

Bombus cullumanus. The insect illustrated is from Spain. The males show this general colour pattern everywhere, but in most parts of Europe the queens are black with a red tail and just a faint trace of yellow on collar and scutellum. They are thus superficially like *lapidarius*, but 1st segment of hind tarsus is shiny black, not downy yellow as in *lapidarius*. Widespread, but rare: extinct in B.

B. mendax. A variable species: pale bands may be missing from thorax and front of abdomen in Alps, but always present in Pyrenees. Tip of abdomen may be red, especially in male. Only in mountains.

B. mesomelas. The pale brown or fawn hair and prominent black band between wings easily identify this species. Front of abdomen sometimes golden: tip of tail black. Males greyish white and quite shaggy, with blacker band on thorax. Rear end more yellowish grey. Alps and Pyrenees.

△n **B. distinguendus.** A long-haired bee, predominantly brown with a black band between wings. Much brighter than *mesomelas*. Nests below ground. Not common. N & C (northern).

▲ **B. pascuorum.** Largely tawny, with variable amounts of black: very dark in N, but often foxy red in S. Coat thin and rather 'scruffy'. Nests on or above ground – often in old birds' nests. One of the last bumble bees to disappear in autumn.



B. gerstaeckeri. Thorax golden or orange yellow. Abdomen with scattered white hairs: sometimes entirely black. Face long and narrow. Alps and Pyrenees, usually feeding at *Aconitum* species.

△s **B. sylvarum.** Thorax pale brown with black central area. Abdominal segments with pale fringes at rear. Tail orange to pinkish red. A relatively late species. Absent from far north.

B. hyperboreus. A large, brightly coloured, long-haired bee. Orange bands may be replaced by yellow. Black inter-alar band not wider than collar. Basal part of wing distinctly darker than outer edge. N.

B. wurfleini pyrenaicus. A colourful bee from the Pyrenees. Resembles Spanish form of *cullumanus*, but much larger and with less yellow hair on abdomen. Nests below ground. Further north, *B.w. mastrucatus* is just black with orange tail.

▲ **B. lapidarius.** Abdomen relatively long. Hair longer and thorax less humped than in *confusus* (p. 250). Male has broad yellow collar. Often nests under stones. Especially common in open country: often coastal in N. ▲ **B. ruderarius** is similar but has red pollen baskets instead of black.

CUCKOO BEES Social parasites once placed in the genus *Psithyrus* but now included in *Bombus*. No workers: females lay in nests of other *Bombus* species, often killing the reigning queen and leaving the host workers to rear the young cuckoos. Generally resemble the bees they parasitise, but coats are less dense and abdominal plates shine through. Females without pollen baskets. Wing membrane often dark. Females hibernates, but wake later than host species – waiting for the bumble bee nests to be established.

▲ **Bombus barbutellus.** Collar and scutellum yellow: front of abdomen may also be yellowish. Tail always white. Parasitises *B. hortorum*.

