

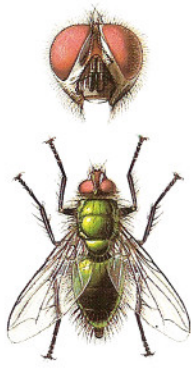
- ▲ ***Drosophila funebris*** Drosophilidae. One of many closely related species known as fruit-flies or vinegar-flies because of their liking for rotting fruit and other fermenting materials. Arista of antenna bears fine bristles and appears forked at tip (strong lens!). 2 clear breaks in front edge of wing. Long cell in hind region of wing, with short anal cell behind it, unlike Ephydriidae and Chloropidae (p. 210). Most common in summer and autumn: all year in food and drink factories. Fond of wine, often settling on opened bottles and glasses. Breeds in decaying vegetable matter.
- ▲ ***Leucophenga maculata***. Closely related to *Drosophila* but arrangement of head bristles differs. Easily identified by body pattern: thorax silver-haired in male and orange-brown in female. Breeds in fungi. S & C.
- ▲ ***Phytomyza ilicis*** Agromyzidae. 4-7 in woods, hedgerows, and gardens. Larva excavates distinctive mine in holly leaf. Mined leaves visible at all seasons, but grubs or pupae present only in spring and early summer. Easy to breed out adults. This large genus is distinguished from many similar groups by lack of posterior cross-vein, but specific identification of adults is difficult. All members of the family are leaf miners in their early stages.

LOUSE-FLIES Hippoboscidae. Also known as flat-flies, these are flattened, blood-sucking parasites of birds and mammals. Head partly sunk into thorax. Long, toothed claws grip feathers or fur of hosts. Many have reduced wings, and even fully-winged species rarely fly. Instead of laying eggs, female periodically gives birth to a fully-grown larva, which pupates immediately. The related Nycteribiidae is a small family of completely wingless bat parasites in which the head folds back into a groove on the thorax.

- ▲ **Sheep Ked *Melophagus ovinus***. Entirely wingless, never leaving hosts, although it can move from one sheep to another when they come into contact. It seems to do the sheep little real harm. *M. rupicaprinus* lives on the chamois.
- ▲ **Forest-fly *Hippobosca equina***. Fully-winged in both sexes. On horses, cattle, and deer. Scuttles sideways with crab-like gait when disturbed. Mostly in wooded areas. 5-10, most noticeable when new adults are seeking hosts.
- ▲ **Deer-fly *Lipoptena cervi***. On deer, especially red deer, mainly in wooded areas. Winged at first, but sheds wings on reaching host. New adults emerge in autumn and fly into trees, from where they drop on to passing animals.
- ▲ ***Ornithomyia avicularia***. Fully-winged. 6-10 on a wide range of woodland birds, including owls, pigeons, and thrushes: mainly on young birds, perhaps because older ones preen themselves better.
- ▲ ***Crataerina hirundinis***. Flightless, with much reduced wings. On martins and swallows. 5-10. Pupae overwinter in nests and new adults emerge when the birds return in spring. ▲ ***C. pallida*** has broader wings and infests swifts.

