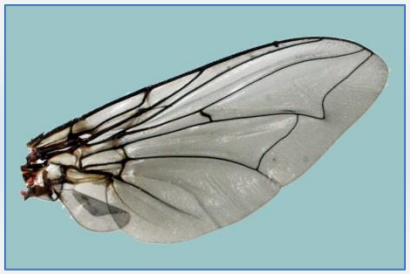
Insects with Two wings

These are the True Flies - Diptera, from the Greek "di" meaning two and "pteron" meaning wing. This group of insects also have club-shaped organs called "halteres" which evolved from a pair of hindwings (there is a group where the halteres are evolved from the forewings but these are rarely encountered). The halteres oscillate in time with the wing beats but in the opposite direction e.g. wings go up, halteres go down and vice-versa. This action is a stabilising mechanism just like a gyroscope.
The halteres are particularly apparent on Crane Flies and Gnats, being quite long, club-shaped and immediately behind the two wings. The image here is from a Gnat species.

Fly – Common Greenbottle (*Lucilia caesar*)



Greenbottle/Bluebottle wings are usually quite robust with a darker hue. Wing venation (or vein pattern) is quite important in identifying to species.

Hoverfly – Drone Fly (*Eristalis tenax*)

In the family of hoverflies there can be much similarity between species. The wing venation is an important factor, though not the only one, when determining similar looking species. The venation in most common species is quite dark and therefore easily observed with a magnifying glass or photographed with a mobile phone camera.

There are many other features on insects worth investigating with the microscope or hand lens. For example: antennae, legs, eyes and mouthparts. So don't throw any bits away without examining them first.

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Things to look at with microscopes: Insect Wings

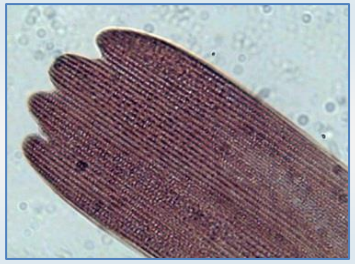
It is commonplace to come across dead specimens of all winged insects, in the garden, the shed, in a spider's web, even individuals that have come to an untimely end on the car windscreen. These are the specimens you should examine rather than take live individuals. It is best if you can view the whole wings as flat as possible. The easiest way to do this is to sandwich the wing between two microscope slides and tape the ends whilst maintaining a steady pressure to flatten the wing as much as possible.

All insects, except those in the order True Flies (Diptera) and the orders of wingless insects, have four wings.
The four-winged orders include:

- Mayflies (Ephemeroptera)
- Dragonflies/Damselflies (Odonata)
- Grasshopper/crickets (Orthoptera)
- Stoneflies (Plecoptera)
- True bugs (Hemiptera)
- Beetles (Coleoptera)
- Ants/Bees/Wasps (Hymenoptera)
- Butterflies/Moths (Lepidoptera)
- Scorpionflies (Mecoptera)
- Alderflies (Megaloptera)
- Lacewings (Neuroptera)
- Caddisflies (Trichoptera)

Insects with Four wings

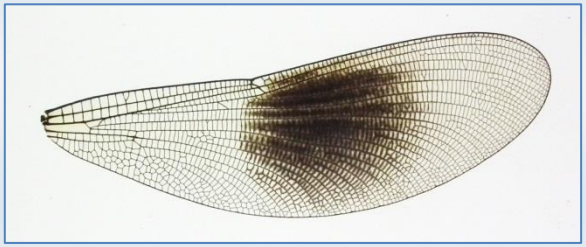
Butterfly - Peacock (*Aglais io*)



All but a few moths and butterflies have wings entirely covered by scales. These are arranged like overlapping roof tiles covering both topside and underside of both fore and hind wings. The density and depth of the furrows and ridges on each scale are responsible for the colouration as light is reflected and refracted. This is a simplistic explanation but the one most readily understood. The shape of each scale and density on the wing also has an effect. You can view the arrangement of scales using a simple magnifier. To observe the individual scales you will need to dab the wing onto a glass slide and view with a compound or stereo microscope.

Damselfly – Banded Demoiselle (*Calopteryx splendens*)

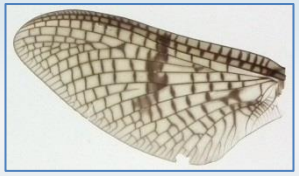
The male of this species (shown here) is by far the most striking of the sexes. The female has a metallic olive-green body and plain green-brown wings, still a beautiful insect. It is usually found around slow-moving rivers and canals but is a frequent visitor to garden ponds.



Forewing

Forewings and hindwings follow the same pattern and size and are independent of one another. When the forewings are on an upward stroke the hindwings are on the downward stroke.

Mayfly – *Ephemera danica*



This group – called the Ephemeroptera, from the Greek meaning 'lasting a day' – bear large, highly structured forewings and comparatively tiny hindwings. These latter are quite often missing when a specimen is examined.

Beetle – 7-spot Ladybird (*Coccinella septempunctata*)

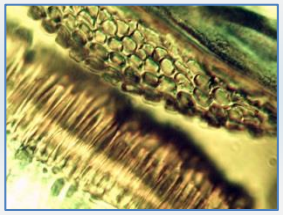
Beetles, of which the 7-spot Ladybird is one such, have modified forewings that are effectively useless as flight organs but have evolved to protect the folded hindwings. The hardened forewing is called an elytron (pl. elytra). During flight the elytra are raised clear of the wings and result in what can only be described as an ungainly flight. However, the wings are large when unfolded being nearly twice the length of the complete insect and thus provide good lift.

The insects featured previously have all had forewings and hindwings that work independantly of each other. The next two examples have fore and hind wings that use a locking mechanism to achieve a single unified flight organ on each side.

True bug - Common Green Shieldbug (*Palomena prasina*)

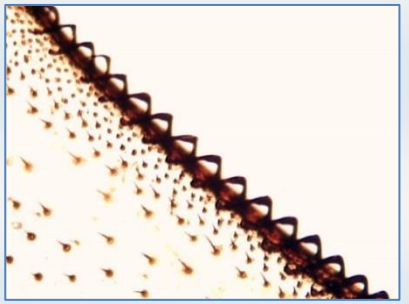
Shieldbugs belong to the order Hemiptera (derived from the Greek words *hemi*, meaning half, and *pteron*, meaning wing). The hind wing is entirely membranous whereas the forewing is comprised of a hardened element and a transparent wing membrane, hence the order name. In flight the two wings on each side are locked together by a small 'hook and clip' mechanism about one-tenth of a millimetre long (clip illustrated-bottom right). You really need a high power microscope to view this latter feature. The hindwing has two folds to allow it to nestle beneath the forewing when at rest. These folds may need to be teased out with a fine artists brush.

Forewing (above)
Hindwing (below)



Bumblebee - White-tailed Bumblebee (*Bombus lucorum*)

Forewing (top)
Hindwing (bottom)



Under resting conditions the fore and hind wings rest along the body, the hindwings beneath the forewings. Along the leading edge of the hindwing are a row of 'hooks' called 'hamuli' (above right), and on the trailing edge of the forewing is a fold aligned to these. When the insect takes flight the hamuli hook into this fold, locking the two wings together such that they work as a single entity. The hamuli can be viewed easily with a low-power stereo microscope.