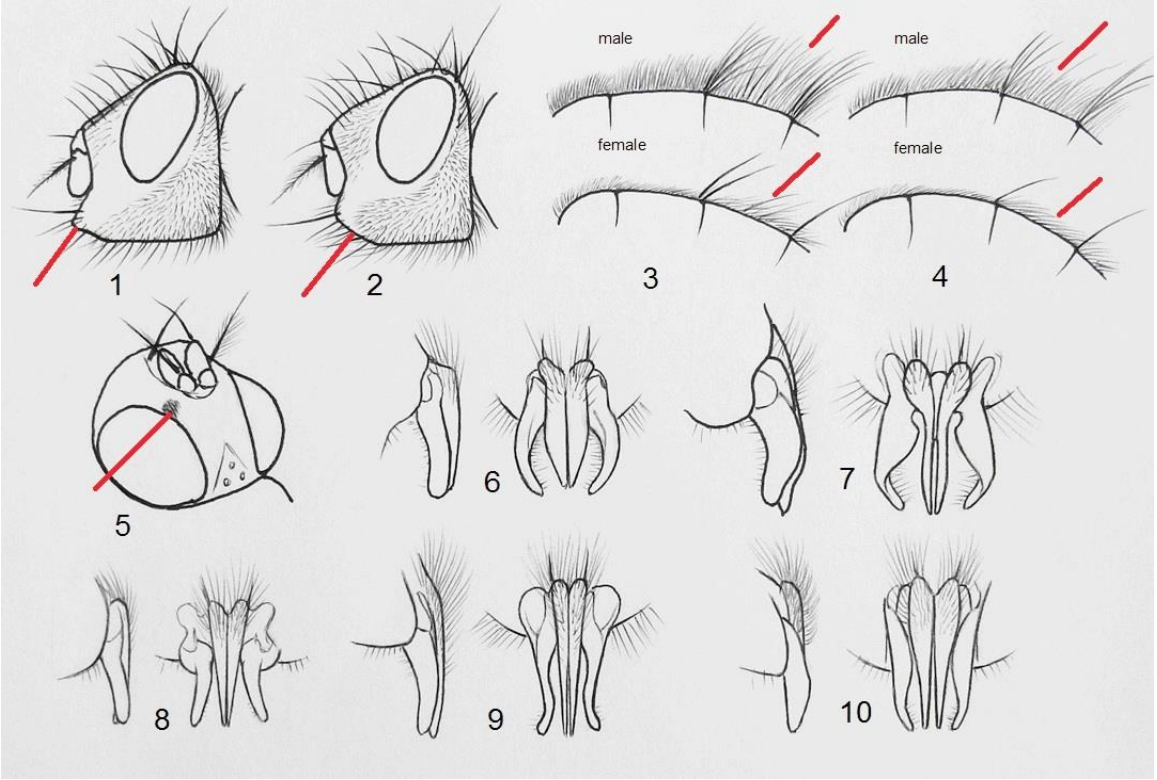
- Front tibiae with one posteroventral bristle. Section of costa between the end of the subcosta and R1 without anyventral-facing hairs on lower surface.……..3

3 Upper part of parafacialia with a dark spot that does not disappear when viewed tangentially from above (Fig 5). Calypters brownish-grey. Male genitalia Fig 8…..……***bayeri***

- Any dark mark on the upper part of parafacialia disappears with angle of view. Calypters yellowish-white……..…….……4

4 Tergite 4 viewed from the side with numerous upright or semi-upright bristly hairs most of which are almost as long as the marginals of tergite 3 and 4 (males) or clearly longer than the normal hairs of tergite 4 (females) (Fig 3). Basal wing veins usually blackish or dark brown, including on underside. Male genitalia Fig 9…….…….……***viarum***

- Tergite 4 viewed from side with shorter hairs, those of the male mostly only about half as long as the marginals of tergite 3 and 4 (Fig 4), those of the female of uniform length, inclined and normally without any longer outstanding hairs. Basal wing veins usually yellowish-brown on underside (especially in females). Male genitalia Fig 10.....…….…..***vulgaris***



***Bellardia bayeri* (Jacentkowský, 1937)** **Bayer's Emerald-bottle**

Description & similar species WL 4.5-7mm (check). A small *Bellardia* with metallic-turquoise tergites, resembling small specimens of *B. viarum* and *B. vulgaris*. The top of the parafacialia have a dark spot that remains visible, even when the head is viewed tangentially from above, and the calypters are brownish-grey. In the limited material seen the upturned section of vein M is relatively straight as in *B. pubicornis*. The male has very small genitalia.
Variation Substantial size variation.
Flight season On the continent it is recorded mainly in July and August but has been found in winter months. British records (some from malaise traps) suggest it flies here from spring until at least late summer.

Bellardia bayeri male (right, Photo: Andreas Haselböck) and female head (right). Notice the brownish lower calypter of the male and the dark mark at the top of the parafrontalia of the female.

Habitat & biology Several British records are from woods featuring mature and fallen Beech trees. The Coventry female was found in a suburban kitchen at night, seemingly attracted by artificial lighting. In Russia it has been reared from the earthworm *Eisenia foetida*. In Britain it has been reared from puparia found under the bark of Beech whilst in Denmark it has been reared from a puparium found under elm bark.

Status & distribution Known in Britain from Mark Ash Wood in the New Forest, Hampshire (1984), Newbattle Abbey, Midlothian (1994, pupa found under loose bark of a fallen Beech), Buckingham Palace Garden, London (several specimens from malaise trap samples in 1995), Burnham Beeches, Buckinghamshire (one male from a malaise trap in 1995 and another reared from a puparium found under bark of a Beech log), and Coventry, West Midlands (one female found indoors in a suburban house in 2000). John Bowden (pers. comm.) also flagged a possible female specimen taken in Colchester in 1995, noting the brownish calypters and persistent spot on the face, but the location of the specimen is not known.

***Bellardia pandia* (Walker, 1849)** **Bisetose Emerald-bottle**

Description & similar species WL 4.5-8.5mm. A typical-looking *Bellardia* with metallic-green tergites that have a shifting pattern of dusting, and a dark-grey thorax with shifting stripes and very slight metallic reflections. The pair of strong

Bellardia pandia male (left) and pinned female (right). You can just see the two posteroventral bristles on the front tibia if you zoom into the male photo.

posteroventral bristles on the front tibiae, and the male genitalia allow easy separation from *B. viarum* and *B. vulgaris* under magnification, but separating them in the field should not be attempted. The hairy underside to the costa between the end of the subcosta and R1 is another useful feature, especially where the front tibiae have been damaged or lost.
Variation Considerable size variation. The metallic reflections of the tergites vary from greenish to bluish-turquoise.
Flight season Late April to early September.
Habitat & biology Found in a wide variety of habitats, especially damper ones, including coastal grazing, fens, damp woods and upland mires. Records from chalk downland may represent stragglers from damper habitats nearby. The biology is unconfirmed, though it is presumed to be an earthworm parasite.
Status & distribution Found locally throughout Britain as far north as Ross & Cromarty and the Outer Hebrides.

***Bellardia pubicornis* (Zetterstedt, 1838)** **Northern Bellardia**

Description & similar species WL 4.5-7mm. A small and rather aberrant *Bellardia* due to the lack of metallic coloration, the strongly produced mouthedge and (typically) the lack of any long hairs on the upper surface of the lower calypters. The mesonotum and tergites have a shifting pattern of grey and black, and the tergites can have a very slight hint of bronze. In the field, it could easily be overlooked as a tachinid.
Variation Moderate size variation. The lower calypters occasionally have 1-2 hairs above.
Flight season May to September.
Habitat & biology Known from a range of upland habitats, especially moorland with exposed boulders among heather between 250-890 metres; also coastal dunes with dune heath. The biology is unknown. Adults characteristically rest on boulders and stones.
Status & distribution A scarce species with records confined to the north and west of Scotland from Arran in the south to Elgin and Sutherland, also St Kilda.


Bellardia pubicornis pinned female (left) and close up of abdomen (right)

***Bellardia viarum* (Robineau-Desvoidy, 1830) Dark-veined Emerald-bottle**

Description & similar species WL 4.5-8.5mm. Superficially resembling *B. pandia* and *B. vulgaris*. Separation, especially from *B. vulgaris*, is best based on male genitalia (the outwardly-splayed surstyli of *B.viarum* are very different to the surstyli of *B. vulgaris*) as the hairs and bristles of the tergite 4 can become damaged, though in good material the hairs of tergite 4 are clearly longer than in *B. vulgaris*. The basal wing veins are usually blackish or dark brown both above and below.
Variation Much as for *B. pandia*.
Flight season Late April September.
Habitat & biology Found in a similar range of habitats to *B. pandia*. The biology is unconfirmed, though it is presumed to be an earthworm parasite.
Status & distribution Widespread and fairly frequent over much of Britain as far north as Easter Ross.

Bellardia viarum male (left) and female (right). Notice the black rather than brown basal wing veins.

***Bellardia vulgaris* (Robineau-Desvoidy, 1830) Pale-veined Emerald-bottle**

Description & similar species WL 4.5-8.5mm. Closely resembling *B. viarum* and best distinguished using the male genitalia, though the basal wing veins are usually paler and the hairs on the disc of tergite 4 much shorter.
Variation Much as for *B. pandia*.
Flight season late April to October.

Bellardia vulgaris pinned male (left) and female (right). Notice the brown rather than black basal wing veins.

Habitat & biology Found in a similar range of habitats to *B. pandia* and *B. viarum* and often flying alongside it. The biology is unconfirmed, though it is presumed to be an earthworm parasite.
Status & distribution Widespread and fairly frequent over much of Britain as far north as the Inverness area and the Western Isles.

Calliphora – true bluebottles

In a British context, these are the familiar bluebottles that often enter buildings and buzz about noisily. All of our species have metallic-blue tergites with a shifting dust pattern and a non-metallic, grey-dusted thorax, sometimes with shifting stripes. The upper surface of the lower calypters has long upright hairs which can cover most of the surface in species like *C. vicina*, *C. vomitoria* and *C. uralensis*, but rather less in the other three species. The face and antennae can be extensively reddish or orange. The antennae are longer than other metallic species except *Cynomya* and the aristae plumose. Non-metallic species occur abroad, notably in Australasia where some species are partially orange, reddish or golden-furred (some are termed 'golden bottles'). The British species are relatively easily identified on external morphology alone but male genitalia can be useful when dealing with wet samples. Very small *Calliphora* individuals can be confused with *Melinda* species in the field but have longer antennae, usually an extensively orange face and, in species such as *C. vicina* and *C. vomitoria*, dark calypters.

All species lay eggs on carrion and several species are important in forensic entomology. Different *Calliphora* species show subtly different preferences in the carrion they use and this has been studied in northern Britain (Davies 1990, 1999). Climate and temperature regimes also affect *Calliphora* assemblages, and diversity is higher in the north, notably in areas like the Cairngorms and Pennines where 5 of the 6 British species can coexist. The only species unrecorded here, *C. uralensis*, is strongly associated with northern seabird colonies. All *Calliphora* species seem to be avid flower visitors and are also attracted to fresh excrement and Stinkhorn fungus. The synanthropic species such as *C. vicina* and to a lesser extent *C. vomitoria* and *C. uralensis* will also attempt to land on food and can be a nuisance and health hazard. They can also breed in garbage and poorly stored food containing meat and dairy products.

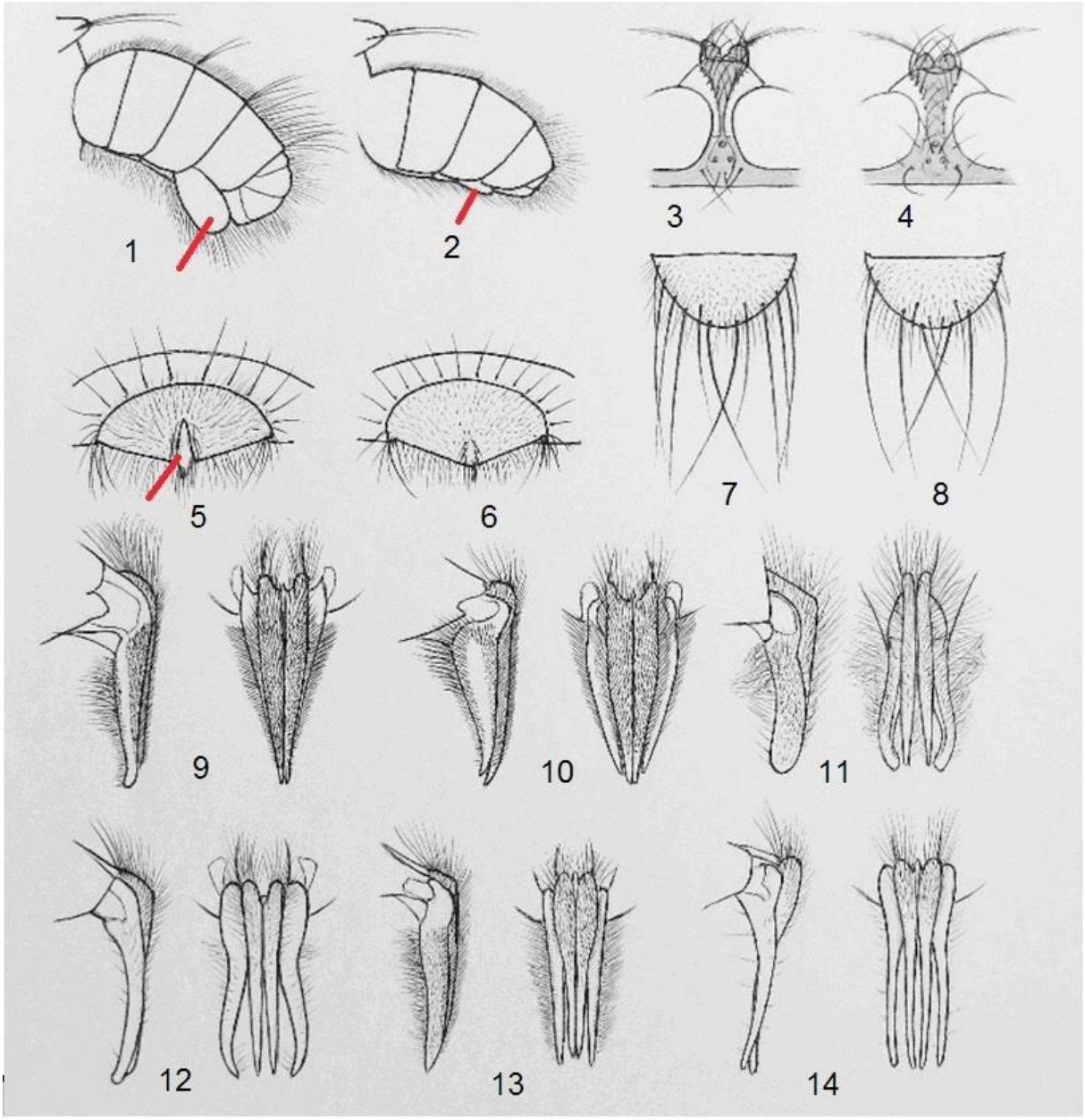
This is one of the largest blowfly genera (about 150 species) with an occurrence centred on the Holarctic plus Australasian regions. *C. genarum* seems to be the only further species found on the near continent and resembles *C. stelviana* but has shorter aristal hairs, a dark face and a non-enlarged male postabdomen (see Marshall et. al. 2011, which is available online, for images). However, synanthropic North American species such as *C. livida* (which resembles *C. uralensis* but has 3 postsutural intra-alars) could easily be bought over and would be easy to overlook. See Marshall et. al. (loc. cit.) for a full account of the *Calliphora* species of Eastern Canada.