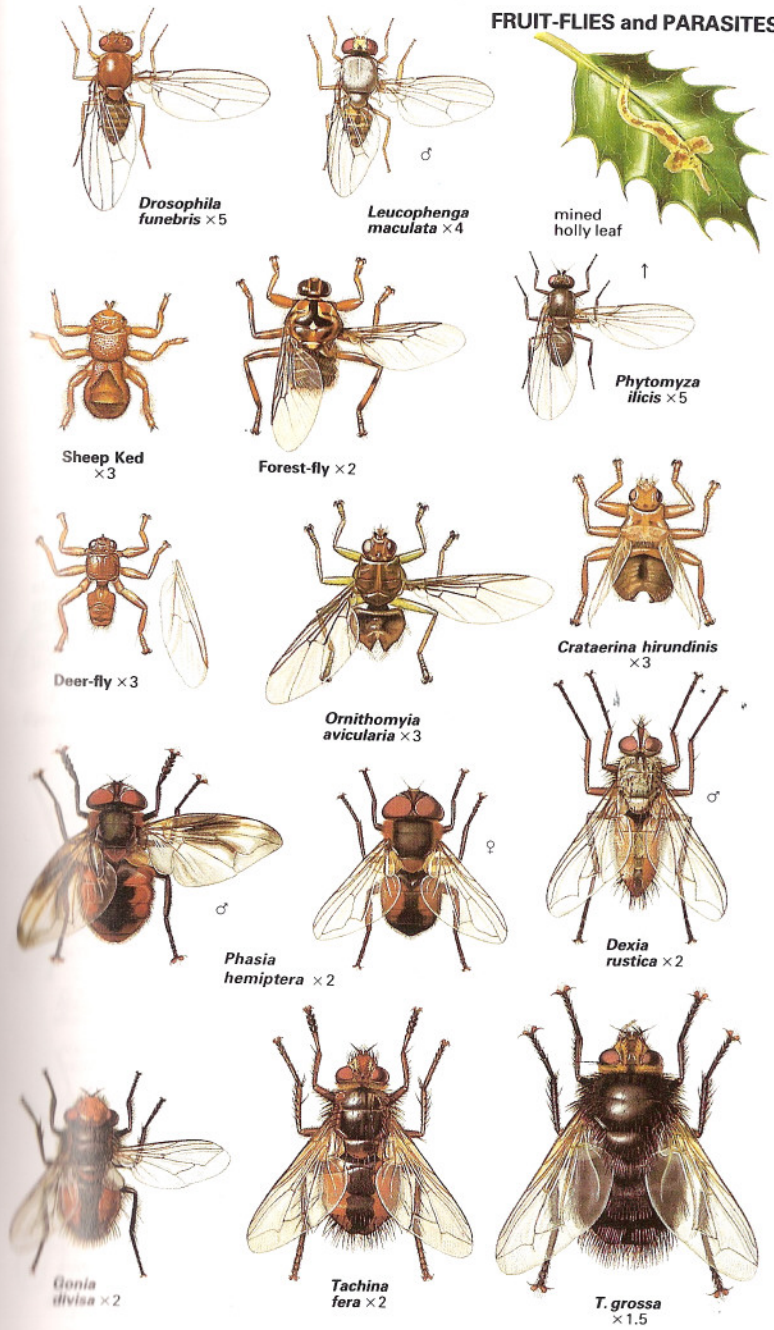
Family Tachinidae. A large and rather variable family most of whose larvae are internal parasites of caterpillars and other young insects. Some attack adult bugs and grasshoppers. Adults are bristly and resemble Calliphoridae (p. 214), but distinguished from them by the prominent post-scutellum bulging beneath the scutellum. 4th long vein sharply bent. Thoracic squamae usually very large. Many species are common on flowers.

- ▲ ***Gymnochaeta viridis***. Resembles *Lucilia* (p. 214), but more bristly and with hairy eyes. Thorax may have golden stripes. On vegetation, especially tree trunks, 3-7. Eggs laid on plants and grubs bore into various moth caterpillars.
- ▲ ***Phasia hemiptera***. Size and colour vary a good deal, but male always has very broad wings and rather bug-like at rest. 4-8. Parasitises various heteropteran bugs, the female ovipositing directly into host.
- ▲ ***Dexia rustica***. Female much blacker. 6-8. Eggs laid on soil and larvae seek out grubs of cockchafer and related beetles.
- ▲ ***Gonia divisa***. Resembles *T. fera*, but wings lack yellow and head is more swollen in front. 3-6 in rough, grassy places. Eggs are scattered and grubs seek out caterpillars of noctuid moths.
- ▲ ***Tachina fera***. Jowls with yellow hair. 4-9 in woods and moist habitats: often abundant on waterside plants in late summer. Eggs are laid on plants and the grubs bore into the caterpillars of numerous butterfly and moth species.
- ▲ ***T. grossa*** resembles a bumble bee in flight. 2-9 in woods and heathland. A parasite of large caterpillars.



Gymnochaeta viridis × 2

FRUIT-FLIES and PARASITES



BLOW-FLIES Calliphoridae. A large family of rather stout flies, resembling Tachinidae (p. 212) in having a fan of bristles close to haltere, but with little or no post-scutellum. 4th long vein usually bends *sharply* forward near tip. Adults soak up surface fluids with mop-like mouth-parts. Most common in summer, but many species are drawn out to bask by winter sunshine. Most breed in carrion and other decaying animal matter. A few larvae are parasites.