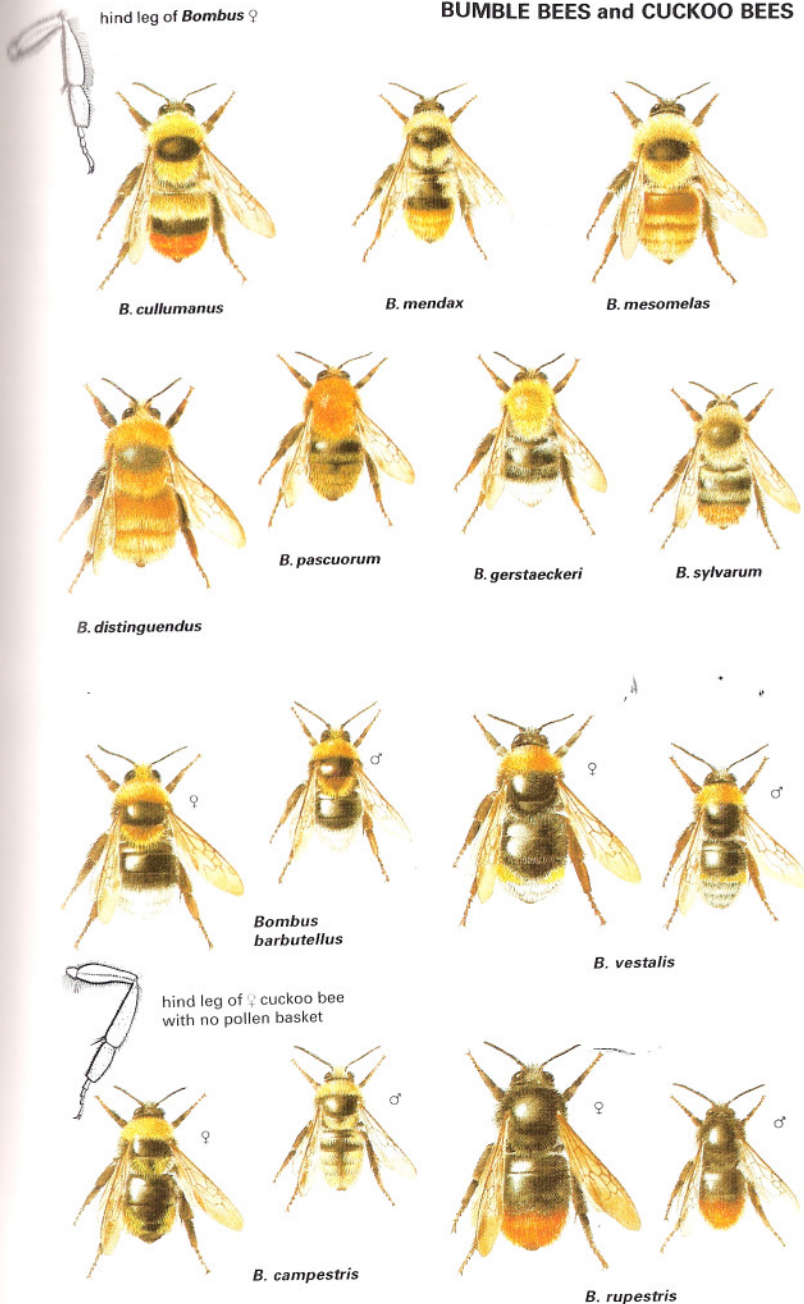
▲ **B. vestalis.** Mainly black, but with prominent golden collar and yellow and white patches near rear of abdomen. Parasitises *B. terrestris*: rare in N.

▲ **B. campestris.** Amount of yellow hair on scutellum varies. Abdomen sometimes all black, but usually with variable amounts of yellow hair, especially towards the rear. Male very variable: generally mainly yellow but may be all black. Parasitises *B. pascuorum* and is unusual in not resembling its host.

△ **B. rupestris.** Female very like *B. lapidarius*, which it parasitises. Male usually has some greyish yellow hairs on collar, scutellum, and front of abdomen. Widespread but not common.

BUMBLE BEES and CUCKOO BEES

hind leg of *Bombus* ♀



BEETLES Order Coleoptera

This is the largest order of insects, with well over 300,000 known species in the world and some 20,000 in Europe. About 4,000 live in the British Isles. The order contains the bulkiest of all insects – the fist-sized Goliath beetle, weighing about 100g – and also some of the smallest, many of them under 0.5mm long.

Beetles are easy to recognise as such, because the forewings, known as elytra, are tough and horny: and with the notable exception of the rove beetles (p. 260), they usually cover the whole abdomen. They normally meet neatly in the mid-line without overlap, giving the insects their characteristic armoured look. The only likely confusion is with some of the heteropteran bugs (p. 72), but these all have overlapping forewings whose tips are usually distinctly membranous. Also, the bugs have needle-like suctorial mouth-parts, whereas all beetles have biting jaws. Beetle hindwings are membranous, and folded beneath the elytra when not in use. They are sometimes absent, in which case the elytra may be fused together for extra protection. Rarely, as in the female glow-worm, the elytra are absent as well.

Compound eyes are usually well developed in the beetles, as are the antennae, whose shape is important in classification. Some antennae are distinctly 'elbowed', with the first segment (the scape) very long and the other segments forming an angle with it – as in the weevils (p. 284). Weevils usually bear their antennae on a prominent snout or rostrum, and the scapes can be retracted into grooves, called scrobes, on each side of it.