Key to species

1 Basicostae mostly pale brown, at least on apical half. Anterior thoracic spiracle orange. Genal dilation pale brown on anterior two-thirds, dark grey on posterior third, and entirely covered with black hairs. Male genitalia Fig 11.....***vicina***

\- Basicostae blackish and anterior thoracic spiracle brownish or blackish. Genal dilation usually entirely darkened (except some *C. uralensis*).....…2

2 Calypters white or very pale grey, the upper calypter with a whitish or pale grey rim. Build relatively slim, the abdomen clearly longer than wide in males, as long



as wide in females. Tip of male abdomen bulbous in side view with sternite 5 produced into two large projecting lobes (Fig 1)…….....3

- Calypters infuscated grey or brownish, the upper calypter with a dark grey or blackish rim. Build more robust, the abdomen as wide as long, or wider (except male *loewi* where it can be a little longer then wide). Male genitalia not noticeably enlarged, the lobes of sternite 5 small (Fig 2)…….....….4

3 Scutellum with 4-5 pairs of strong marginals in addition to the apicals (Fig 7). Mesonotum with distinct stripes (very obvious when viewed from behind). Male mid tibiae without a ventral bristle; the eyes separated by about the width of a third antennal segment, the interfrontalia narrower than the parafrontalia (Fig 3). Averaging larger (wing length to 10mm) and without an orbital bristle on each side of the ocellar triangle. Male genitalia Fig 9….....…..…….***subalpina***

- Scutellum with only 2-3 pairs of strong marginals in addition to the apicals (Fig 8). Mesonotum without distinct stripes (only weak ones appearing when viewed from behind). Male mid tibiae with a ventral bristle; the eyes separated by about

1.5 times the width of a third antennal segment, the interfrontalia wider than the parafrontalia and with an orbital bristle on each side of the ocellar triangle (Fig 4). Averaging smaller (wing length to 9mm). Male genitalia Fig 10….....….***stelviana***

4 Genae extensively orange-haired. Male genitalia Fig 12.....…..……..***vomitoria***

\- Genae black-haired..…….....……..5

5 Mesonotum with a dark median stripe running between the acrostichals and weaker shifting dark stripes running down the dorsocentral and intra-alar rows. Top of parafacialia with a black and silvery-white spot when viewed from certain angles, the genae blackish with light dusting and shining from some angles. Female tergite 5 deeply notched apically (Fig 5). Male genitalia Fig 13... …..***loewi***

\- Mesonotum without distinct stripes. Top of parafacialia never producing a silvery, reflective spot, the genae brown or blackish but dulled by thick dusting. Female tergite 5 not deeply notched apically (Fig 6). Male genitalia Fig 14……..***uralensis***

***Calliphora loewi* Enderlein, 1903** **Long-horned Bluebottle**

Description & similar species WL 6-10 mm. The stripy mesonotum means that this species could be overlooked in the field as *C. subalpina*, so care should be taken to check for the darker squamae and less swollen male genitalia. Males of *C. loewi* also have a narrower frons (about 0.75 the width of a third antennal segment). Their build is slimmer than species such as *C. vicina* and *C. vomitoria* but a little stouter than *C. subalpina*. Females are readily identified under the microscope by the deep cleft along the hind margin of tergite 5 (much deeper than any other *Calliphora*). They have the longest third antennal segment of any *Calliphora*, about five times as long as wide and only ending a little short of the mouth edge. Both sexes have a shifting silvery-white mark at the top of the parafacialia and the genal dilations are entirely dark with rather light dusting that allows them to shine from some angles.
Variation The ground colour of the face and frons varies from entirely dark to having the front of the frons, much of the parafacialia and the parts of genae surrounding the dark genal dilation orange a female - check if this applies to both sexes.
Flight season May to September.

Calliphora loewi male (left) and female (right) showing the striped thorax combined with dark calypters. Notice the silvery mark at the top of the female's parafacialia and her particularly long antennae.

Habitat & biology Typically moorland and upland woods, between 455 and 740 metres in Wales but some lowland sites further north (e.g. Davies & Laurence, 1992). The larvae develop in assorted carrion. It is not particularly synanthropic.
Status & distribution A northern and western species with records concentrated in the Scottish Highlands (where fairly frequent and occuring north to Orkney) but extending south to the Peak District and the Black Mountains of Breconshire.

***Calliphora stelviana* (Brauer & von Bergenstamm, 1891) Little Bluebottle**

Description & similar species WL 5-9mm. A relatively small, slimly-built *Calliphora* without conspicuous striping on the mesonotum and with white calypters. The genal dilations are mostly dark but the face extensively yellow. The scutellum only has 2-3 strong marginals (4-5 in all other *Calliphora*). Males resemble *C. subalpina* in having an enlarged abdominal tip with expanded lobes arising from sternite 5, though these lobes are not quite as large as in *C. subalpina*. The male eyes are separated by about twice the width of a third antennal segment, resulting in a wider frons than other male *Calliphora*.
Variation Check more material
Flight season British records extend from early June to late September.
Habitat & biology Upland and montane areas mostly between 530 to 1070 metres, including tall *Calluna* heath, *Racomitrium* moss-heath and the subalpine zone where scattered trees are present (Horsfield, 2002). Larvae mostly develop in the carcasses of small mammals such as shrews, voles and mice. Horsfield (loc. cit.) had considerable success in recording adults throughout the Scottish Highlands using water bowl traps.
Status & distribution A scarce species with records confined to the Scottish Highlands and a few sites in the northern Pennines. Even in areas where it occurs with the related *C. subalpina*, *C. stelviana* clearly prefers higher altitudes (Davies & Laurence, loc. cit.).

Calliphora stelviana pinned males showing the widely separated eyes (left) and swollen tip to the abdomen (right image: Knut Rognes)

***Calliphora subalpina* (Ringdahl, 1931)** **Woodland Bluebottle**

Description & similar species WL 7-10mm. A rather slimly-built *Calliphora*, especially males, and one of two species with a distinctly striped mesonotum. Distinguished from the other, *C. loewi* (alongside which it can occur), by the whitish calypters, predominantly orange ground colour to the face, much expanded tip to the male abdomen (with greatly enlarged lobes arising from sternite 5), and lack of a deep cleft on the hind margin of the female's tergite 5. The male eyes are separated by about the width of a third antennal segment.
Variation Substantial size variation. The interfrontalia and third antennal segments of both sexes can vary from mostly reddish to mostly dark.
Flight season May to October.
Habitat & biology Strongly attached to woods over much of its range, especially damp/humid ones but recorded from moorland as high as 500 metres in area such as the Derbyshire Peaks and North Wales (Davies & Laurence, loc. cit.). It visits flowers such as Hogweed, Angelica and brambles, also Stinkhorn fungus. It also sunbathes on foliage along the edges of rides and clearings. The larvae develop in assorted carrion. It has been recorded in gardens and urban greenspace of various sorts but is not particularly synanthropic.
Status & distribution Widespread in the north and west but extending to lowland areas as far south as Herefordshire and Warwickshire. Fairly frequent in the Scottish Highlands. Almost completely absent from SE England (there is a single Colchester record from John Bowden).

Calliphora subalpina male (left) and female (right) showing the striped thorax combined with whitish calypters

***Calliphora uralensis* Villeneuve, 1922** **Seabird Bluebottle**

Description & similar species WL 6-10mm. Resembling *C. vicina* in the field (alongside which it usually flies) but the dark basicostae and dark anterior thoracic spiracles allow ready separation under a microscope or a strong hand lens, and the genae are more extensively darkened. The male eyes are separated by the width of a third antennal segment.
Variation Substantial size variation. The interfrontalia can be entirely dark or partially reddish. The tip of the scutellum can be brownish.
Flight season May to October, but mainly in June and July.

Habitat & biology Mostly found on cliffs and beaches, especially in the vicinity of seabird colonies, also around rabbit burrows on dunes. Adults can often be seen basking on rocks and walls close to the shore or on short turf on clifftops (Macdonald, 2014). It will visit roadside flowers and especially umbellifers (Laurence, 1991). It seems to be primarily associated with bird carrion in Britain and has been reared in large numbers from a Gannet at Ailsa Craig, together with *C. vicina* (Laurence, 1987). It occurs less frequently in upland and montane areas of Britain, but is frequent in non-coastal montane areas of Scandinavia. In Scandinavia it will also use the remains from reindeer slaughters. It can be synanthropic, regularly entering houses in the Hebrides and Shetland but is generally less frequent than *C. vicina*. It is apparently mostly synanthropic in arctic Scandinavia and Russia where it can be associated with human latrines rather than carrion.
Status & distribution Our most boreal *Calliphora* with records mostly concentrated in the north of Scotland (Ross & Cromarty, Sutherland, Caithness, Orkney, Shetland and the Western Isles) extending as far south as Ailsa Craig in the west and the Isle of May in the east. The distribution is most recently summarised by Macdonald (loc. cit.). In Shetland, it can be the commonest bluebottle in coastal areas, but becomes outnumbered by *C. vicina* in built up areas and further away from the coast. It was added to the Irish list by Irwin (1976).

Calliphora uralensis male (left) and female (right) showing the dark basicosta, dark-haired genae and relatively unstriped thorax. Images: Roger Thomason.

***Calliphora vicina* Robineau-Desvoidy, 1830** **Common Bluebottle**

Description & similar species WL 5-11mm. Very easily distinguished from other *Calliphora* species by the pale brown basicostae and orange anterior thoracic spiracles. Over much of Britain it can be found alongside *C. vomitoria* and has a similar broad build but looks paler in the field, with bluer reflections on the tergites, and it lacks the orange beard and entirely dark genal dilations of that species. Males of *C. vicina* also have the eyes more widely separated (by the width of a third antennal segment) with the black interfrontalia is as wide as the silvery parafrontalia.
Variation Considerable size variation. The extent of red at the base of the third antennal segment varies. The interfrontalia of both sexes can be partially (female) or entirely (male) reddish rather than black. The scutellum can be brown-tinged apically.
Flight season Most active between April and October, though it can be found indoors throughout winter and can be active outside on mild winter days, especially around buildings and rabbit warrens.

Calliphora vicina male (left) and female (right) showing the brownish basicosta

Habitat & biology Found in many settings but abundance greatest in urban, pastoral and rabbit-occupied settings. The larvae develop in fresh carrion of many sorts, from bird nestlings to large mammals. Myiasis has been recorded in assorted mammals (including humans), also birds and reptiles and it is an occasional sheep-strike species. It will also exploit meat, meat and dairy-based products and garbage. It is the main blowfly responsible for fly-blown food. Adults visit many sorts of flowers, including spring-blossoming shrubs, umbellifers and Ivy; also Stinkhorn fungus and faeces.
Status & distribution Widespread and common over most of the British Isles extending north to Shetland. Our commonest bluebottle, though sometimes outnumbered by *C. vomitoria*, and occasionally other species in wooded, upland and northern areas.

***Calliphora vomitoria* (Linnaeus, 1758)** **Orange-bearded Bluebottle**

Description & similar species WL 7-11mm. Readily distinguished from all other *Calliphora* species by the orange-haired genae. The ground colour of the genae, face and interfrontalia is usually dark. In the field it tends to look darker than *C. vicina* and the tergites produce deeper blue reflection, often with a hint of turquoise. Males have the eyes separated by about 0.75 times the width of a third antennal segment, with the interfrontalia narrower than the parafrontalia.

Calliphora vomitoria male (left) and female (right) showing the orange 'beard'. Notice the narrowly separated the male eyes.

Variation Considerable size variation. The face and interfrontalia can occasionally be extensively reddish.

Flight season Mostly March to November – overwintering predominantly as a larva.

Habitat & biology Very similar to *C. vicina*, though less strongly synanthropic and more shade and humidity-loving in the south and often commoner than *C. vicina* in southern woods of such areas. However, C. *vomitoria* can also be the dominant bluebottle in moorland areas to altitudes of up to 700 metres in areas such as the Pennines and Wales, where it clearly capitalises on dead sheep (e.g. Davies & Laurence, 1991, Davies, 1999). It seems to prefer larger carrion than *C. vicina*. It has also been implicated in myiasis, including sheep fly-strike.

Status & distribution Widespread and common over most of the British Isles extending north to Shetland.

Cynomya – dog-headed blowflies

A small holarctic genus (6 species) related to *Calliphora* but with only 1 or 2 postsutural acrostichals, no presutural intra-alars, no dusting of tergites 1+2 to 5 (resulting in particularly glossy tergites), and greatly enlargened male genitalia that are armed with long and strongly-muscled surstyli. The biology is broadly similar to *Calliphora*, and both *C. mortuorum* and the North American *C. cadaverina* (which resembles a dark-faced *C. mortuorum*) can be used in forensic entomology.

***Cynomya mortuorum* (Linnaeus, 1761)** **Yellow-faced Blowfly**

Description & similar species WL 7-13mm. Abundantly different from other metallic-blue calliphorids with the face and front of the frons bright yellow. The antennae are mostly reddish except for a dark anterior edge to the third antennal segment. The mesonotum has shifting stripes (rather like *Calliphora loewi* and *C. subalpina*), though there is only a single (prescutellar) pair of postsutural acrostichals. Tergites 1+2 to 5 are a stunning reflective blue or turquoise without any dusting. Males have exceptionally large genitalia with a long, curved surstyli and a pair of large squarish lobes arising from sternite 5. Females have very strong bristles towards the tip of the abdomen. Large males are arguably our most impressive blowflies.
Variation Tremendous size variation. The metallic colour of the abdomen can vary from pure blue through turquoise to greenish (females more prone to show the latter state). The extent of darkening on the third antennal segment varies from about 50% to barely evident.
Flight season April to October.
Habitat & biology Found in a wide range of habitats from the coast to montane areas and with a preference for open, expansive settings. It is not synanthropic. Larvae develop in carrion of various sorts (especially small mammals) but also apparently fish. It has been implicated in myiasis of a Brown Hare. Adults visit flowers such as umbellifers, thistles and Devil's-bit Scabious; also Stinkhorn fungus.
Status & distribution Recorded from most parts of Britain from the south coast to Shetland but most frequent in the north and west. It is rarely ever abundant, suggesting a more specialised biology than the commoner *Calliphora* species.


Cynomya mortuorum male (left) and female (right)

Eggisops – false woodlouse-flies

A small Palaearctic genus (just two species) of rather small, slim, grey-dusted and strongly bristled blowflies that more closely resemble certain rhinophorids than other calliphorids. The biology is poorly understood but females are known to be viviparous (because gravid ones contain larvae rather than eggs) and larvae are suspected to develop in snails.