- ▲ **Bluebottle** *Calliphora vomitoria*. One of several similar flies common in and around houses: rests on sunny walls all year. Female attracted to meat and fish indoors for egg-laying. Larva (p. 294) is typical of whole family. ▲ *C. vicina* is almost identical but has reddish jowls (below eyes) instead of black.
- ▲ **Cluster-fly** *Pollenia rudis*. Golden hairs on thorax and chequered abdomen identify this fly, named for its habit of hibernating in dense clusters in attics and out-houses, usually with wings laid over each other on top of abdomen. Larvae parasitise earth-worms.
- ▲ **Cynomya mortuorum**. Brilliant blue or occasionally green, with yellowish jowls. On carrion but less common than bluebottle and greenbottle.
- ▲ **Greenbottle** *Lucilia caesar*. Bluish green to emerald, often becoming coppery with age. Eyes bare; jowls silvery. 4th long vein sharply bent. Size varies. On carrion, dung, and flowers everywhere: rarely indoors. Larvae sometimes live in wounds on sheep and other animals. Commonest of several very similar species in this genus.
- ▲ **Flesh-fly** *Sarcophaga carnaria* Sarcophagidae. One of several very similar species with large feet and red eyes. Size very variable. Common around houses, but not often inside. Breeds in carrion, female bringing forth young larvae instead of eggs.

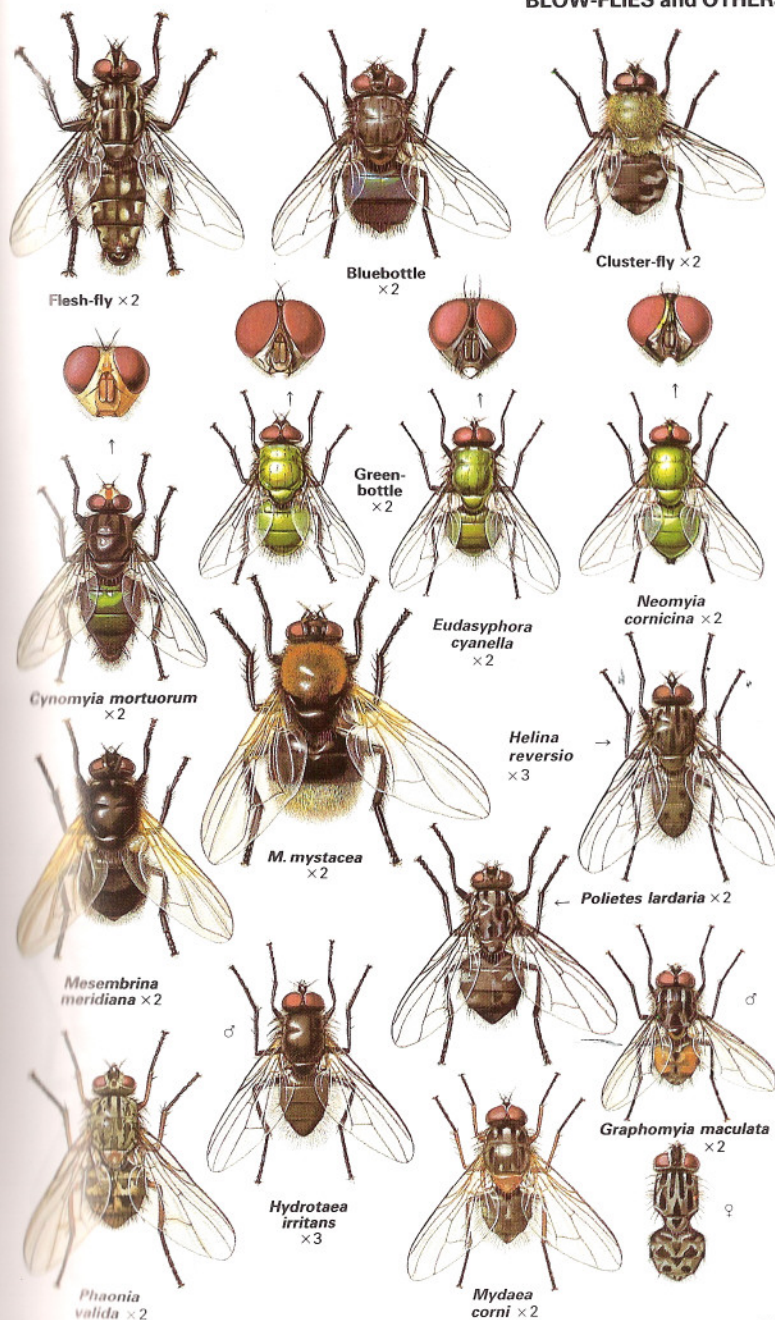
HOUSE-FLIES and kin Muscidae. A large and rather variable family: often resemble blow-flies, but generally smaller and never with a fan of bristles near haltere. 4th long vein rarely bends sharply forward. Most species mop up fluids like blow-flies. Most breed in dung and other decaying matter, larvae being like those of bluebottle. Identification of many smaller species difficult, relying on bristle patterns and genitalia.