The prothorax is always large, and covered by a tough and often highly ornamented shield called the pronotum. In some beetles this shield almost covers the head as well. The rest of the thorax is generally covered by the elytra, except for a small triangle called the scutellum, which sits in the midline between the bases of the elytra. The legs vary a great deal with the beetles' habits. Dung beetles, for example, have broad front legs with strong teeth for excavating their burrows and manipulating the dung, while most water beetles have paddle-like hind legs for swimming. The number of tarsal segments on each leg (usually 4 or 5) and the shape of the coxa (the 1st segment of the leg) are also important, although not readily appreciated in the field.

Most beetles can fly, but most spend relatively little time in the air. They are essentially insects of the ground and the vegetation. Many live among stones and leaf litter, where the tough elytra provide valuable protection: the armoured and often tank-like look is no masquerade and it is surprisingly difficult to crush even a small specimen. With their biting jaws, both adults and larvae exist mainly on solid food, although some species lap nectar from flowers and some larvae have hollow mandibles through which they suck the juices of their prey. Different beetles exploit almost every kind of solid food: even the dried bones of animals, pepper, grain, or the dried wood of a chair leg. These dry foods present the insects with no problems because the elytra and the general thickness of the adult cuticle effectively prevent loss of body moisture. Nevertheless, the majority feed on living plant tissue, including roots and woody stems as well as leaves and fruits. The ability to exploit such a wide range of food – made possible by the biting jaws – has been one of the main factors in the success of the beetles throughout the world.

Life Histories All beetles undergo a complete metamorphosis, rarely with any form of parental care. The larvae (pp 295-7) are much more varied than the adults, although most use the same kind of food as their parents. Most have three pairs of legs, but weevil larvae, mostly living inside their food-plants and surrounded by provisions, are generally legless. Most European beetles have just one generation each year, normally passing the winter as larvae or adults – either active or in hibernation. Very few species pass the winter in the egg stage.

Water Beetles Beetles of several different families, notably the Dytiscidae and Hydrophilidae, have opted for life in the water, although most of them retain the power of flight and can move from pond to pond. The adults have generally evolved smooth outlines (pp 290-2), and many have broad, paddle-like hind legs. They remain essentially air-breathing insects and carry air supplies with them under the water. Among the dytiscids, the air is carried in the space between the elytra and the body, and the abdominal spiracles draw air directly from this

reservoir. When the oxygen content has been exhausted, the beetle rises tail-first, breaks the surface with the tip of its abdomen, and draws fresh air into the reservoir. The hydrophilid beetles carry only part of their air supply under the elytra. The rest is held in a bubble 'strapped' to the underside of the body in a coat of fine, water-repellent hairs. This bubble gives the beetles a bright silvery appearance in the water. The hydrophilids come up head-first and break the surface with one of their club-shaped antennae. These are clothed with water-repellent hairs that form channels through which air is drawn into both reservoirs.

A few small water beetles have managed to dispense with surface visits altogether by developing a physical gill. A film of air is held around the body by a dense coat of extremely fine hairs. This film acts as a gill: it is in direct contact with the spiracles, and as oxygen is drawn from it more oxygen is drawn in from the surrounding water to redress the balance. This system is sometimes known as plastron breathing. The larvae of some water beetles have evolved true gills, which absorb oxygen directly from the water, but most are air-breathers like the adults and they come to the surface tail-first to draw air into their posterior spiracles. Although both larval and adult stages are spent in the water, nearly all water beetles pupate in the soil.

STYLOPIDS. These tiny insects, only 2-3mm long, grow up as internal parasites of bees, wasps, and homopteran bugs and are rarely seen, although they are quite common. Among the European species, only the short-lived adult males emerge from their hosts – through the inter-segmental membranes of the host abdomen. These males have relatively huge hindwings, but their forewings are club-shaped and act rather like the halteres of flies (p. 190). The adult females, which remain grub-like, do no more than protrude from their hosts' inter-segmental membranes. The males spend their few hours of freedom flying rapidly about in search of the females, which they smell out with their large antennae. Mated females give birth to small larvae which then search out new hosts. Unlike ichneumons and tachinid flies, the stylopids do not normally kill their hosts, although they commonly render them sterile. About 400 species are known, with about 30 in Europe.