***Eggisops pecchiolii* Rondani, 1862** **False Woodlouse-fly**

Description & similar species WL 4.5-6mm. A slim, dark-greyish, bristly fly with vague shifting markings on the mesonotum and tergites. Vein M has a bend of about 130 degrees. Superficially resembling a rhinophorid of the genus *Phyto* rather than any other blowfly, but with cell R4+5 narrowly open, plumose aristae, and lower calypters hugging the edge of the scutellum. The head is also relatively small and broader than high in front view. The male frons is about 1.5 times the width of a third antennal segment, whilst that of the female is just under one-third the width of the head.
Variation Moderate size variation.
Flight season May to August.
Habitat & biology Typically found in scrubby grassland and scrub edge, especially that on calcareous soils. This includes post-industrial sites such as old cement quarries and disused railway lines; occasionally in woodland. Larvae are thought to develop in snails and the females are known to be viviparous.
Status & distribution Widespread but very local in southern England north to Warwickshire plus an isolated 1936 record from Glen Shin, Sutherland.

Eggisops pecchiolii pinned male (left) and living female (right, Photo: Christophe Quintin)

Eurychaeta – false fleshflies

Another blowfly genus containing species that do a good impersonation of flies of another family, in this case *Sarcophaga* fleshflies (Sarcophagidae). In fact, these flies were classified as sarcophagids until relatively recently and *E. palpalis* is the *Helicobosca distinguenda* of van Emden's 1954 sarcophagid key and Kloet & Hincks (1976). The resemblance in the field is quite uncanny though numerous differences are revealed under magnification. However, transfer of the genus from the Sarcophagidae to the Calliphoridae by Rognes (1986) was strongly refuted by Lehrer (2007) and it is treated as part of the sarcophagid subfamily Paramacronychiinae in The Flesh-Flies of Central Europe (Povolný, & Verves 1997**)**. The treatment here as a calliphorid follows the NBN checklist and GBIF.

Eurychaeta species are snail scavengers. A single large larva is deposited on a dead or dying pulmonate snail and the larva devours the entire shell contents before either pupating within the shell or in soil nearby. Adults will visit flowers.

This is a small Palaearctic genus (4 species) with two European representatives. The other, *E. muscaria* is a central and southern European species with much broader parafacialia that only bear a single strong bristle (3-4 present in *E. palpalis*).

***Eurychaeta palpalis* (Robineau-Desvoidy, 1830)** **False fleshfly**

Description & similar species WL 7.5-10mm. A fairly large, strongly-bristled, black and grey marked species most likely to be overlooked as a female *Sarcophaga*, though the abdomen is not quite as neatly tessellated, the bristles are much stronger, the parafacialia much narrower (with several very strong bristles), the proepisternal depression (in front of the anterior thoracic spiracle) hairy and the palpi bright orange. The aristae are densely short-plumose. The male frons is about one-quarter the width of the head, that of the female about one-third.
Variation Moderate size variation.
Flight season May to August.
Habitat & biology Mostly recorded in scrubby calcareous grassland, the rides and sunny margins of woodland, and alongside hedges. Adults visit flowers such as Wood

Eurychaeta palpalis pinned male (left) and living female (right)

Spurge and Wild Parsnip. The larvae develop in helicid snails such as *Cepaea* species. Females are viviparous.

Status & distribution Widespread but localised in southern England north to Warwickshire (mostly in chalk and limestone districts) with some outlying records in Yorkshire.

Lucilia – true greenbottles

These are the familiar greenbottles that quickly arrive at a fresh kill and often come indoors. All the British species are metallic-green, turquoise or coppery (the last usually representing older individuals). No other British genus of blowfly is as metallic as *Lucilia*, and confusion in the field is most likely with muscids of the genus *Neomyia*. These muscid look-alikes have a glossy green frons and straighter upturned section of vein M. Another common green muscid, *Eudasyphora cyanella*, is somewhat less convincing due to the dust stripes on the thorax and the more gently curved vein M. The metallic-green tachinid *Gymnocheta viridis* is a more strongly bristled, slimmer fly with longer legs and a more strongly produced frons.

One species, *L. caesar* is particularly synanthropic and is the greenbottle most often seen indoors. *L. sericata* can be abundant in pastoral settings and around farmsteads and is the species most implicated in sheep fly-strike here, though other species have been reported doing this, and most British *Lucilia* will attempt opportunistic myiasis on a range of mammals.

However, the typical life cycle involves the laying of eggs on fresh carrion and maggots devouring soft tissue, often as the dominant component of the first wave of decomposition. As such, they can be important in forensic entomology and also in medicinal maggot therapy. *L. bufonivora* is rather more specialised, developing internally within the head of toads as an obligate parasite. *L. silvarum* will also attack living toads but in a more generalised manner, and also uses fresh toad corpses plus mammal corpses in damp settings. Adult greenbottles are keen flower visitors and are also attracted by fresh faeces and Stinkhorn fungus.

Lucilia is a large genus (about 250 species) with diversity highest in temperate zones, though a number of species thrive in subtropical conditions e.g. *Lucilia cuprinus*. In warmer climes, other metallic-green calliphorids become the familiar greenbottles, notably *Chrysomyia* and *Hemipyrellia* species, and there is always the chance that individuals of these could arrive in Britain with imports. Several further *Lucilia* species occur on the near continent (notably *L. pilosiventris* and *L. regalis*) and can be keyed out using Rognes (1991) and Mihályi (1977).

The British species can mostly be identified on external morphology alone but male genitalia can be useful when dealing with wet samples and for screening for non-British species. Females of *L. caesar* and *L. illustris* can only be separated by checking the base of the ovipositor. The taxonomy of the British *Lucilia* fauna is now well understood, but it is worth reading Richards (1926) to see just how much confusion over names and species limits existed at that time.

Key to species

1 Basicosta creamy-white. Subcostal sclerite (at base of stem vein on underside of wing) covered in microscopic yellow hairs (Fig 1, good magnification and lighting required)…….....……..….2
- Basicosta black or brown. Subcostal sclerite with black hairs, either long and obvious (Fig 2) or microscopic.....…….....……..3

2 Mid tibiae with a single anterodorsal bristle. Palpi orange, sometimes darker at tip. Gap between male eyes almost twice the width of a third antennal segment (Fig 3). Genitalia viewed from side with relatively few straight black hairs between the surstyli and aedeagus (Fig 9). Female with black interfrontalia less than twice as wide as the silvery parafrontalia on either side and with the parafacialia broader than the width of a third antennal segment (Fig 16). Female tergites with conspicuous pale grey dusting from some angles…..…….*sericata*

- Mid tibae with 2 strong anterodorsals. Palpi usually entirely dark brown or blackish. Gap between male eyes slightly wider than the width of a third antennal segment (Fig 4). Genitalia viewed from side with a mass of curled black hairs between the surstyli and aedeagus (Fig 10). Female with black interfrontalia more than twice as wide as the silvery parafrontalia on either side and with the parafacialia narrower than the width of a third antennal segment (Fig 17). Female tergites inconspicuously dusted…..…….…….*richardsi*

3 Subcostal sclerite pale brown or yellowish with numerous long black hairs. Tergite 1+2 metallic green as in tergite 3, at least from some angles. Tergite 3 with median marginals about half as long as the length of tergite 4 in male (Fig 6) and about one-quarter as long in female.....……...4

- Subcostal sclerite dark brown or blackish with a covering of microscopic black hairs. Tergite 1+2 blackish and contrasting markedly with the metallic green tergite 3 in all angles of view. Tergite 3 with median marginals nearly as long as the length of tergite 4 in male (Fig 7) and half as long in female.....……..6

4 Coxopleural streak missing (angle of view and lighting critical). Male genitalia viewed from side with a mass of curled black hairs between the surstyli and aedeagus and with the surstyli broad and blunt (Fig 12). Female third antennal segment almost as long as the width of the frons. Male eyes separated by about half the width of a third antennal segment, the whitish orbits almost touching (Fig 5).....*ampullacea*

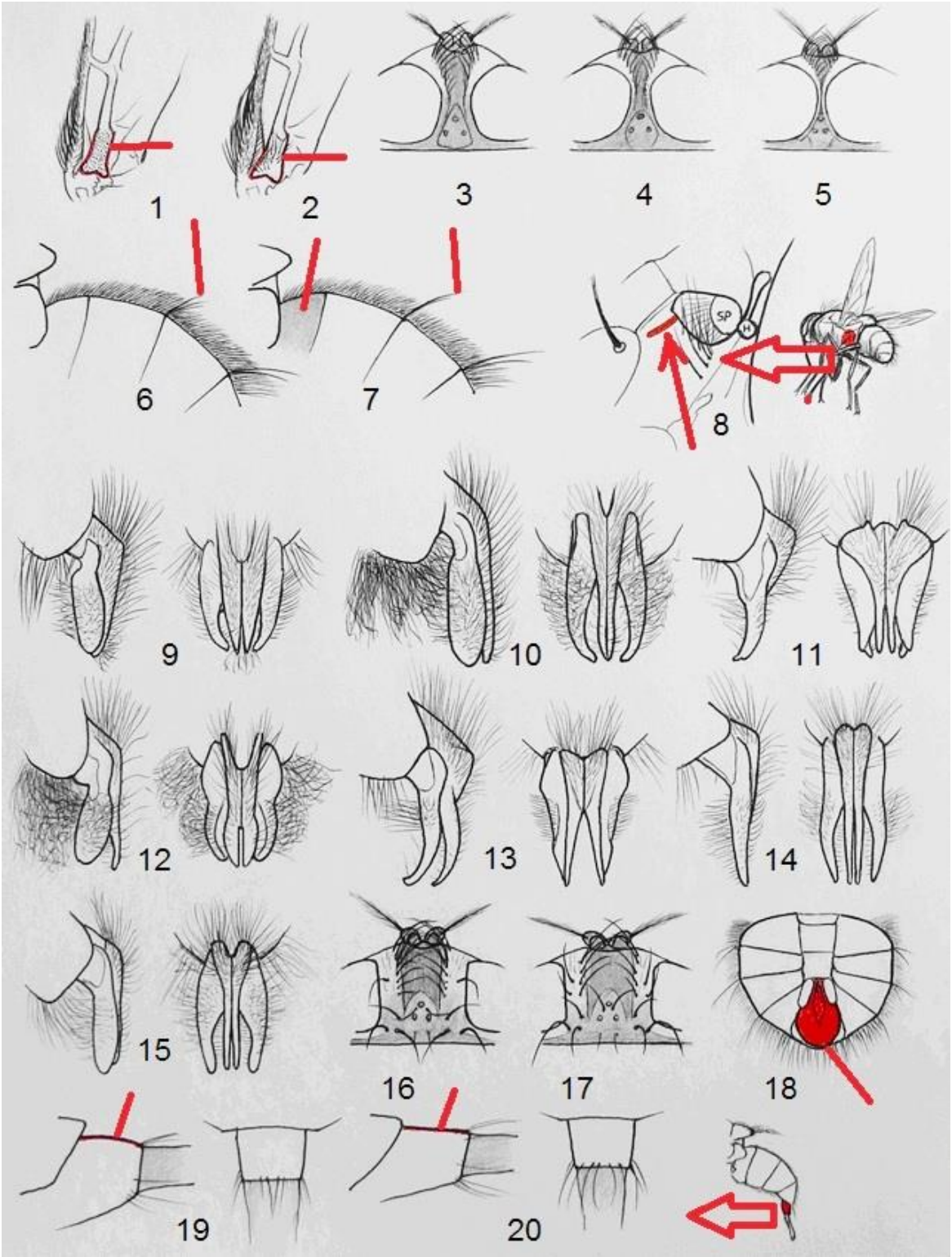
- A greyish coxopleural streak present (Fig 8, indicated by red stripe). Male genitalia viewed from side without a mass of curled black hairs between the surstyli and aedeagus and with the surstyli slimmer and more pointed (Figs 11 & 13). Female third antennal segments length about 0.75 the width of the frons.....5

5 Male eyes very narrowly separated, the whitish orbits almost touching (Fig 5). Male genital capsule large and bulbous, even when in normal folded position (Fig 18). Male genitalia Fig 11. Female tergite 6 (the base of the ovipositor) with a convex dorsal edge when viewed from the side and apically with some long bristles laterally but much shorter ones dorsally in the middle (Fig 19 - the ovipositor needs to be extracted to see this)…..…….*caesar*

- Gap between male eyes about the width of a third antennal segment, the whitish orbits clearly separated by a black interfrontalia (Fig 4). Male genital capsule smaller. Male genitalia Fig 13. Female tergite 6 with a straight dorsal edge when viewed from the side and apically with a complete row of long bristles (Fig 20).....….*illustris*

6 Three postsutural acrostichals present. Male surstyli relatively long and narrow (Fig 14). Female frons at least one-third the width of the head……..….*silvarum*

- Usually only two postsutural acrostichals. Male surstyli short and blunt (Fig 15). Female frons slightly less than one-third the width of the head....…….*bufonivora*



***Lucilia ampullacea* Villeneuve, 1922** **Streakless Greenbottle**

Description & similar species WL 5-10 mm. The lack of a coxopleural streak allows ready separation from all other *Lucilia* species under the microscope (good lighting and correct angle of view vital to check this). Both sexes look superficially like *L. caesar* in the field, and males share with *L. caesar* the possession of a very narrow

Lucilia ampullacea female (left) and close up of hind thoracic spiracle area (right) showing the lack of a coxopleural streak and the strong bluish tint and brownish cuticle that is typical of this species

frons (about half the width of a third antennal segment) with the silvery orbits almost touching (males of all other *Lucilia* have the frons at least equal to the width of a third antennal segment with orbits clearly separated by a dark interfrontalia). However, males lack the large genital capsule of *L. caesar* and have different genitalia with a mass of curly black hairs, a character shared with *L. richardsi*. A further field clue to *L. ampullacea* is its bluish, teneral-looking appearance. It does not readily acquire the very green metallic appearance of other *Lucilia* species and often retains brown-tinted areas on the sides of the thorax and base of the abdomen.
Variation Substantial size variation.
Flight season May to October.
Habitat & biology Strongly associated with woodland - it seems to like shaded and humid conditions. It is presumed to develop in woodland carrion and is a species used in forensic entomology but is also implicated in myiasis of Hedgehog, cats and toads. Adults visit woodland flowers such as Angelica; also Stinkhorn fungus.
Status & distribution Widespread and fairly frequent in woods of southern Britain with records extending more sparingly to Wester Ross.

***Lucilia bufonivora* Moniez, 1876** **Toad Greenbottle**

Description & similar species WL 5.5-7mm. A small, rather slimly-built *Lucilia*, and one of a pair of species featuring the combination of a dark subcostal sclerite bearing microscopic black hairs, a blackish tergite 1+2 (which contrasts with the metallic-green tergite 3), unusually long marginals on tergite 3, and blackish basicostae. Distinguished from the other species, *L. silvarum*, by having 2 rather than 3 pairs of postsutural acrostichals and different male genitalia. Females have a narrower frons than *L. silvarum* (less than one-third the head width). The male eyes are usually separated by just over the width of a third antennal segment.
Variation Moderate size variation. The male frons can vary from 1.0 to 1.5 times the width of a third antennal segment. It can occasionally have 3 pairs of postsutural acrostichals.
Flight season May to October.
Habitat & biology Found in wet and damp habitats such as wet woodland, marshes and around ditches, ponds and lake margins. It is an obligate and specialised parasite of toads, the eggs being laid on the head or shoulders and the larvae then invading the

nasal cavity via the nostrils. They initially feed within the nasal cavity including the rim of the nostrils and then consume the soft tissue inside the head, often including the eyes. This results in death within a few days and results in horrific injury to the host. Large toads are apparently preferred. Frogs are attacked to a lesser extent, and it has been reported developing in other parts of the body. The symptons of attack are so distinctive, that this may prove to be a reliable way of recording the fly.
Status & distribution A scarce species with scattered records as far north as Anglesey, Shropshire and Nottinghamshire.