- ▲ **Eudasyphora cyanella**. Like *Lucilia* but 4th long vein bends gently forward. Eyes hairy. Green becomes coppery with age. Viviparous. Often overwinters in buildings with Cluster-fly. Several similar species.
- ▲ **Neomyia cornicina**. Like *Lucilia*, with 4th vein sharply bent, but jowls metallic green. On flowers, dung, and carrion. Larvae live in dung and are blue.
- ▲ **Mesembrina meridiana**. Enjoys basking on ground or vegetation: especially fond of umbellifer flowers. 3-10, mainly in woods and hedgerows. Breeds in dung.
- ▲ **M. mystacea** is hairier, especially on middle tibia. Like *Volucella bombylans* (p. 206) in flight. 6-9, mainly on umbellifers and other flowers. Much of Europe, but only on mountains in S.
- ▲ **Helina reversio**. 4th long vein curves gently backwards. 4-10. Enjoys basking in all kinds of habitats from pinewoods to marshes. Many similar species.
- ▲ **Polietes lardaria**. Like a small Flesh-fly but with 4th long vein almost straight. 4-10 in open country and light woodland. Larva predatory in dung.
- ▲ **Phaonia valida**. 4th long vein almost straight, but differs from *Helina* and *Mydaea* in having a strong bristle on dorsal side of hind tibia (not easily detected). 4-11, basking on tree trunks and flowers. Breeds in leaf litter. Many similar species.
- ▲ **Hydrotaea irritans**. Males of this genus have oddly-shaped front legs. Female plain grey, although abdomen may be reddish at base. 6-9, often swarming round human heads seeking sweat, especially in woodland. Larva partly predatory.
 - ▲ **H. ignava**. Hind tibia of male curved and with tuft of soft hair. 4-10 on and around lush vegetation, especially among trees. Common in orchards. Hovers in shafts of sunlight. Breeds in decaying vegetation and manure, where larvae feed on other fly grubs. Abundant in poultry houses and on pig farms. The very similar ▲ **H. capensis** occurs in the same places.
 - ▲ **Mydaea corni**. Scutellum yellow. A few bristles at base of 3rd long vein. 5-8, basking on flowers, foliage, and ripe fruit: especially fond of elder flowers.
 - ▲ **Graphomya maculata**. 4th long vein bends quite sharply forward, thus distinguishing female from *Polietes*. Male wings have yellowish tinge, but female wings yellow only at base. 5-10, mainly on umbellifers. Larvae predatory in muddy pools and damp leaf litter.



Hydrotaea ignava ×3

BLOW-FLIES and OTHERS



▲ **Stable-fly** *Stomoxys calcitrans* Muscidae. One of the 'biting house-flies', both sexes being blood-suckers. Piercing proboscis points forward at all times, readily distinguishing this species from House-fly. 4th long vein gently curved. 4-10, mainly around farms and stables: often bites people. Breeds in dung and stable litter,

▲ **Common House-fly** *Musca domestica*. 4th vein sharply bent. Most common 6-9. Breeds in and around houses throughout the world. Especially numerous around farms and rubbish dumps where decaying matter abounds. ▲ **Face-fly** *M. autumnalis*, also called Autumn-fly, is very similar, especially female, but body more rounded and male has more orange on abdomen. Swarms over cattle: Sun-bathes on walls and fences. Enters houses for hibernation in autumn - when House-fly population is declining.