Adult stylopids have no obvious relationship to other insects, but a study of larval structure and metamorphosis reveals a number of similarities with the oil beetles and others with parasitic larvae. For this reason, some entomologists regard the stylopids as a specialised group of beetles and place them in the Coleoptera. Other entomologists believe that the similarities with beetles are merely the result of similar lifestyles, and place the stylopids in a separate order – the Strepsiptera.



A stylopid male, showing the large hindwings and club-shaped halteres derived from the forewings



Cicindela germanica
× 1.5

Tiger Beetles (*Cicindela* species) are sun-loving insects with huge eyes and jaws. The antennae are attached above the jaws and their bodies are somewhat flattened. Most fly well, with a loud buzzing sound. They hunt ants and other prey on the ground and usually live in open habitats. They are among the fastest runners in the insect world. The larvae (p. 295) construct burrows from which they ambush prey. About a dozen species live in Europe.

- ▲ **Green Tiger Beetle** *Cicindela campestris*. Legs and sides of thorax are coppery or purplish bronze and very shiny. Underside of abdomen metallic green. Elytral pattern varies and ground colour may be very dark. 5-7. Mainly on heathland, sand dunes, and other sandy places.
- △ *Cicindela hybrida*. Elytra may have a greenish tinge, but margins always reddish, as are the edges of the thorax. Each elytron has 3 or 4 yellow marks. Underside of body metallic green. 8-9 and again 4-6 after hibernation. Heathland and dunes. Absent from far north.
- △s **Wood Tiger Beetle** *C. sylvatica*. Similar to *hybrida*, but darker and with a distinct purplish tinge; yellow markings less heavy. Metallic blue below. Heathland and pinewoods. 5-9. N & C.
- △s *C. germanica*. Smaller and more cylindrical than the other tiger beetles. Thorax distinctly bronze and elytra usually very dark green, often almost black. Elytral pattern usually confined to 3 small spots on outer margin of each side. Rarely flies. 5-9. Dry, grassy places in lowlands. S & C: south coast only in B.

Ground Beetles are generally less flattened than tiger beetles and largely nocturnal, although some of the more metallic species are active by day. The antennae are attached between the eyes and the jaws. Many are flightless, with vestigial hindwings and often with the elytra fused together. Front tarsi are strongly dilated in males. They eat a wide range of invertebrates and also take carrion: many eat plant matter as well. The larvae (p. 295) are active hunters like the adults. Most species are long-lived and adult throughout the year, although they hibernate in the coldest months. Several hundred species live in Europe.