Lucilia bufonivora pinned male (above left) and female (above right). Notce the rather slim build, blackish tergite 1+2 and presence of only 2 pairs of postsutural acrostichals. Below: an infected Common Toad showing typical symptoms of L. bufonivora attack (Photo: Marek Kozlowski).

***Lucilia caesar* (Linnaeus, 1758)** **Common Greenbottle**

Description & similar species WL 5-9.5 mm. Males are easily distinguished by the combination of a very narrow frons (about half the width of a third antennal segment) and a very large genital capsule. The male of *L. ampullacea* looks similar in the field but has a much smaller genital capsule and under the microscope will be seen to lack a coxopleural streak and have different genitalia. Females can only be confirmed under the microscope, and separation from *L. illustris* is notoriously difficult and requires detailed examination of tergite 6 which forms the base of the ovipositor and requires retraction.
Variation Substantial size variation. Old, worn individuals become bronze-coloured.
Flight season April to October.
Habitat & biology Found in most terrestrial habitats from the depths of woods to open coastal or upland settings. Often abundant in urban locations and fairly synanthropic, regularly entering houses/buildings and ovipositing on meat or dairy-based products. The larvae develop on carrion of many sorts (it is often the first species to arrive on a dead bird or mammal) and have been implicated in myiasis of various mammals including humans. It is a major sheepstrike species in parts of Europe. Adults visit flowers of many sorts, but perhaps especially, umbellifers, brambles and Ivy. They are also attracted by fresh faeces and Stinkhorn fungus.
Status & distribution Our commonest *Lucilia*, frequent and often abundant across much of Britain, though scarcer at high altitudes and possibly absent from Scottish Islands.

Lucilia caesar male (left) and female (right). Notice the narrow separation of the male eyes and rather inflated tip to its abdomen.

***Lucilia illustris* (Meigen, 1826)** **Illustrious Greenbottle**

Description & similar species WL 5.5-8 mm, averaging smaller than *L. caesar*. In males, the combination of dark basicostae and a relatively broad frons (as broad as the width of a third antennal segment) brings it out with *L. silvarum* and *L. bufonivora*, but tergite 1+2 is metallic-green like tergite 3 (blackish in the other two) and the subcostal sclerite of the wing base is pale brown and bears long hairs (dark and bearing minute black hairs in the other two). The male genitalia allows easy identification. Females can only be separated from those of *L. caesar* by examination of tergite 6 which requires pulling out of the ovipositor. In *L. illustris*, this has a fairly straight dorsal edge when viewed from the side (dorsal edge convex in *L. caesar*), and

when viewed from above has a complete row of long bristles along the hind margin (much shorter hairs present in the middle of the hind margin in *L. caesar*). Distinguishing females of the two based on the number of ray hairs on the aristae or the relative length of the third antennal segment (as used by van Emden, 1954) appears to be unreliable.
Variation Substantial size variation and in the tint of green on the body.
Flight season April to October.
Habitat & biology Found in a variety of habitats but considered to be more themophilic and heliophilic than *L. caesar*. Females visit flowers and faeces much as *L. caesar*. Larvae develop in carrion but have also been implicated in myiasis, including sheepstrike.
Status & distribution Found throughout the British Isles with records extending north to Caithness. Fairly frequent but considerably less common than *L. caesar*.

Lucilia illustris pinned male (left) and female (right). It is only by having the base of the ovipositor exposed that the female could be distinguished from L. caesar.

***Lucilia richardsi* Collin in Richards, 1926** **Richards' Greenbottle**

Description & similar species WL 5-7mm. One of two *Lucilia* species with creamy-white basicostae. It can be separated from the other, *L. sericata*, by the presence of two anterodorsal bristles on the mid tibiae and the dark palpi. Compared with *L. sericata*, males have a narrower frons. Females have the silvery parafrontalia and parafacialia distinctly narrower than *L. sericata*, the tergites less heavily grey dusted, and the antennae proportionately longer (almost reaching the mouthedge). The male genitalia allows easy identification and features a mass of curly black hairs (a character shared with *L. ampullacea*).
Variation Moderate size variation. The tint of green can vary to some degree.
Flight season Late April to September.
Habitat & biology Found in a variety of habitats but possibly more thermophilic than *L. sericata*, with a particular liking for downland and open brownfield sites but not often recorded in wooded settings.
Status & distribution Widespread but local in the southern half of Britain with records extending as far north as Lancashire. Described as new to science on the basis of British material by J.E. Collin *In* Richards (1926).

***Lucilia sericata* (Meigen, 1826)** **Sheep-strike Greenbottle**
Sheep-maggot Fly

Description & similar species WL 5-7.5mm. The second of two *Lucilia* species with creamy-white basicostae. Formal separation from the other, *L. richardsi*, should be done using a microscope, though females of *L. sericata* can usually be spotted in the field because of the flashes of pale grey dusting on the tergites (more conspicuous than in any other *Lucilia* species) and the unusually broad white parafacialia, which gives them a 'small-eyed, white faced' appearance. This is a rather stocky-looking *Lucilia*. There is usually a trace of a darker median line on tergite 3.
Variation Substantial size variation. The orange palpi can be variably darkened at the tip. The tint of green can vary to some degree.
Flight season April to October.
Habitat & biology Found in wide range of habitats, but especially abundant in pastoral settings though it can be strongly synanthropic in some areas outnumbering *L. caesar* as the indoor greenbottle. Larvae typically develop in carrion but are also responsible for myiasis in mammals of various sorts including man and have also been reared from a toad. They can also develop in garbage, including decaying matter of vegetable origin. This species is the main agent of sheep fly-strike in Britain (hence their other name of 'sheep maggot fly'). Sterile larvae can be used medicinally for maggot therapy.
Status & distribution Locally common over much of Britain, though scarce in the Scottish Highland and Western Isles. It has been accidentally introduced to most temperate regions of the world and is a sheep fly-strike problem in many places. In warmer regions it tends to be replaced by the closely-related, non-British *L. cuprina*, another important sheep fly-strike species that has spread far beyond its natural range (e.g. Stevens & Wall, 1996).

Lucilia sericata male (left) and female (right). Notice the rather broad frons in both sexes, the very white face of the female and her grey-dusted abdomen. It is also a very solid-looking greenbottle.

***Lucilia silvarum* (Meigen, 1826)** **Marsh Greenbottle**
Common Toad-fly

Description & similar species WL 4.5-8.5mm. One of a pair of *Lucilia* species featuring the combination of a dark subcostal sclerites bearing microscopic black hairs, a blackish tergite 1+2 (which contrasts with the metallic-green tergite 3), unusually long marginals on tergite 3, and blackish basicostae. Distinguished from the

other species, *L. bufonivora*, by the 3 pairs of postsutural acrostichals (normally only 2 pairs in *L. bufonivora*) and different male genitalia. Females of have a broader frons than *L. bufonivora* (about one-third the head width). The male frons is about as wide as a third antennal segment.
Variation Considerable size variation.
Flight season April to September.
Habitat & biology Like *L. bufonivora*, this is an important parasite of toads and frogs and it is typically recorded in and around wetlands, pools, ditches and other features supporting such amphibians. The parasitism is not as specialised as *L. bufonivora* in that the myiasis is facultative and does not target the nostrils. It will also use fresh amphibian corpses and can switch to mammalian carrion, including human corpses, in damp locations. This occasionally makes it a species of forensic value.
Status & distribution Frequent over much of Britain Isles with records extending sparingly north to the Outer Hebrides and Sutherland.

Lucilia silvarum pinned male (left, Photo: Yann Loscoat) and pinned emale (right)

Melanomya – little black blowflies

In its strict sense, this is a monotypic Palaearctic genus, though GBIF lists 17 species by including *Angioneura* and the Nearctic genus *Opsodexia*, a classification that is not universally accepted. All these non-metallic species share much in common, notably the obtuse bend near the mid point of vein M. The plumose aristae allow ready separation from *Angioneura* species. Little is known of the biology, though its taxonomic affinity to *Angioneura* and *Melinda* suggests that it is a snail parasitoid. It is suprising that no hard evidence exists given its abundance in various countries. *Morinia doronici*, which occurs on the near continent, resembles an oversized *M. nana* but has a facial ridge between the antennae (like *Pollenia*) and darker wings.

***Melanomya nana* (Meigen, 1826)** **Little Black Blowfly**

Description & similar species WL 3-4mm. A slim blackish species, usually with a rather darkened anterior edge to the wing and an obtusely curved vein M. This makes for a reasonably distinctive calliphorid, and it can be readily identified in the field with experience. *Rhinophora lepida* (Rhinophoridae) is a similar-sized dark species that can often be found alongside *M. nana*, but its long-stalked R4+5 and more conspicuously silvery parafrontalia and parafacialia allow easy separation under a hand lens. The male frons of *M. nana* is about half the width of a third antennal segment. That of the female is about one-third the width of the head.
Variation Moderate size variation. The intensity of wing darkening can vary
Flight season Mid-May to September.
Habitat & biology Found in a variety of open habitats including dunes, calcareous grassland, soft rock cliffs, heathland, field margins, brownfield sites, woodland rides and clearings and urban greenspace. The biology is entirely unknown and has been the debate of much speculation. Snails seem most likely, but this is not yet proven. Adults are usually found resting on low sunlit herbage in sheltered settings but will visit flowers such as umbellifers.
Status & distribution Common over much of southern Britain with records extending sparingly north to Ross & Cromarty.

Melanomya nana male (left, Photo: Lars Brunkman) and female (right, Photo: Jeremy Richardson)

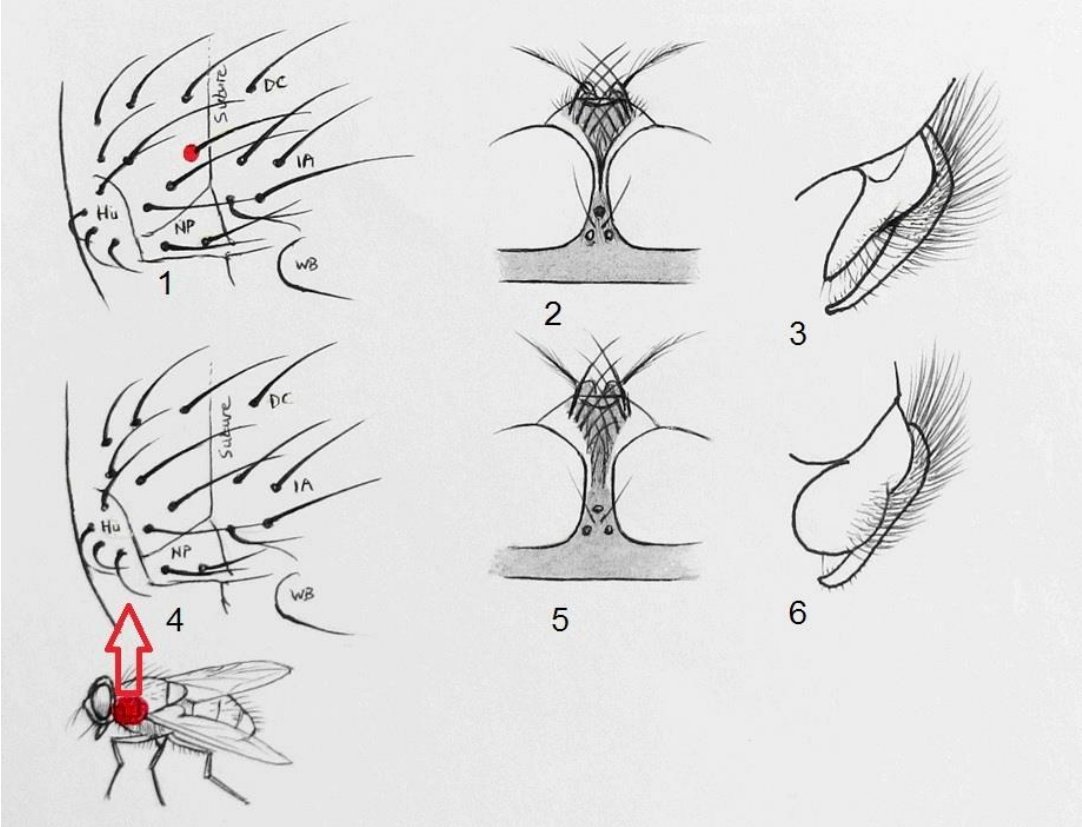
Melinda – lesser bluebottles

These are rather small, *Calliphora*-like blowflies with glossy blue tergites bearing shifting dust patterns, and a grey-dusted mesonotum with slight shifting stripes and feint metallic-blue reflections. The dark ground colour of the face, relatively narrow genae and rather short, black antennae are the more obvous differences of *Melinda*, and their closest relatives appear to be non-metallic species such as *Eggisops* and *Melanomya*. *Melinda* is an old world genus of some 66 species. Diversity is highest in the Oriental regions but with species extending to Western Europe, North Africa and even Samoa and Fiji within the Australasion regions. Some taxonomic confusion has affected the British species, with *Melinda viridicyanea* being placed in the genus *Bellardia* by Kloet & Hincks (1976). No further species occur on near continent.

The biology of a few species is known and involves parasitism of snails and oviposition rather than larviposition. Adults are keen flower visitors.

Key to species

- Presutural intra-alar bristles usually strong (Fig 1). Palpi pale brown. Male eyes separated by about half the width of a third antennal segment (Fig 2). Male surstyli narrow and pointed in side view (Fig 3)…… ..…….***gentilis***
- Presutural intra-alar bristles usually absent (Fig 4). Palpi black. Male eyes separated by about the width of a third antennal segment (Fig 5). Male surstyli circular in side view (Fig 6)....….....……*viridicyanea***



***Melinda gentilis* Robineau-Desvoidy, 1830** **Pale-palped Melinda**

Description & similar species WL 5-7mm. Superficially resembling a small *Calliphora* in the field (the completely dark face and genae and much shorter antennae will allow quick separation). Easily separable from *M. viridicyanea* under the microscope using the key but not easily in the field, though it has a slightly more robust build (with the abdomen not much longer than wide) and averages larger. The narrower male frons can be checked with a strong hand lens.
Variation Moderate size variation. The presutural intra-alar can occasionally be weak.
Flight season Late March to early October.
Habitat & biology Usually found in and around woodland and dense scrub, especially (but not exclusively) that on calcareous soils. Males will often cluster in large numbers on sun-dappled foliage (in a similar manner to some muscids). Host snails include *Cernuella virgata* and *Helicella itala*.
Status & distribution Widespread but rather local in most districts with records extending north to the Inverness area.

Melinda gentilis living male (left) and pinned female (right). Notice the narrowly separated eyes and rather broad build of the male.

***Melinda viridicyanea* (Robineau-Desvoidy, 1830)** **Dark-palped Melinda**

Description & similar species WL 4.5-7mm. Easily separable from *M. gentilis* under the microscope but not easily in the field, though it has a slightly slimmer build (with the abdomen distinctly longer than wide) and averages smaller. The broader male frons can be checked with a strong hand lens.
Variation Considerable size variation.
Flight season Late March to mid-October.
Habitat & biology It uses a much greater variety of habitats than *M. gentilis*, including woodland, wetlands, coastal dunes and shingle, plus brownfield sites, sometimes in base-poor heathland districts. Host snails include *Cernuella virgata* and *Discus rotundatus*, wth eggs being laid in the pulmonary cavity. Adults can be observed on a variety of flowers, including umbellifers, thistles, knapweeds, mayweeds, Oxeye Daisy, buttercups and Ivy.
Status & distribution Frequent over much of Britain with records extending north to the island of Pabay (near Skye) and Rum.