▲ **Lesser House-fly** *Fannia canicularis* Fanniidae. Smaller and more slender than *Musca* and with 4th long vein almost straight. Female very dull, without clear patches at base of abdomen. Male flies incessantly round lights and other objects indoors. Larva (p. 294) feeds in various kinds of dung. There are many similar species.

▲ **Eustalomyia festiva** Anthomyiidae. Closely related to muscids but 6th long vein reaches wing margin. 4th vein almost straight. On flowers 5-8. Breeds in bodies of flies stored by solitary wasps.

▲ **Anthomyia pluvialis**. Abdomen much broader than *Eustalomyia* and very flat. 4-8 on umbellifers and other flowers, especially in damp places. Males 'dance' before rain. Breeds in decaying vegetation.

▲ **Cabbage Root-fly** *Delia radicum*. One of many very similar small flies. 3-11 on flowers and leaves. Susceptible to fungal attack, and corpses not uncommonly found clinging to vegetation in large masses. Larvae damage roots of brassicas.

▲ **Cordilura impudica** Scathophagidae. Outer half of costa hairy (lens!): wing clearly darker towards apex. Legs very spiky, 4-9, mainly in damp places. Frequents cow-pats and other dung, preying on small insects. Breeds in dung. There are many similar species.

▲ **Norellisoma spinimanum**. Identified by double row of bristles under front femur (lens!). Tibiae very bristly. Narrow brown (not black) bands on thorax. 6-9, mainly in damp places. Adults are predatory, but larvae feed in stems of docks.

▲ **Yellow Dung-fly** *Scathophaga stercoraria*. Golden-furred males swarm on fresh cow-pats and horse dung. Females are less furry and rather greyish: less common than males. Adults prey on other flies on the dung, while larvae develop in the dung. There are several similar species.

▲ **Warble-fly** *Hypoderma bovis* Oestridae. Hairy, bee-like fly, with 4th long vein bent sharply forward in line with posterior cross-vein. 6th vein reaches wing margin. 5-6. Adult does not feed. Eggs laid on cattle legs and larvae work their way through body to spend final 3 months in swellings (warbles) just under skin on the back. Fall out when mature and pupate on ground. Hides are ruined by the warbles and exit holes.

▲ **H. lineatum** is similar, although a little slimmer, with blacker veins and shorter hair. ▲ **H. diana** has a similar life history but attacks red deer.

Oedemagena tarandi. A parasite of reindeer, with a life history like Warble-fly. N.

▲ **Sheep Nostril-fly** *Oestrus ovis*. Wrinkled or warty surface characterises this fly. 3rd and 4th long veins join before reaching wing margin: 6th vein does not reach margin. 5-6, resting on rocks and walls in sheep country. Adult does not feed. Viviparous, with female depositing young larvae in sheep nostrils. The larvae feed on mucus and blood in the nasal cavity and sinuses for about 9 months and then pupate in the soil. The fly also attacks goats and various other mammals, including man on occasions.