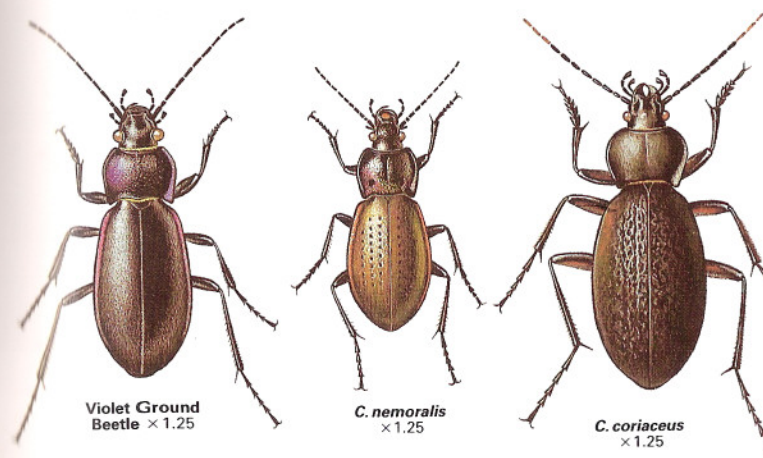
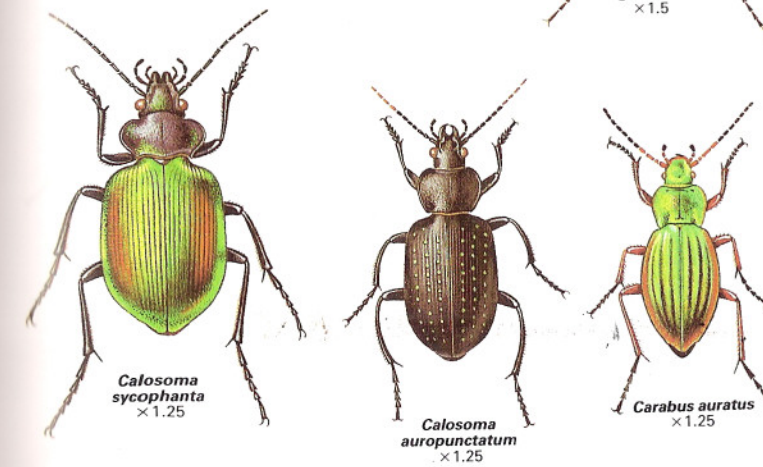
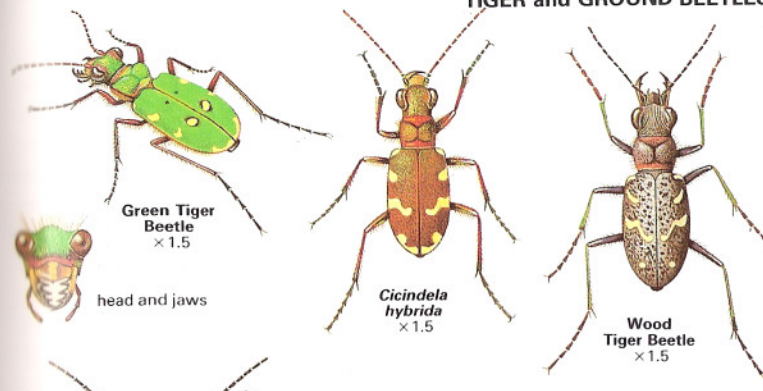
Calosoma sycophanta. Elytra are golden green to brassy red and strongly striated. Flies well. Diurnal. Mainly in woodlands, adults and larvae living in trees and preying on moth larvae. They are important predators of gypsy and processionary moth caterpillars. Most of Europe but a sporadic visitor to B.

C. auropunctatum is recognised by the 3 rows of golden green dots on each elytron. Adults and larvae prey on moth larvae on the ground, although adults fly well. Diurnal. Most frequent in moist grassland. C.

- △ **Carabus auratus**. Elytra and thorax green with a golden or brassy iridescence. Three broad ridges on each elytron. Flightless, with vestigial hindwings like most *Carabus* species. Gardens and other cultivated land, mainly in spring. Eats slugs, snails, and cockchafer grubs. S & C: occasionally introduced to B and establishing itself for short periods.
- ▲ **Violet Ground Beetle** *C. violaceus*. Elytra almost smooth, with a bright violet sheen around the edges and around the edges of the thorax. Common in many habitats, including gardens and hedgerows, hiding under stones and litter by day and emerging to hunt slugs and other prey at night. ▲ *C. nemoralis* has very convex elytra, especially in male, marked with fine ridges and rows of conspicuous pits. Bronzy to bright brassy green, becoming violet on the sides. Thorax is also purplish or bronze on the sides. Females are less shiny. Found in many habitats: especially common in gardens on the continent. Its habits are much like those of *violaceus* and most other *Carabus* species.

C. coriaceus. Resembles a large Violet Ground Beetle in shape, but thorax and elytra are dull black. Elytra patterned with coarse dots and wrinkles. Mainly in damp deciduous woodland.