Melinda viridicyanea male (left) and female (right). Notice the slightly greater separation of the eyes and rather narrow build of the male compared with M. gentilis.

Phormia – black blowflies

A monotypic genus which is now widespread in warmer parts of the Palearctic and Nearctic, though scarce on the near continent. However, this is a species prone to being transported accidentally so should be looked out for here, though there is no evidence it has ever been a resident of Great Britain and Ireland.

***Phormia regina* (Meigen, 1826)** **Black Blowfly**

Description & similar species WL 6-9mm. A metallic greenish or bluish species (the tergites usually bluer than the mesonotum) most resembling *Protophormia terraenovae*, but with whitish calypters (with short white hairs on the lateral parts of the upper surface) and a thin dusting of the mesonotum (but without the paler stripes at the front seen in *Protocalliphora azurea*). The acrostichals are weak but obvious (barely evident in *P. terraenovae;* much longer in *P. azurea*) and the antennae extensivly reddish (entirely or mostly dark in the other two species). The mesonotum has 1 presutural and 2 postsutural intra-alars. The anterior thoracic spiracles are orange. The male eyes are separated by less than half the width of a third antennal segment (much less than in males of the other two) and the head is rather large and globose, producing an overall body shape reminiscent of *Pollenia amentaria*. The female frons is slightly under one-third the head width.
Variation Substantial size variation and some variation in the metallic tint.
Flight season July, August check more data.
Habitat & biology The larvae develop in carrion and it has been implicated in human and animal myiasis. It is a species of forensic value in hotter climes and is also used in maggot therapy.
Status & distribution Only known as British from a very old Oxfordshire record. There is another old record from Dublin. It is not common on the near-continent check.

Phormia regina male (left) and female (right). Photos: Tom Murray.

Pollenia – clusterflies

Clusterflies are amongst our most numerous and universal blowflies. They most attract attention when they enter buildings in late summer and autumn to overwinter. They are broadly-built, rather flattened calliphorids that, when fresh, have a characteristic covering of yellow, crinkly hairs over the top and sides of the thorax. These hairs quickly get rubbed off, though it is rare to find an old one without some crinkly hairs still present on the sides of the thorax.

Despite the superficial similarity of most of the British species, they are relatively straightforward to identify under a microscope on external morphology, and a single character state (e.g. the dark abdomen of *P. amentaria*, tuft of hairs under the wing of *P. pediculata* or reduced number of scutellar marginals or intra-alars in *P. griseotomentosa*) will often suffice. But even in the more challenging species, such as those most resembling *P. rudis*, a surprising number of microscopic characters are available. However, care should be taken to screen for extra species present on the near continent such as *P. atramentaria* and *P. mayeri*, and having the genitalia exposed on pinned material will assist.

Like *Bellardia*, these are earthworm parasitoids, though relatively little is known about species-levels preferences. However, some niche differention can be detected as there are differences in the timing of peaks of different species. This is most noticeable in districts where several species occur together. *P. griseotomentosa* and *P. labialis* also show a rather strong attachment to wetlands.

About 200 species are described globally and the genus is widespread in the Holarctic, Oriental and Australasian regions. There has bee much recent transfer of species between continents, with many of the commoner European species now well established in North America (Jewiss-Gaines et.al., 2012), and species like *P. pediculata* well established in New Zealand where is has become a pest (Heath et. al., 2004, as *P. pseudorudis*).

Key to species

1 Tergites blackish-grey without conspicuous dusting (a very faint pattern of tessellations can be made out if viewed obliquely from behind). Scutellum usually with 4-5 strong marginals in addition to the apicals (Fig 1). Mesonotum thinly dusted with some pale dusting behind the head but no hint of stripes. Broad-bodied, the males ‘big-headed’ with the orbits of the frons virtually touching…….....……..***amentaria***

- Tergites with a conspicuous shifting pattern of grey dusting (but beware specimens that have turned black due to grease or exposure to damp). Scutellum usually with only 2-3 strong marginals in addition to the apicals (Figs 2 & 3). Mesonotum often with more obvious stripes at the front. Males of most species smaller-headed, some with the orbits clearly separated by a black interfrontalia (Fig 7)….....….2

2 Node at the junction of the humeral cross-vein and subcosta on underside of wing with a tuft of yellowish hairs (Fig 9).....……..……***pediculata***

- Node at the junction of the humeral cross-vein and subcosta without a tuft of yellowish hairs…….....…….……..3

3 Mesonotum in front of suture with a median dark stripe, the width and intensity of which varies according to angle of view, plus broader black stripes at the sides starting just inward of the humeri. Humeri with 2 or more anterior bristles in front of the main 3 bristles. Two presutural intra-alars present on each side of mesonotum. Third antennal segments only about 1.5 times as long as the second. Tessellation of the tergites rather weak with a distinct dark median stripe appearing on tergites 3-5 from some angles, plus slight bluish tints. Build unusually slim, long-legged and long-winged.....***vagabunda***

- Mesonotum in front of suture without a median dark stripe (a pair of very weak stripes may run between the acrostichals and dorsocentrals). Humeri without anterior bristles in front of the main three bristles. Only one presutural intra-alar on each side of the thorax. Third antennal segments about twice as long as second. Tessellations of the tergites well formed in most species. Build stockier without noticeably long wings or long legs.….....4

4 Outer posthumeral bristle missing (Fig 4). Facial keel barely extending below the antennal sockets. Scutellum with only two pairs of scutellar marginals in addition to the apicals. Males noticeably short-legged, the front tarsi and tibiae of equal length. Small (wing length rarely exceeding 6.5mm)...……***griseotomentosa***

- Outer posthumeral bristle usually present (Fig 5). Facial keel extending well below the antennal sockets (except *labialis*). Scutellum with three pairs of scutellar marginals in addition to the apicals. Males with the front tarsi longer than the front tibiae. Typically larger (wing length regularly to 8-8.5mm)....……..…..5

5 Posterior thoracic spiracles brown. Basicostae coal-black. Facial keel weak, usually petering out before a point level with the mid point of the third antennal segment (Fig 14). Third antennal segments only red at their extreme base and usually slightly more than twice as long as the second segment.....……***labialis***

- Posterior thoracic spiracles yellowish. Basicostae usually brown, at least apically. Facial keel stronger, usually petering out at a point just short of the tip of the third antennal segment (Figs 12 & 13). Third antennal segments more extensively red and at most twice as long as the second segment.….....…….6

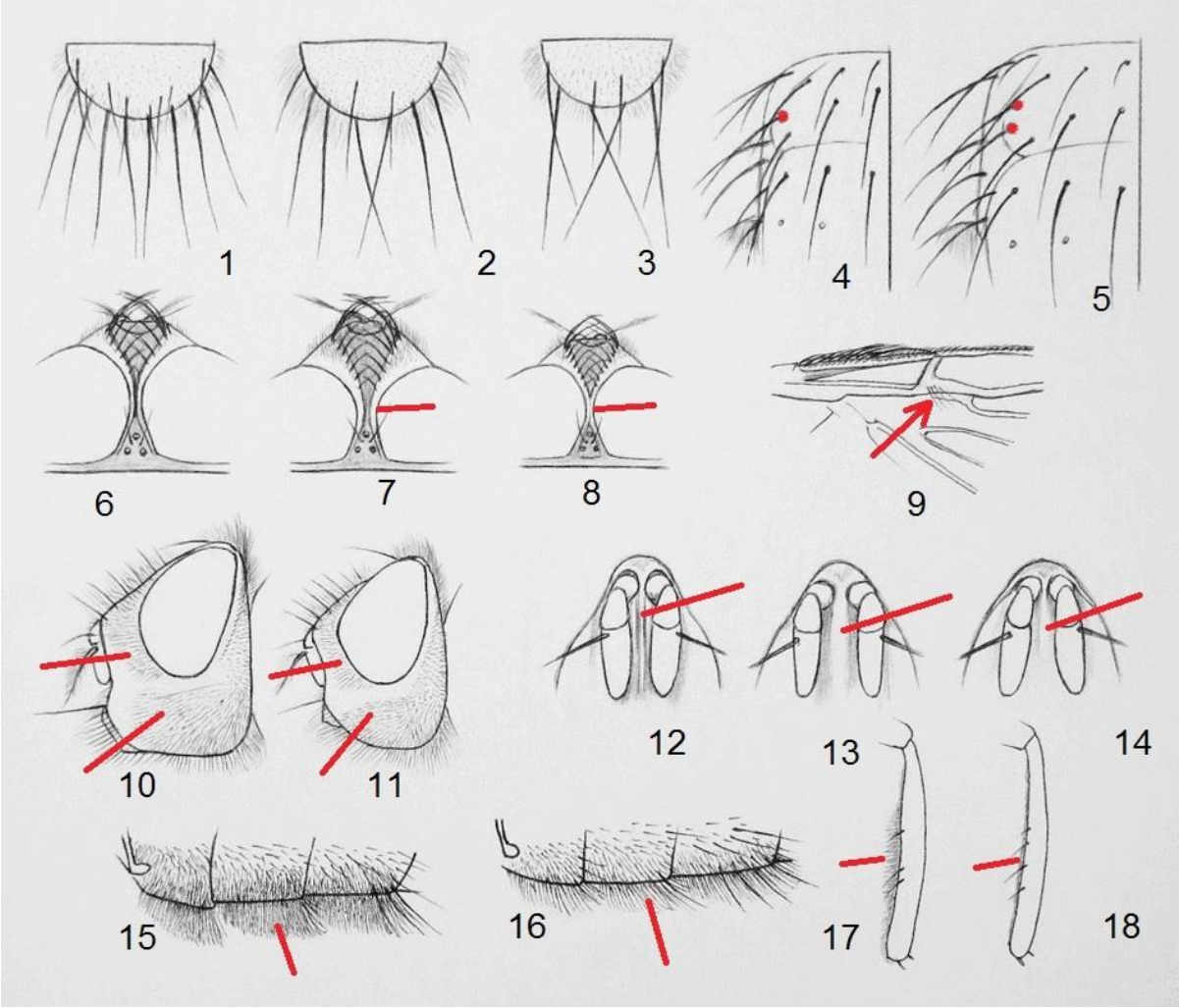
6 Palpi reddish-orange for apical third or more. Facial ridge broad and flattened on its crest, about as wide as a third antennal segment in the male (Fig 13) or half as wide in the female. Both sexes with 2-3 anteroventrals on the mid tibiae. Male with eyes usually separated by slightly more than the width of a third antennal segment and male hind tibiae without long anteroventral hairs half way along.....***viatica***

- Palpi dark. Facial ridge narrow and ridged along its crest (Fig 12). If palpi slightly reddish at tip, either mid tibiae with only a single anterodorsal, or male eyes separated by only half the width of a third antennal segment (Fig 8), or male hind tibiae with long anteroventral hairs (Fig 17), or hind femora with short yellow hairs posteroventrally..…….....7

7 Mid tibiae with 2-3 anterodorsals. Hind femora entirely covered with black hairs. Male eyes typically separated by the width of a third antennal segment (Fig 7). Depth of male genae usually about 0.6x the height of an eye, the parafacialia wider, about 3 times the width of a third antennal segment (Fig 10). Male hind tibiae mid way along with many anteroventral hairs that are almost as long as the width of the tibia (Fig 17). Male abdomen, viewed from side ventrally with a

dense fine pile of hairs that are mostly perpendicular to the tergite surface (Fig 15)…….....……..…***rudis***

- Mid tibiae with only 1 anterodorsal. Hind femora yellow-haired posteroventrally (lighting and angle of view critical to see the hair colour clearly). Male eyes typically separated by half the width of a third antennal segment (Fig 8). Depth of male genae usually about 0.5x the height of an eye, the parafacialia only about twice the width of a third antennal segment (Fig 11). Male hind tibiae with any anteroventral hairs much shorter than the width of the tibia (Fig 18). Male abdomen viewed from side ventrally with a sparser pile of hairs that are somewhat inclined with respect to the tergite surface (Fig 16)....….....….***angustigena***



***Pollenia amentaria* (Scopoli, 1763)** **Black-bellied Clusterfly**

Description & similar species WL mm. WL 4.5-8.5mm. Our most distinctive *Pollenia* due to the dark abdomen and broad build. Fresh specimens look particularly striking, with the fine yellow hairs of the mesonotum contrasting strongly with the dark tergites. The extra marginals on the scutellum is another distinction, and males have a particularly large and globose head with a very narrow frons (eyes separated by about half the width of a third antennal segment).
Variation Considerable size variation. The number of pairs of scutellar marginals varies between 3 and 5, but is usually 4 or 5.

Flight season March to October.
Habitat & biology Found in a wide variety of habitats but often in the vicinity of damp habitats. Adults will visit a variety of flowers including umbellifers, thistles, Heather and Ivy. The larvae are presumed to be earthworm parasites but the host is unknown.
Status & distribution Widespread but local in the south, becoming more abundant in Wales and Scotland, and common in the Scottish Highlands except the far north.

Pollenia amentaria male (left, Photo: Nigel Jones) and female (right, Photo: Ian Andrews) showing the blackish tergites and large eyes of the male.

***Pollenia angustigena* Wainwright, 1940** **Narrow-cheeked Clusterfly**

Description & similar species WL 4.5-8 mm, averaging smaller than *P. rudis* (on par with *P. pediculata*) with yellowish hairs on the posteroventral surface of the hind femora, as in *P. viatica* (hairs black in *P. rudis*). Otherwise resembling *P. rudis* (formerly considered a variety of *rudis*) but with a host of microscopic differences. The mid tibiae only have a single anterodorsal bristle (a character only shared with *P. griseotomentosa* and *P. vagabunda*) and the male eyes are only separated by about half the width of a third antennal segment. In side view, the male genae and parafacialia are rather narrower than *P. rudis*. Further distinctions of *P. rudis* are given under that species.

Pollenia angustigena male (left) and female (right). Notice the very narrowly separated eyes of the male.

Variation Substantial size variation and a little variation in the width of the male frons. Some specimens can have just a single outer posthumeral bristle (as in *P. griseotomentosa*).
Flight season Active from March until October, and overwintering as an adult. It can be especially abundant in spring and late summer-early autumn.
Habitat & biology Found in many habitats without any clear preferences and often clustering in large numbers on sunlit foliage. It visits a wide range of flowers, including spring-blossoming shrubs and Ivy. The larvae are presumed to be earthworm parasites but the host is unknown.
Status & distribution Widespread and common in many areas – often the most abundant *Pollenia* over large areas during certain weeks of the year. Scarcer in the Scottish Highlands.