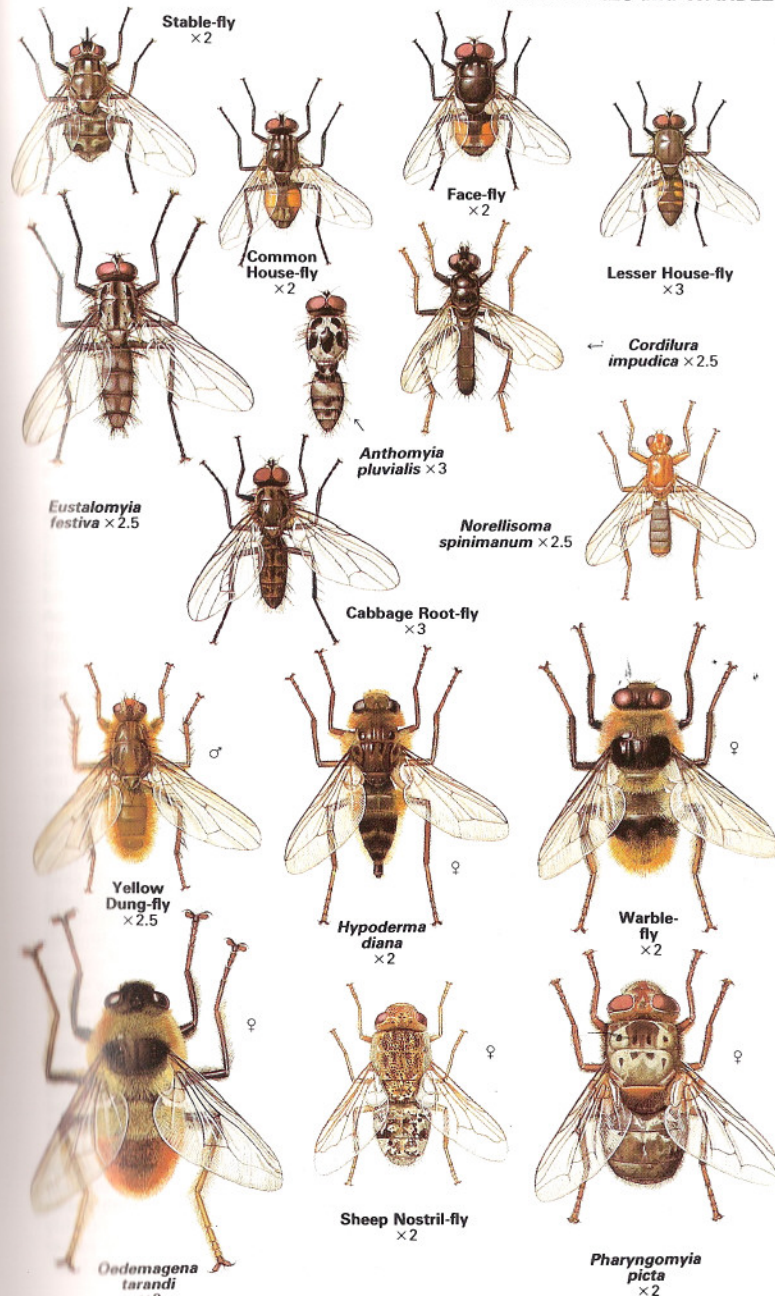
Pharyngomyia picta. Life cycle like that of *Oestrus*, but living on deer. Widespread but rare.

▲ **Bot-fly** *Gasterophilus intestinalis* Gasterophilidae. 4th long vein almost straight. 7-9. Adult does not feed. Eggs are laid on legs of horses, donkeys, and mules: larvae enter mouth when legs are licked, and then pass into stomach to complete their growth attached to the lining. They pass out of the body to pupate in the soil. There are several similar species, mostly without brown on the wings.



Bot-fly × 2

HOUSE-FLIES and WARBLES



ANTS, WASPS, BEES, and their relatives

Order Hymenoptera

This immense order contains well over 100,000 known species. As well as the bees, wasps, and ants, it contains the sawflies and gall wasps and a bewildering assortment of ichneumons and other parasites. The range of size is enormous, from huge spider-hunting wasps down to the minute fairy flies (family Mymaridae) that pass their larval stages inside the eggs of other insects and are strong contenders for the title of the world's smallest insect.

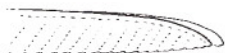
The typical hymenopteran has two pairs of membranous wings, the front and hind ones being coupled by a row of minute hooks on the leading edge of each hindwing. The latter is usually very much smaller than the forewing and not always easy to detect, even when the insects are at rest. Wing venation is often much reduced, producing a network of large and often rather square cells not seen in any other group of insects. There is frequently a pigmented pterostigma towards the tip of the forewing, with a generally elongated cell, known as the marginal cell, beyond it. Just behind the pterostigma and marginal cell lies a row of two or three sub-marginal cells, which are of great value in identifying the insects, especially the bees and wasps. The pronotum is often no more than a narrow collar at the front of the thorax, but it sometimes extends back along the sides of the thorax to meet the tegulae. The latter are scales or swellings over the bases of the forewings. The form of the pronotum is another useful guide when identifying bees and wasps.