TIGER and GROUND BEETLES





↑ antenna-cleaning notch on front tibia of many ground beetles

- ▲ *Cychrus caraboides*. The narrow front end of this very convex beetle is associated with its diet of snails, the head being plunged deeply into the shells when feeding. Flightless, with elytra fused together. It squirts a jet of yellow liquid from the rear end when alarmed. Mainly in damp woodland.
- ▲ *Notiophilus biguttatus*. A sun-loving beetle with a bronze sheen that obliterates the elytral pattern from some angles. Flattened and very fast-running, feeding on mites and springtails and other small arthropods on the ground. Flightless. Abundant in gardens, grassland, and many other habitats. There are several similar species.
- ▲ *Elaphrus riparius*. Elytra sometimes metallic blue or bronze. Fully winged. Tarsi green. Sun-loving and fast-running. On bare sand and silt by ponds and streams.
- ▲ *Omophron limbatum*. The shape and colour immediately identify this ground beetle. Fast-running on bare ground around ponds and streams. Burrows in the sand.

- ▲ *Brosicus cephalotes*. Huge jaws and appetite to match. A prominent antenna-cleaning notch. Elytra dull black. Fully winged, but rarely flies. Lies in wait for prey in a burrow. Sandy places: mainly coastal.
- ▲ *Callistus lunatus*. Dark areas of elytra with blue or green reflections. Antenna-cleaning notch. Fully winged. Diurnal, running rapidly over dry grassland, usually on chalk or sand: often coastal. S & C.
- ▲ *Badister unipustulatus*. Several similar species with asymmetrical jaws. Antenna-cleaning notch. Fully winged. Among leaf litter and moss, usually near water.
- ▲ *Dyschirius globosus*. Smallest of many very similar species. Flightless. Usually lives near water, using spiny front legs to dig burrows in soft, sandy ground.
- ▲ *Dromius 4-maculatus*. Yellow spots may join on each elytron. Fully winged, with flattened body. Antenna-cleaning notch. Lives in trees and hibernates under bark.
- ▲ *Harpalus affinis*. Green to black, often strongly metallic: female less shiny. Antenna-cleaning notch. Fully winged. Open country, often on cultivated land. Largely vegetarian. A distinctive member of this very large family.
- ▲ *Pterostichus madidus*. Body and elytra black, like most members of this large genus, but legs usually chestnut, especially the femora. Antenna-cleaning notch present. Hind angles of pronotum blunt. Flightless. Common in gardens and other cultivated land, where it is fond of fruit and sometimes called Strawberry Beetle. ▲ *P. nigrita* is similar but legs are black and hind angles of pronotum sharp. Sides of pronotum strongly rounded. Fully winged. ▲ *P. cupreus* elytra range from brassy green to black: legs may be chestnut. Fully winged. Usually found near water.
- ▲ *Agonum 6-punctatum*. Each elytron with a row of six small punctures. Fully winged. Antenna-cleaning notch. Usually found near water, often on bare soil and peat.
- ▲ *Panagaeus bipustulatus*. Has antenna-cleaning notch. Lives in short, dry grassland. ▲ *P. cruxmajor* is slightly larger and lives in damp places.

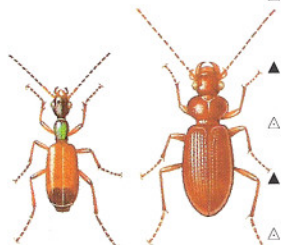
▲ *Lebia cruxminor*. Black elytral marks may link up with black scutellum to form a larger cross. Antenna-cleaning notch present. Climbs on grassland vegetation, feeding on other beetle larvae.

▲ *Amara aenea*. Elytra black with very fine striations and brassy green lustre. Fully winged. Antenna-cleaning notch. In short, dry vegetation in summer.

▲ *Odacantha melanura*. Thorax and elytral tips reflect blue or green. Fully winged. Antenna-cleaning notch. On reeds and other tall waterside plants.

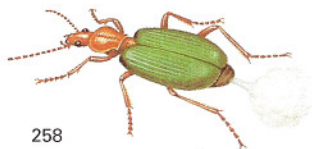
▲ *Leistus ferrugineus*. Body and elytra yellow or brown. Jaws very broad and flat. Among grass tufts and debris, usually in open country.

▲ *Bombardier Beetle*. *Brachinus crepitans*. When disturbed, it fires a burning, volatile liquid from its rear end like a puff of smoke, accompanied by a soft popping sound. Elytra reflect blue or green. Fully winged. Antenna-cleaning notch. Under stones in dry, open country, especially on chalk.