Pollenia griseotomentosa (Jacentkowský, 1944) Little Clusterfly

Description & similar species WL4-7 mm. Averaging as our smallest *Pollenia* and the only one lacking an outer posthumeral bristle and having only 2 pairs of marginals on the scutellum (all other *Pollenia* have at least 3 pairs). The facial keel is very short. Males are relatively distinctive due to their very short tarsi and proportionately large, globose heads with very narrowly separated eyes. This creates a somewhat dumpy appearance. Females are less distinctive and care needs to be taken with small individuals of other species, particularly *P. angustigena* which shares with *P. griseotomentosa* the possession of only one anterodorsal on the mid tibiae.
Variation Substantial size variation.
Flight season Active from March until October, and overwintering as an adult.
Habitat & biology Found in a variety of damp habitats including fen, damp woodland and other marshy areas. The larvae are presumed to be earthworm parasites but the host is unknown.
Status & distribution Widespread but local in most areas extending north to the Moray Firth and the island of Raasay, near Skye. Never attaining the abundance of the commonest *Pollenia* species.

Pinned male (left) with details of the head and thorax (right)

***Pollenia labialis* Robineau-Desvoidy, 1863** **Dark-based Clusterfly**

Description & similar species WL4.5-8.5 mm. Resembling *P. rudis* but with the unique combination of coal-black basicostae and brown (rather than yellowish) posterior thoracic spiracles. It also has a short and weak facial ridge and the third antennal segments are longer (usually over twice as long as the second segment) and darker (only red at the extreme base). The mid tibiae have 2-3 anterodorsals and the male eyes are separated by just under the width of a third antennal segment. The female hind femora are entirely black-haired. It looks a little darker in the field than other *rudis*-like species, particularly about the wing bases.
Variation Substantial size variation.
Flight season Active from April until October, and overwintering as an adult.
Habitat & biology Usually associated with damp habitats such as coastal levels, dune slacks, fens and valley mire and sometimes quite common in these locations. The larvae are presumed to be earthworm parasites but the host is unknown.
Status & distribution Widespread but rather local, with records extending north to East Ross.

Pollenia labialis male (left) and female (right). Notice the coal-black basicosta. Photos: Tom Murray.

***Pollenia pediculata* Macquart, 1834)** **Tufted Clusterfly**

Description & similar species WL 4.5-8 mm. Superficially resembling species such as *P. rudis* (but averaging smaller and slightly slimmer) and *P. angustigena*. Under the microscope it is readily separated from these and other *Pollenia* species by a tuft of yellowish hairs on the underside of the wing where the humeral crossvein meets the subcosta (angle of view and lighting critical to see these). The mid tibiae have 2-3 anterodorsals and the male frons is about the width of a third antennal segment i.e. wider than *P. angustigena* and within the range of *P. rudis*. The facial keel is long and sharp as in *P. rudis* and *P. angustigena*.
Variation Substantial size variation. The basicostae can be quite dark in some which can lead to initial confusion with *P. labialis* (which has dark posterior thoracic spiracles and weaker facial keel).
Flight season Active from March until October, and overwintering as an adult. It can be especially abundant in spring and late summer-early autumn and is of the main clustering species in buildings.
Habitat & biology Found in a similar range of habitats to *P. rudis* and *P. angustigena* and usually found flying alongside these species. The earthworm *Eisenia rosea* is a known host.

Status & distribution Widespread and common – often outnumbering other *Pollenia* species during certain weeks of the year, though scarce in the Scottish Highlands.

Pollenia pediculata male (left,) and female (right)

***Pollenia rudis* (Fabricius, 1794)** **Awkward Clusterfly**

Description & similar species WL 4.5-8.5 mm. Our best known *Pollenia* but superficially very similar to *P. angustigena*, *P. labialis*, *P. pediculata* and *P. viatica*. Males have two characters that set them apart from the others: the hind tibiae have numerous outstanding hairs along the anteroventral surface of the middle section (the longest of which are almost as long as the thickness of the tibia) and the ventral-facing surfaces of tergites 3 and 4 have a particularly dense covering of fine hairs that are mostly perpendicular to the surface of the tergite (hairs sparser and/or more inclined in the other four species). Other characters shared by both sexes that assist in identification include: entirely black-haired hind femora (ruling out *P. angustigena* and *P. viatica*), 2-3 anterodorsals on the mid tibiae (ruling out *P. angustigena*), a fairly long and sharp facial ridge (ruling out *P. labialis* and *P. viatica*), yellowish hind thoracic spiracles and brownish basicostae (ruling out *P. labialis*), dark palpi (ruling out *P. viatica*) and no tuft of hairs on the underside of the wings where the humeral cross-vein meets the subcosta (ruling out *P. pediculata*). The male eyes are separated by about the width of a third antennal segment (ruling out *P. angustigena*).

Pollenia rudis male (left,) and female (right)

Variation Substantial size variation. The palpi can be dark or narrowly reddish at the tip. The basicostae can be rather dark in some but never the coal-black of *P. labialis*. The mid tibiae occasionally only have a single anterodorsal.
Flight season Most active from March until October (with pronounced peaks of abundance within this), but often recorded as adults overwintering within buildings.
Habitat & biology Found in a wide range of habitats, and common in urban settings. The larvae have been reared from earthworms of the genera *Aporrectoda*, *Eisenia* and *Lumbricus*. Adults visit a variety of flowers. They generally start to enter houses in late summer or early autumn and can form large clusters which can create a nuisance. It is not uncommon to find many dead clusterflies on a floor or window pane (though having checked many such samples, it is clear that *P. angustigena* and *P. pediculata* can also be involved in clustering). Infestations can pose a potential health risk, especially if large numbers of dead flies end up in water tanks.
Status & distribution Seemingly widespread and common over much of Britain to northern Scotland (the commonest *Pollenia* of the Scottish Highlands). NBN records are likely to include misidentifications.

***Pollenia vagabunda* (Meigen, 1826)** **Vagabund Clusterfly**

Description & similar species WL 7-7.5mm. An aberrant *Pollenia* in various respects, with a slimmer, longer-legged and longer-winged build than our other species, a dark median stripe at the front of the mesonotum, a very short third antennal segment, and shifting markings on the tergites that are less tessellated than most other *Pollenia*. The humeri have 2-3 small bristles anteriorly in addition to the three main ones and there are two presutural intra-alars on each side of the mesonotum. The tergites also produce slight blue tints from some angles.
Variation Little noted.
Flight season Most active from April to October, but hibernating as an adult and recorded in most winter months.
Habitat & biology Recorded from a variety of habitats, with no obvious preference. The larvae are presumed to be earthworm parasites but the host is unknown.
Status & distribution Our scarcest *Pollenia*, with relatively few records (mostly old) extending from the south coast of England to the Inverness area. The largest cluster of modern records is from the Scottish Highlands.

Pollenia vagabunda living (left, Photo: Tom Murray) and pinned (left) showing the median stripe of the thorax and rather slim, leggy build

***Pollenia viatica* Robineau-Desvoidy, 1944 Orange-palped Clusterfly**

Description & similar species WL 4.5 – 8.5 mm. Resembling *P. rudis* and matching its size but usually readily separable from this and other *rudis*-like species by the broadly orange tips to the palpi (the orange usually occupying at least the apical third or more). Where doubt exists (some of the other species can have the extreme tip of the palpi reddish) males of *P. labialis* have a very broad, flat-topped facial ridge between the antennae (almost as wide as the width of a third antennal segment) and there are further differences from *P. rudis* discussed under that species. Females also have a broad facial ridge but not to the extent shown by the male. In both sexes the hind femora are yellowish haired posteroventrally, as in *P. angustigena* (black-haired in *P. rudis*) There are 2-3 anterodorsals on the mid tibiae and the basicosta is pale brown. The male frons is about the width of a third antennal segment.
Variation Substantial size variation. Some variation in the extent of orange at the tip of the palpi.
Flight season Reliable records seem to be from June to August, without the very long flight period and spring plus autumn peaks of other species. This suggests a different ecological strategy may be at play.
Habitat & biology Found in a variety of habitats. It can be particularly abundant on coastal levels, dunes, chalk downland and at sandy Breckland sites. The larvae are presumed to be earthworm parasites but the host is unknown.
Status & distribution Widespread but rather local in southern Britain with records extending to south Scotland.

Pollenia viatica pinned female (left) and close up of haad showing the pale palpi (right)

Protocalliphora – bird blowflies

These are blue or greenish, rather flattened blowflies with distinct dust stripes on the mesonotum, at least on the front immediately behind the head. All species are obligate external parasites of bird nestlings, periodically attaching themselves to the skin of the nestling with a crown of setae and then sucking the blood of the bird. A badly infested nest may harbour several hundred larvae, and in such instances, the nestlings will probably all die. However, a small infestation may not result in mortality. If the maggot enters the nasal cavity it can cause the beak to become deformed ('shovel-beaked'). *Protocalliphora* diversity is particularly high and well-studied in North America, and a paper by Bennett & Whitworth (1992 reveals how different species show different host preferences and different degrees of host specificity.

This is a holarctic genus with about 45 species but only a single one occurs here. However, several further species occur on the continent (see Rognes, 1991) and any specimens with pure white calypters or where the parafrontalia and parafacialia are brown will need to be checked carefully. The closely related genus *Trypocalliphora* (represented by a single species, *T. braueri*) also occurs in NW Europe but has bright yellow basicostae, calypters and thoracic spiracles. It is a subcutaneous bird nestling parasite.

***Protocalliphora azurea* (Fallén, 1817)** **Bird Blowfly**

Description & similar species WL 5.5-9.5mm. A medium-large, rather flattened blowfly with rather different-looking sexes. Males are deep blue-black, usually with a pair of paler 'dorsocentral' dust stripes at the front of the mesonotum (best seen from behind). Females are greener with pronounced shifting dust stripes on the mesonotum and grey-dusted humeri. In both sexes, the ground colour of the head capsule and antennae are black, with pale grey dusting on parafrontalia and parafacialia. The acrostichals are well formed and the calypters are pale yellowish-grey but not usually pure white. The male eyes are seprated by about the width of a third antennal segment; the female frons is about one-quarter the width of the head. When resting, the wings are normally held tightly over the abdomen in the same fashion *as Protophormia terraenovae* rather than the delta-winged fashion of *Calliphora* and *Cynomya*.

Protocalliphora azurea male (left) and female (right)

Variation Substantial size variation. The female reflections can vary from turquoise-blue to decidedly greenish. In some males, the pale dust marks at the front of the mesonotum are barely detectable. The calypters can occasionally be white (a feature that characterises some non-British species).
Flight season April to October, as two generations. Overwintering is apparently as an adult.
Habitat & biology Found in a variety of habitats, but usually in the vicinity of woodland, trees or shrubs. The larvae mostly seem to develop in the nests of smaller passerines. Adults visit flowers such as umbellifers and Ivy. Females also like to feed on human sweat and fresh bird droppings. They have a particular liking for basking on tree trunks and fence posts. They will occasionally enter houses, possibly searching for nests, as they are not attracted by food or carrion.
Status & distribution Widespread and fairly frequent in most areas with records extending north to Ross & Cromarty.

Protophormia – blackbottles

A genus of deep-blue, rather flattened blowflies resembling *Protocalliphora* species but with the thorax undusted and acrostichals barely distinguished from the surrounding hairs. The lower calypters are also less divergent and darker, with a covering of tiny black hairs on the upper surface. The larvae develop in carrion and seem to prefer corpses in cool, boreal conditions. Indeed, subfossil puparia of *P. terraenovae* have been found in large numbers associated with the remains of tundra-dwelling European Bison and Woolly Rhinoceros dated at 75,000 years old and also the remains of Mammoth. The only other species, *P. atriceps*, has a strongly protruding lower face, aristae almost bare below and an entirely black third antennal segment. It is an alpine and boreo-montane species with lavae that can take two years to develop. Both species show a Holarctic distribution.

***Protophormia terraenovae* (Robineau-Desvoidy, 1830) Blackbottle**

Description & similar species WL 6-9mm. Resembling *Protocalliphora azurea* but a deep blue-black throughout without any obvious dusting on the mesonotum, smoky-grey calypters with dark rims, and acrostichals that are barely differentiated from the normal hairs of the mesonotum. The parafacialia are dusted grey-white. The male frons is about 1.5 times the width of a third antennal segment, the female frons just over one-third the width of the head. The tip of second antennal segment and base of the third are reddish. When resting, the wings are normally held tightly over the abdomen in the same fashion *as P. azurea* rather than the delta-winged fashion of *Calliphora* and *Cynomya*.
Variation Substantial size variation. The interfontalia can occasionally be partially reddish
Flight season Adults have been recorded in all months of the year but are most evident from May to September, representing two generations.
Habitat & biology Found in a range of habitats and very exposure tolerant, so can occur in montane areas, exposed moorland and exposed coastal areas, and overwinter as an adult. The larvae develop in carrion of various sorts and mature much more rapidly then those of other carrion-exploiting blowflies. It has been implicated in myiasis of grazing stock, reindeer and other wild animals. It is also one of the main blowfly species used in maggot therapy and can be useful in forensic entomology. It

Protophormia terraenovae male (left, Photo: Jan Zwaaneveld) and female (right)

is strongly synathropic under some circumstances, often reaching nuisance levels in slaughter houses, poultry farms and refuse dumps, and then entering nearby houses.
Status & distribution Frequent in northern and western areas extending north to Shetland but becoming scarce in south-east England.

Stomorhina – locust blowflies

Medium-sized calliphorids with strongly projecting lower faces, banded eyes, and tergites that can be strongly marked or even entirely orange. There can be fairly strong sexual dimorphism affecting the abdomen in particular and some species resemble hoverflies more than other blowflies. The stem vein of the wing bases has long hairs on the hind edge of its upper part side, and the lower calypters diverge away from the sides of the scutellum. The larvae of some species develop in the egg pods of locusts and larger grasshoppers. Other species are associated with ant nests.

This is an Old World genus that is well represented in Africa, south Asia and Australia. Over 60 species have been described. There are no further species known from the near continent.

***Stomorhina lunata* (Fabricius, 1805)** **Locust Blowfly**

Description & similar species WL 5-7mm. A very distinctive fly, with rather different-looking sexes. In both, the strongly projecting, partially shiny-black lower face provides a unique character amongst British calliphorids. The mesonotum is greyish with three broad greyish-bronze stripes. When alive, the eyes have about 6 horizontal stripes. In the male, tergites 3 and 4 have large orange patches at the sides (creating an appearance rather like male *Musca autumnalis*). The eyes virtually touch on the top of the head and the genae and sides of the thorax have a rather dense yellow pile. In females, the yellow patches are usually weak or missing and the sides of tergites 3-5 have grey dust patches with black spots coinciding with the hair sockets. The female frons is about one-third of the head width and the genae and sides of the thorax have a less conspicuous whitish pile. Vein M is rather curved in its apical upturned section making cell r-m convex apically.
Variation Female can have a variable amount of yellow ground colour at the sides of tergites 3 and 4. Moderate size variation in both sexes.
Flight season June to October.
Habitat & biology Found in a variety of warm, open, flowery habitats. The larvae develop in the egg pods of various locusts e.g. *Locusta migratoria*. Adults visit a variety of flowers, including umbellifers, mints, ragworts, Fleabane, thistles and Michaelmas daisies.

Stomorhina lunata male (left, Photo: Tim Ransom) and female (right)

Status & distribution Formerly regarded as a rarity (e.g. Wainwright, 1949), it is now quite frequent in SE England with records extending as far north as the Newcastle area (check). Given that it appears unable to use any British grasshoppers, it is likely that all records relate to vagrants that have flown in from the continent. Like many migratory insects it has periodic eruptions and 'good years'. 1901 was the first of these noted by entomologists (Perry, 2006), and the period 2004-2006 also saw an unusually high number of records (see Dipterists Digest 2006 for a batch of papers).