The head is usually rather hard and extremely mobile, being attached to the thorax by a slender neck. Three ocelli are usually present in addition to the compound eyes. The antennae are extremely variable in form, especially among the sawflies, and are often longer in males than in females. Mouth-parts are essentially of the biting type, equipped with toothed jaws for dealing with solid food, but many hymenopterans also lap up liquids and the bees feed largely on nectar. Most bees have developed long, tubular tongues in connection with their nectar-feeding habits, but they retain their biting jaws for nest-building and other chores.

The order is divided into two very distinct sub-orders – the Symphyta, containing the sawflies, and the Apocrita.

SAWFLIES Sub-order Symphyta

The sawflies are readily distinguished from the other hymenopterans by the absence of any 'waist', the abdomen being joined to the thorax across its full width and showing little, if any narrowing at the front. The insects get their name for the female's ovipositor, which in most species is in the form of a minute saw. This saw is used to cut slits in plants, and the eggs are then laid in the slits. Each species has a distinct pattern of teeth on the saw, and it is often possible to identify a species just from the ovipositor. The horntails or wood-wasps (p. 222) are sawflies with drill-like ovipositors which are used to bore into timber.



The saw-like ovipositor of a sawfly

Adult sawflies are mostly quite sturdy insects, although the stem sawflies in the family Cephidae (p. 222) are notable exceptions. The wings are folded flat over the body at rest. The antennae are mostly thread-like, but they are clubbed or feathery in some species. Most of the species are active by day and some, notably the pamphilids (p. 222), fly very rapidly in the sunshine. Others are rather sluggish and are more likely to scuttle away through the vegetation than to take

to the air if disturbed. Some species are at least partly carnivorous, capturing other insects on the flowerheads of umbellifers and other plants, but most sawflies are vegetarians. They lap nectar and nibble pollen as they roam over the flowers.

Larval sawflies are almost all vegetarians. Most of them feed freely on the leaves and resemble the caterpillars of butterflies and moths, but they differ from these caterpillars in having at least six pairs of fleshy abdominal legs. The lepidopterous larvae have no more than five pairs of these prolegs (p. 111). Some sawfly larvae tunnel inside their food-plants and they have no abdominal legs. They look more like beetle larvae (p. 295) than caterpillars. These tunnelling larvae usually pupate inside the food-plant, but the other sawfly larvae generally pupate in cocoons in the soil or leaf litter or attached to the food-plant.

Sub-order Apocrita

By far the larger of the two sub-orders of the Hymenoptera, this group contains a very wide range of insects, including many parasitic and social species. The most obvious difference between this group and the sawflies lies in the possession of the typical 'wasp waist'. Although appearing to divide the thorax from the abdomen, the waist is, in fact, entirely in the abdomen if we stick strictly to anatomical criteria. The first segment of the abdomen, known as the propodeum, is firmly fused to the rear of the thorax and the waist comes just behind it. The whole of the abdomen behind the propodeum is known as the gaster, but for practical purposes we can consider the propodeum part of the thorax and equate gaster with abdomen. The narrow front part of the abdomen, which forms the waist, is known as the petiole (pedicel in ants) and may consist of one or two segments or just part of one segment. In a few families (p. 228) it is attached to the top of the propodeum, but it is generally attached near the bottom.

Entomologists split the Apocrita into two sections – the **Parasitica** and the **Aculeata**.

The **Parasitica** are almost all parasites, the females using their ovipositors to pierce the host tissues and to lay their eggs there. A wide range of other insects are used as hosts, and it is almost always the young stages that are attacked. Some of the parasites have extremely long ovipositors (p. 231) that can reach hosts tunnelling deep inside plants or even inside other animals. In this last instance, the parasite is known as a hyperparasite – parasitising an insect that is already living parasitically inside its host. Clearly, these parasites have extraordinary powers of detection – based on scent and vibration – to enable them to seek out their hidden hosts. Although most of the **Parasitica** attack other insects, some lay their eggs in the egg cocoons of spiders.

The young parasites grow up inside, or firmly attached to the outside of the host. Depending on the relative sizes of the parasite and its host, there may be anything from one to several hundred parasitic larvae in each host, which is gradually eaten alive. But the parasites are careful not to damage any vital organs until they themselves are almost mature. It would obviously not be in the parasite's interest to kill its host too early. The host usually dies at about the time that the parasites pupate – either inside or outside its shrivelled skin. Insects with this kind of life history, resulting in the eventual death of the host, are usually known as parasitoids. They are also known as protelean parasites, indicating that they are parasitic only in the larval state.