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RHINOPHORIDAE – WOODLOUSE-FLIES

A small family of about 150-250 described species (depending on how the family is defined) found in most parts of the world. There are affinities to both the Calliphoridae and Tachinidae and it has been included in both at various points prior to it becoming recognised as a distinct and probably monophylitic family (Crosskey, 1977). As well as historic changes to the ranking of the family, the boundaries have always been unstable and van Emden (1954) included the calliphorid genera *Angioneura* and *Melanomya* and the tachinid genera *Cinochira* and *Litophasia*. The first two genera were still listed as rhinophorids in the 1976 British checklist (Pont, 1976). Today, there remains disagreement over whether the Australian genus *Axinia* should be included or placed within its own family, the Axiniidae.

The British fauna was subject of a classic PhD study by Bedding (1965 - summarised in Bedding, 1973) which examined thousands of woodlice collected from some 50 localities in southern England and reared most of the British species. Where the biology is known, it involves endoparasitism of woodlice.

Key to rhinophorid species

1 R5 either without a stalk or with a short one that is shorter than cross vein r-m (Figs 1 & 2)…….....……...…2
- R5 with a stalk that is much longer than cross-vein r-m (Figs 3 & 4)…….....…..4
2 Femora and tibiae partially reddish. Scutellum yellowish apically with only a single pair of strong marginal bristles in addition to the strong, crossed apicals (Fig 5). Vein M usually ending on the wing margin leaving the radial cell narrowly open (Fig 1). Male sternite 5 produced into two large projecting, partially orange lobes Fig 6), the sides of tergite 1+2 & 3 orange….....…***Tricogena rubricosa***
- Legs black, at most narrowly orange at the knee joints. Scutellum with 2-3 strong marginals in addition to the strong, crossed apicals, the tip never orange. Vein M usually joining the end of vein R4+5 leaving a short stalk (Fig 2). Mesonotum and scutellum not so strongly dusted.....…….....…3
3 Tergites 3 and 4 with some strong discals as well as marginals (Fig 7). Mesonotum with three broad black stripes, the middle ‘acrostichal stripe’ fairly solid in top view and separated from the lateral ones by broad pale grey stripes aligned with the dorsocentrals (Fig 9). Palpi orange-brown. Male with strong marginals on tergite 1+2 and frons nearly one-third head width (Fig 11).....***Phyto melanocephala***
- Tergites 3 and 4 without discals, only marginals (Fig 8). Mesonotum with three narrow black stripes down the middle (the middle one weak from some angles), separated from the lateral black patches by less conspicuous pale grey stripes aligned with the dorsocentrals. Palpi blackish. Male without marginals on tergite 1 and frons only about one-tenth head width (Fig 10).....….***Phyto discrepans***
4 Parafacialia bare (Fig 11). Apical half of wing, especially fore section and membrane around the other veins, conspicuously darkenened and contrasting with the milky-white membrane and yellow veins of the basal half (this character can be poorly expressed in teneral specimens). Third antennal segment conspicuously orange on basal half..…….....….....…***Paykullia maculata***

- Parafacialia with hairs, bristles or both (Figs 12 & 13). Wings either relatively clear, or entirely darkened, or darkened with a conspicuously milky-white wing tip. Third antennal segment dark.....5

5 Halteres with dark knobs. Body shining black without any obvious pale dusting. Wings conspicuously darkened, entirely in male but with a milky white apical spot in female (Fig 3); the stalk of R4+5 longer then the upturned section of M. Small species (wing length to 3.5 mm)…….....……***Melanophora roralis***

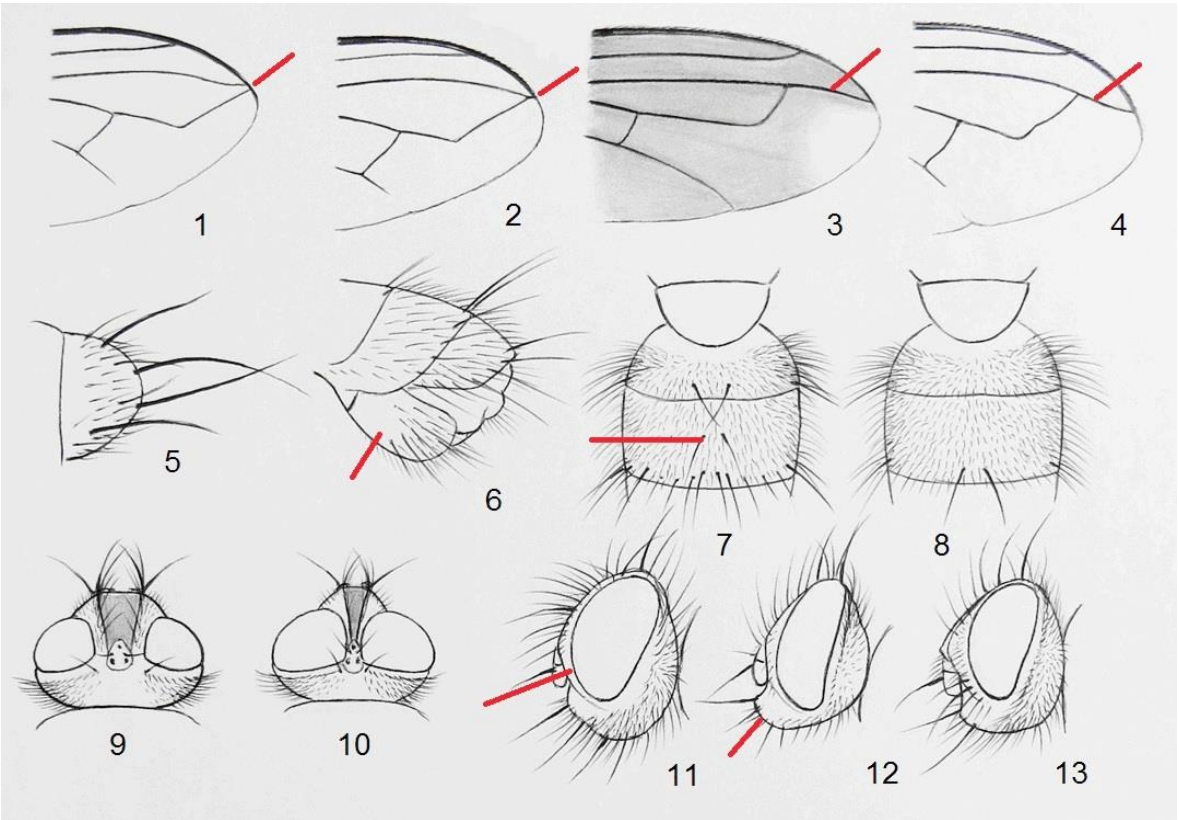
- Halteres with yellow knobs. Body with at least the parafacialia and genae with pale dusted. Wings not conspicuously darkened; the stalk of R4+5 clearly shorter than than the upturned section of M (Fig 4)...…….....……..6

6 In side view, mouth edge projecting beyond the level of the frons (Fig 12). Tergites 3 and 4 without discals. Mesonotum without pale dust stripes. Small species (wing length to 4 mm)…….....……....***Rhinophora lepida***

- In side view, frons projecting much further than the mouthedge (Fig 13). Tergites 3 and 4 with discals. Mesonotum with pale dust stripes. Typically larger (wing length to 6 mm)…….....……7

7 Palpi and antennae completely dark. A darker species with thorax, tergites and occiput rather inconspicuously dusted. Male tergite 3 without orange patches at sides. Female femora black to tip……...….……***Stevenia atramentaria***

- Palpi and tip of second antennal segment reddish. Thorax, tergites and occiput conspicuously dusted. Male tergite 3 with orange marks at sides basally. Female femora usually reddish at tip, especially below….....….***Stevenia deceptoria***



***Melanophora roralis* (Linnaeus, 1758)** **Smoky-winged Woodlouse-fly**

Description & similar species WL 3-3.5mm. A small, shiny black species with smoky wings – entirely so in males but with a milky-white apical spots in females that

can be very conspicuous against a dark background, making for a very distinctive insect. The venation is also unusual with the stalk of R4+5 longer than the upturned section of M, and cell R4+5 unusually narrow and small for a calypterate. The similar-sized *Catharosia pygmaea* (Tachinidae) has a very similar venation and also a milky white wing tip, though the wing is darker at the front than the rear, and it also has a broader, shorter-legged build and an obvious subscutellum. The male frons of *M. roralis* is about two-fifths the width of the head, the female frons nearly one-half.
Variation A little size variation. The intensity of wing darkening varies and can be less evident in teneral individuals.
Flight season Mid-May to September.
Habitat & biology This is our most synanthropic rhinophorid and used to be fairly frequent in houses and gardens. However, it can also occur well away from settlements along upper shores, soft rock cliffs and in woods associated with dead wood and old trees. Hosts include *Porcellio scaber* (especially those under loose bark) and *P. spinicornis* in a dry stone wall (Irwin, 1985). Further hosts have been used under laboratory conditions (Sassaman & Pratt, 1992). Adults have been observed vibrating their wings when walking. It does not seem to visit flowers.
Status & distribution Scattered records as far north as the Edinburgh area. It is the only rhinophorid to have shown a substantial decline, and is now rare in houses – no doubt linked to the reduced abundance of woodlice here due to central heating and modern building techniques.

Melanophora roralis male (left, Photo: *Patrick Derennes) and female (right, Photo: Pierre Duhem). Only the female has a white wing tip but the male's broad frons makes it look like a female.*

***Paykullia maculata* (Fallén, 1815)** **Picture-winged Woodlouse-fly**

Description & similar species WL 4.5-6mm. A shiny-black species with distinctive dark markings in the apical half of the wing, which combined with the long-stalked R4+5 make for an easily distinguished species. The male frons is about one-quarter the width of the head, the female frons about one-third.
Variation Substantial size variation. Teneral individuals lack conspicuous wing markings and can be confused with *Stevenia* species but the orange bases to the third antennal segments and bare parafacialia of *P. maculata* allow easy separation.
Flight season Mid-June to early October.

Habitat & biology Our most shade- and tree-loving rhinophorid. It can be encountered in woodland, scrub, hedges and gardens. Recorded hosts include *Porcellio scaber* (particularly those beneath loose bark) and *Oniscus asellus*. Adults have been observed running up tree trunks waving their wings in a similar manner to the *Dipogon* spider-wasps (which also have shiny-black bodies and marked wings). They will visit flowers of umbellifers such as Angelica and Wild Parsnip.
Status & distribution Widespread with records extending as far north as the Cromarty Firth area of Scotland. Once regarded as rare though it is probably overlooked. Bedding (1965) regarded it as the commonest parasite of *P. scaber*.

Paykullia maculata pinned male (left) and living female (right, Photo: Jeremy Richardson) - showing the distinctive wing markings

***Phyto discrepans* Pandellé, 1896** **Five-striped Woodlouse-fly**

Description & similar species WL 4-6mm. A medium-sized rhinophorid with a very short stalk to R4+5 and three narrow stripes down the 'acrostichal midline' of the mesonotum at the front (the middle one less obvious from some angles) which are separated by broad pale stripes of varying intensity from the dark lateral stripes. The mesonotum thus lacks the bold striping of *P. melanocephala*. Tergite 1+2 lacks marginals (present in male *P. melanocephala*) and tergites 3 and 4 lack discals (present in both sexes of *P. melanocephala*. The male frons is only about one-tenth the width of the frons, the female frons about one-third. The palpi are blackish (orange-brown in *P. melanocephala*). *Eggisops pecchiolii* (Calliphoridae) looks rather similar but has cell R4+5 narrowly open, plumose aristae and lower calypters hugging the edge of the scutellum.
Variation Moderate size variation. The markings on the mesonotum can vary in intensity.
Flight season May to September.
Habitat & biology Found in a variety of habitats including coastal grassland and heathland, brownfield sites, woodland rides and clearings, and occasionally gardens. Adults have been recorded visiting the flowers of umbellifers such as Rock Samphire, Hogweed and Wild carrot; also Rosebay Willowherb. Recorded hosts include *Porcellio scaber* (especially those under loose bark) and *Oniscus asellus*.
Status & distribution Scarce and localised with records extending north to Cumbria (check).

Phyto discrepans male (left) and female (right). Photos: Jeremy Richardson.

***Phyto melanocephala* (Meigen, 1824)** **Three-striped Woodlouse-fly**

Description & similar species WL 3.5-7.5 (typically 5-6mm). The very short stalk to R4+5 combined with the boldly striped mesonotum (three broad dark stripes separated by two broad grey stripes) make this a fairly easily-recognised rhinophorid, and further differences from *P. discrepans* are given in the key. The male frons is about one-quarter the width of the head, the female frons about one-third.
Variation Substantial size variation. Big individuals qualify as our largest rhinophorids but the smallest are no larger than a typical *Rhinophora lepida*. Vein M occasionally meets vein R4+5 on the wing margin, leaving the latter without a stalk.
Flight season Late April into October, presumably as two or more generations.
Habitat & biology A clear preference is shown for warm, open sites with short or sparse vegetation. Particularly strong populations can form on brownfield land and coastal shingle, and it will also use chalk downland, coastal dunes, saltmarsh edge, sea walls, gardens and woodland clearings. Adults visit flowers such as umbellifers, Yarrow, Sea-kale, Sea Mayweed and Elder. They will also bask on tree trunks. Recorded hosts include *Armadillidium vulgare* and *Porcellio scaber*.
Status & distribution Widespread and frequent (sometimes common) in southern Britain with records extending as far north as Yorkshire.

Phyto melanocephala male (left) and female (right)

***Rhinophora lepida* (Meigen, 1824)** **Pouting Woodlouse-fly**

Description & similar species WL 2.5-4mm. A small blackish species vying with *Melanophora roralis* for the title as our smallest rhinophorid, and the smallest individuals probably are. Easily distinguished from other rhinophorids and most other calypterates by the combination of the projecting upper mouth edge, the long stalk to R4+5 and the yellow halteres. Both sexes have the lower parafrontalia, parafacialia and gena silvery-white. The back of the head and sides of the thorax (including the humeri and notopleuri) are grey-dusted. The male additionally has conspicuous grey dust patches at the front corners of tergites 3 and 4, though this feature is much weaker in females. The male frons is about one-quarter the width of the head, with a matt black interfontalia that is about the same width as the silvery parafrontalia on either side. The female frons is about one-third the width, with the interfrontalia narrower than the parafrontalia. *R. lepida* often occurs alongside the superficially similar *Melanomya nana* (Calliphoridae) in the field, but the different venation and face profile will quickly separate the two even under a hand lens.
Variation Considerable size variation.
Flight season Late June into September.
Habitat & biology Found in a wide variety of warm, flowery habitats, including dry grasslands, the drier parts of wetlands, assorted coastal habitats, brownfield sites, heathland edge, arable margins and larger rides and clearings of woods. Adults like to visit flowers such as mayweeds, chamomiles, Oxeye Daisy, Tansy and umbellifers such as Wild Carrot, Fennel and Hogweed. *Porcellio scaber* seems to be the main host.
Status & distribution Widespread and locally common in the southern half of lowland Britain extending north to Fife.