Best known of the parasitic hymenopterans are the ichneumons (p. 230), an immense and very varied group that can usually be recognised by having a prominent stigma in the forewing and more than 16 antennal segments. The front edge of the forewing is somewhat thickened, owing to the virtual fusion of the first long vein with the front margin and the consequent obliteration of the long narrow cell found in most other hymenopterans. Many ichneumons are quite large, but the rest of the **Parasitica** are mostly very small insects. They include the chalcids (p. 228), which often have beautiful metallic sheens, and the plant-feeding gall wasps (p. 226).

The bees, wasps, and ants belong to the *Aculeata*, in which the female's ovipositor is generally modified as a sting and use for paralyzing prey or for defence. Wasps are essentially predatory insects: the adults often feed on nectar and fruit juices, but the larvae are almost always fed on animal matter. Bees are entirely vegetarian, feeding mainly on nectar and pollen, while the ants include predatory, vegetarian, and omnivorous species. Numerous social insects belong to this section, including all the ants and many bees and wasps. They live in colonies consisting of one or more fertile females (queens), a sprinkling of males (often only at certain times of the year), and numerous sterile females called workers. There are often marked differences between these castes – especially among the ants, where the workers are wingless. Ant and honeybee colonies are perennial, but the bumble bees and wasps produce annual colonies, with over-wintered queens starting new nests in the spring.

There is no hard and fast dividing line between the Parasitica and the Aculeata and there are several transitional families, such as the ruby-tailed wasps and velvet ants (p. 232). These families contain species with parasitic larvae, although the adults are anatomically closer to the Aculeata than to the Parasitica.

The larvae of the sub-order Apocrita – both Parasitica and Aculeata – are always surrounded by food and are poorly developed in comparison with the sawfly larvae. They are always legless and even the head is commonly reduced, especially in the parasitic species.

The following simplified pictorial key will enable you to identify the major groups of the Apocrita and to turn to the appropriate page, although only a very small proportion of species can be illustrated in this book.



1 Insects with abdomen attached near the top of the propodeum

Superfamily Evanioidea p. 220

1 Insects with abdomen attached near the bottom of the propodeum

2 Antennae with more than 16 segments (lens!). Forewing with a distinct stigma; costal cell almost or quite obliterated



Ichneumons p. 230

2 Antennae with less than 16 segments. With or without a stigma in forewing; costal cell may or may not be distinct

3 Hindwing smoothly rounded, without any lobes or notches close to body on rear margin. Mostly very small insects

4 Petiole of one or two segments, either scale-like or bearing distinct dorsal swellings. Antennae strongly elbowed. Often wingless.



Ants p. 234

4 Abdomen laterally compressed. Antennae not elbowed



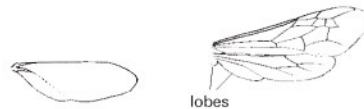
Gall Wasps p. 226

4 Abdomen fatter. Antennae elbowed



Chalcids p. 228

3 Hindwing usually with one or two distinct lobes close to body on rear margin (sometimes only a small notch is discernible). Mostly medium-sized or large insects



5 Hindwing with no closed cells

Ruby-tailed Wasps and relatives p. 232

5 Hindwing with at least one closed cell

6 Pronotum reaches back to tegulae at bases of forewings

pronotum

tegula



7 Forewings folded longitudinally at rest. Eyes strongly emarginate



Potter, Mason, and Social Wasps pp 240-2

7 Forewings held flat at rest. Hind legs very long – much longer than abdomen. Body rarely very hairy



Spider-hunting Wasps p. 240

7 Forewings held flat at rest. Hind legs never much longer than abdomen. Body often very hairy. Often wingless

Velvet Ants and Scoliids p. 232

6 Pronotum does not reach back to tegulae, but forms a lobe on each side of thorax

tegula



8 Hind tarsi broad and often very hairy



Bees p. 244-252

8 Hind tarsi not broad and never very hairy



Digger Wasps pp 236-238