Rhinophora lepida male (left) and female (right)

***Stevenia atramentaria* (Meigen, 1824)** **Black Woodlouse-fly**

Description & similar species WL 5-6mm. A shiny black species with a long stalk on R4+5 and two pale grey ‘dorsocentral’ dust stripes on the front of the mesonotum separated by a black ‘acrostichal’ stripe of similar width (best seen from behind). Tergites 3 and 4 have inconspicuous dusting at the basal corners. The palpi, antennae and legs are entirely dark and the arista long-pubescent. Males lack any red patches

on the side of tergite 3 and have a particularly slim build. The male frons is about one-fifth the width of the head, the female frons about one-third.
Variation Moderate size variation. The wing can have the fore margin somewhat darkened but not conspicuously so.
Flight season May to August.
Habitat & biology British records include field margins, damp grassland, brownfield sites and clearings in damp woodland. Recorded hosts include *Oniscus asellus* and *Trachelipus rathkei*. It will visit flowers such as umbellifers.
Status & distribution Scarce and localised in southern England north to Cambridgeshire.


Stevenia atramentaria male (Photo: Jeremy Richardson) and pinned female (right)

***Stevenia deceptoria* (Loew, 1847)** **Grizzled Woodlouse-fly**

Description & similar species WL 4-6mm. A medium-sized rhinophorid, the most heavily dusted of the species with a long stalk on R4+5. Easily separable from *S. atramentaria* by reddish palpi and tip of the second antennal segment and heavily dusted thorax, tergites and occiput. Males have orange patches at the sides of tergite 3 basally. The male frons is about one-quarter the width of the head, that of the female nearer one-third. Females usually have the tip of the femora broadly reddish, especially below.
Variation Substantial size variation. The length of the stalk on R4+5 varies from almost as long as the upturned section of M in some to only about as half as long in others. The wing membrane varies from fairly clear to slightly darkened along the fore margin and alongside the veins, but is never darkened to the extent of *Paykullia maculata*, and never with a milky-white basal section with yellow veins. In males, the extent of red at the side of tergite 3 varies somewhat. In females, the extent of red on the tip of the femora varies and in some females the femora are black virtually to the tip.
Flight season Late May to mid-August.
Habitat & biology The Kent sites are mainly chalk grassland plus one damp meadow. The Tide Mills site is vegetated shingle with scattered bramble, scrub grassland and tall herb. Adults visit the flowers of umbellifers such as Wild Carrot and also like to bask on bramble foliage. The host woodlouse does not seem to be known.
Status & distribution Recently added to the British list from several sites in Kent (Clemons, 2006), the oldest record coming from 2000. A very strong population was

then discovered at Tide Mills, Sussex in 2010, and it can be adundant here throughout summer. Considered a recent colonist in Britain capable of exploiting woodlice on boats or cargo. It was recently added to the South American list (Mulieri et. al., 2010). A number of very similar species occur on the continent.

Stevenia deceptoria male (left) and female (right)

***Tricogena rubricosa* (Meigen, 1824)** **Red-shinned Woodlouse-fly**

Description & similar species WL 3-4mm. A smallish, heavily-dusted species that is abundantly distinct from other rhinophorids through its rather stocky build, wing venation (with cell R4+5 usually narrowly open), yellow-tipped scutellum, and partially red legs (more extensively so in females than males). Males have the sides of tergites 1+2 and 3 reddish, and large, projecting lobes arising from sternite 5 which make the tip of the abdomen appear swollen. Both sexes have the frons about one-third the width of the head, that of the female slightly broader and with the parafacialia slightly wider. Females have the second antennal segment reddish but in males it is mostly dark. More likely to be confused with a small tachinid than other rhinophorids in the field.
Variation The tibiae are variably darkened basally and the extent of red varies on the femora. Moderate size variation.
Flight season Late May into September.

Tricogena rubricosa male (left, Photo: Dick Belgers) and female (right, Photo: P. Walter). Notice the orange tip to the scutellum of both sexes and the protruding lobe of sternite 5 in the male.

Habitat & biology Found in a variety of open grassy habitats, including heathland, chalk downland, acid grassland, marshy grassland, coastal dunes, brownfield sites and larger rides and clearings of woods. No flower visits noted. Reared from *Porcellio scaber*.
Status & distribution Widespread but local over much of Britain with records extending north to Moray.

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Checklist and classification of British species

CALLIPHORIDAE BLOWFLIES

CALLIPHORINAE

Bellardia bayeri (Jacentkowský, 1937)	Bayer's Emerald-bottle
Bellardia pandia (Walker, 1849)	Bisetose Emerald-bottle
Bellardia pubicornis (Zetterstedt, 1838)	Northern Bellardia
Bellardia viarum (Robineau-Desvoidy, 1830)	Dark-veined Emerald-bottle
Bellardia vulgaris (Robineau-Desvoidy, 1830)	Pale-veined Emerald-bottle
Calliphora loewi Enderlein, 1903	Long-horned Bluebottle
Calliphora stelviana (Brauer & von Bergenstamm, 1891)	Little Bluebottle
Calliphora subalpina (Ringdahl, 1931)	Woodland Bluebottle
Calliphora uralensis Villeneuve, 1922	Seabird Bluebottle
Calliphora vicina Robineau-Desvoidy, 1830	Common Bluebottle
Calliphora vomitoria (Linnaeus, 1758)	Orange-bearded Bluebottle
Cynomya mortuorum (Linnaeus, 1761)	Yellow-faced Blowfly

CHRYSOMYIINAE

Phormia regina (Meigen, 1826)	Black Blowfly
Protocalliphora azurea (Fallén, 1817)	Bird Blowfly
Protophormia terraenovae (Robineau-Desvoidy, 1830)	Blackbottle

HELICOBOSCINAE

Eurychaeta palpalis (Robineau-Desvoidy, 1830)	False fleshfly

LUCILIINAE

Lucilia ampullacea Villeneuve, 1922	Streakless Greenbottle
Lucilia bufonivora Moniez, 1876	Toad Greenbottle
Lucilia caesar (Linnaeus, 1758)	Common Greenbottle
Lucilia illustris (Meigen, 1826)	Illustrious Greenbottle
Lucilia richardsi Collin in Richards, 1926	Richards' Greenbottle
Lucilia sericata (Meigen, 1826)	Sheep-strike Greenbottle
Lucilia silvarum (Meigen, 1826)	Marsh Greenbottle

MELANOMYINAE

Angioneura acerba (Meigen, 1838)	Pale Least Blowfly
Angioneura cyrtoneurina (Zetterstedt, 1859)	Dark Least Blowfly
Eggisops pecchiolii Rondani, 1862	False Woodlouse-fly
Melanomya nana (Meigen, 1826)	Little Black Blowfly
Melinda gentilis Robineau-Desvoidy, 1830	Pale-palped Melinda
Melinda viridicyanea (Robineau-Desvoidy, 1830)	Dark-palped Melinda

POLLENIINAE

Pollenia amentaria (Scopoli, 1763)	Black-bellied Clusterfly
Pollenia angustigena Wainwright, 1940	Narrow-cheeked Clusterfly
Pollenia griseotomentosa (Jacentkowský, 1944)	Little Clusterfly
Pollenia labialis Robineau-Desvoidy, 1863	Dark-based Clusterfly
Pollenia pediculata Macquart, 1834)	Tufted Clusterfly

Pollenia rudis (Fabricius, 1794)	Awkward Clusterfly
Pollenia vagabunda (Meigen, 1826)	Vagabund Clusterfly
Pollenia viatica Robineau-Desvoidy, 1944	Orange-palped Clusterfly

RHINIINAE

Stomorhina lunata (Fabricius, 1805)	Locust Blowfly

RHINOPHORIDAE	**WOODLOUSE-FLIES**
Melanophora roralis **(**Linnaeus, 1**758**)	Smoky-winged Woodlouse-fly
Paykullia maculata (Fallén, 1815)	Picture-winged Woodlouse-fly
Phyto discrepans Pandellé**,** 1896	Five-striped Woodlouse-fly
Phyto melanocephala (Meigen, 1824)	Three-striped Woodlouse-fly
Rhinophora lepida (Meigen, 1824)	Pouting Woodlouse-fly
Stevenia atramentaria (Meigen, 1824)	Black Woodlouse-fly
Stevenia deceptoria (Loew, 1847)	Grizzled Woodlouse-fly
Tricogena rubricosa (Meigen, 1824)	Red-shinned Woodlouse-fly

Name change navigator

Black - Calliphoridae (Rhinophorinae*) (Sarcophaginae*)
Red - Rhinophoridae
Blue - Sarcophagidae
Brown - Oestridae
Green - Tachinidae

Van Emden (1954)	**Kloet & Hincks (1976)**	**Chandler (1998)**	**NBN (2016)**
n/a	*Angioneura acerba*	*Angioneura acerba*	*Angioneura acerba*
*Angioneurilla cyrtoneurina**	*Angioneura cyrtoneurina*	*Angioneura cyrtoneurina*	*Angioneura cyrtoneurina*
n/a	*n/a*	*Bellardia bayeri*	*Bellardia bayeri*
Onesia biseta	*Bellardia biseta*	*Bellardia pandia*	*Bellardia pandia*
Pseudonesia puberula	*Pseudonesia puberula*	*Bellardia pubicornis*	*Bellardia pubicornis*
Onesia aculeata	*Bellardia pusilla*	*Bellardia viarum*	*Bellardia viarum*
Onesia agilis	*Bellardia agilis*	*Bellardia vulgaris*	*Bellardia vulgaris*
Calliphora loewi	*Calliphora loewi*	*Calliphora loewi*	*Calliphora loewi*
Acrophaga alpina	*Calliphora alpina*	*Calliphora stelviana*	*Calliphora stelviana*
Acrophaga subalpina	*Calliphora subalpina*	*Calliphora subalpina*	*Calliphora subalpina*
Calliphora uralensis	*Calliphora uralensis*	*Calliphora uralensis*	*Calliphora uralensis*
Calliphora erythrocephala	*Calliphora vicina*	*Calliphora vicina*	*Calliphora vicina*
Calliphora vomitoria	*Calliphora vomitoria*	*Calliphora vomitoria*	*Calliphora vomitoria*
Cynomya mortuorum	*Cynomya mortuorum*	*Cynomya mortuorum*	*Cynomya mortuorum*
Eggisops pecchiolii	*Eggisops pecchiolii*	*Eggisops pecchiolii*	*Eggisops pecchiolii*
*Helicobosca distinguenda**	*Helicobosca distinguenda*	*Eurychaeta palpalis*	*Eurychaeta palpalis*
Lucilia ampullacea	*Lucilia ampullacea*	*Lucilia ampullacea*	*Lucilia ampullacea*
Lucilia bufonivora	*Lucilia bufonivora*	*Lucilia bufonivora*	*Lucilia bufonivora*
Lucilia caesar	*Lucilia caesar*	*Lucilia caesar*	*Lucilia caesar*
Lucilia illustris	*Lucilia illustris*	*Lucilia illustris*	*Lucilia illustris*
Lucilia richardsi	*Lucilia richardsi*	*Lucilia richardsi*	*Lucilia richardsi*
Lucilia sericata	*Lucilia sericata*	*Lucilia sericata*	*Lucilia sericata*

Lucilia silvarum	*Lucilia silvarum*	*Lucilia silvarum*	*Lucilia silvarum*
*Morinia nana**	*Melanomya nana*	*Melanomya nana*	*Melanomya nana*
Melinda anthracina	*Melinda gentilis*	*Melinda gentilis*	*Melinda gentilis*
Melinda caerulea	*Bellardia cognata*	*Melinda viridicyanea*	*Melinda viridicyanea*
Phormia regina	*Phormia regina*	*Phormia regina*	*Phormia regina*
Pollenia vespillo	*Pollenia vespillo*	*Pollenia amentaria*	*Pollenia amentaria*
Pollenia rudis f. angustigena	*Pollenia rudis f. angustigena*	*Pollenia angustigena*	*Pollenia angustigena*
Pollenia varia	*Pollenia varia*	*Pollenia griseotomentosa*	*Pollenia griseotomentosa*
Pollenia excarinata	*Pollenia intermedia*	*Pollenia labialis*	*Pollenia labialis*
n/a	*n/a*	*Pollenia pediculata*	*Pollenia pediculata*
Pollenia rudis rudis	*Pollenia rudis rudis*	*Pollenia rudis*	*Pollenia rudis*
Pollenia vagabunda	*Pollenia vagabunda*	*Pollenia vagabunda*	*Pollenia vagabunda*
Pollenia carinata	*Pollenia pallida*	*Pollenia viatica*	*Pollenia viatica*
Protocalliphora sordida	*Protocalliphora azurea*	*Protocalliphora azurea*	*Protocalliphora azurea*
Protocalliphora sordida	*Protocalliphora sordida*	Non-British	Non-British
Phormia terrae-novae	*Phormia terraenovae*	*Protophormia terraenovae*	*Protophormia terraenovae*
Stomorhina lunata	*Stomorhina lunata*	*Stomorhina lunata*	*Stomorhina lunata*
*Melanophora roralis**	*Melanophora roralis*	*Melanophora roralis*	*Melanophora roralis*
*Parafeburia maculata**	*Paykullia maculata*	*Paykullia maculata*	*Paykullia maculata*
*Styloneura discrepans**	*Phyto discrepans*	*Phyto discrepans*	*Phyto discrepans*
*Phyto melanocephala**	*Phyto melanocephala*	*Phyto melanocephala*	*Phyto melanocephala*
*Rhinophora lepida**	*Rhinophora lepida*	*Rhinophora lepida*	*Rhinophora lepida*
*Stevenia atramentaria**	*Stevenia atramentaria*	*Stevenia atramentaria*	*Stevenia atramentaria*
n/a	*n/a*	*n/a*	*Stevenia deceptoria*
*Stevenia umbratica**	*?Stevenia umbratica*	Misident, Non-British	Non-British
*Frauenfeldia rubricosa**	*Tricogena rubricosa*	*Tricogena rubricosa*	*Tricogena rubricosa*
Cephenemyia auribarbis	*Cephenemyia auribarbis*	*Cephenemyia auribarbis*	*Cephenemyia auribarbis*
Pharyngomyia picta	*Pharyngomyia picta*	*Pharyngomyia picta*	*Pharyngomyia picta*
*Cinochira atra**	*Cinochira atra*	*Cinochira atra*	*Cinochira atra*
*Litophasia hyalinipennis**	*Litophasia hyalinipennis*	*Litophasia hyalinipennis*	*Litophasia hyalinipennis*
*Remaining Sarcophagidae**		*Sarcophagidae*	*Sarcophagidae*

Its is also worth noting that *Pollenia pediculata* has been referred to as *P. pseudorudis* in some foreign literature.

Acknowledgements

In assembling this account I have been reminded of the various entomologists who have provided me with information, advice and specimens relating to calliphorids and rhinophorids over the years: John Bowden, Peter Chandler, Laurence Clemons, Jonathan Cole, Lewis Davies, Murdo Macdonald and Knut Rognes. I am also extremely grateful to Duncan Sivell (the Natural History Museum (NHM), London) and Darren Mann (Oxford University Museum) for allowing me to examine and borrow specimens from their collections. The gathering of nearly 40 dipterists at the Dipterists Forum/Field Studies Council calliphorid, sarcophagid and rhinophorid workshop at Preston Montford in February 2016 provided valuable feedback for the first draft, and I am grateful to all who attended and especially to Duncan Sivell for organising it. Mike Pugh very kindly proof read the final draft.

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