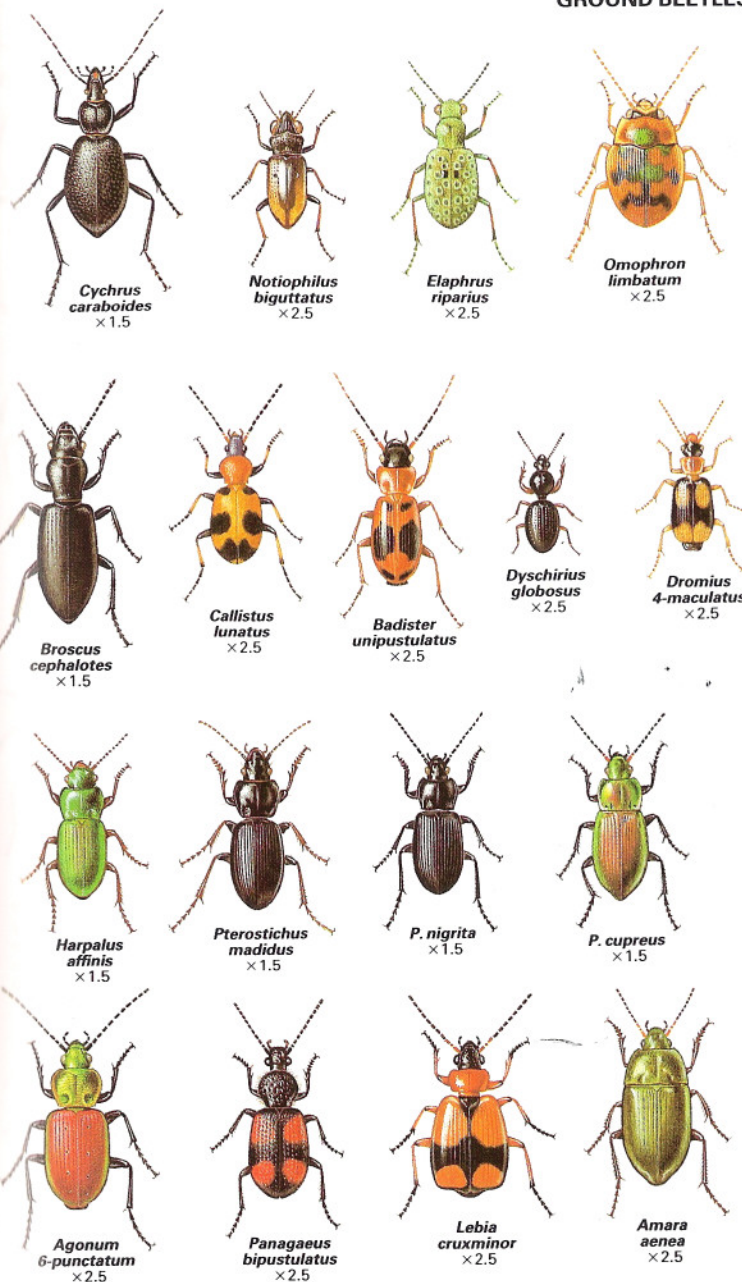
Odacantha melanura
× 2.5

Leistus ferrugineus
× 2.5



Bombardier Beetle
× 2.5

GROUND BEETLES



Cychrus caraboides
× 1.5

Notiophilus biguttatus
× 2.5

Elaphrus riparius
× 2.5

Omophron limbatum
× 2.5

Brosicus cephalotes
× 1.5

Callistus lunatus
× 2.5

Badister unipustulatus
× 2.5

Dyschirius globosus
× 2.5

Dromius 4-maculatus
× 2.5

Harpalus affinis
× 1.5

Pterostichus madidus
× 1.5

P. nigrita
× 1.5

P. cupreus
× 1.5

Agonum 6-punctatum
× 2.5

Panagaeus bipustulatus
× 2.5

Lebia cruxminor
× 2.5

Amara aenea
× 2.5

- ▲ ***Sphaeridium scarabaeoides*** Hydrophilidae. A terrestrial member of a largely aquatic family (p. 292), with slender palps almost as long as antennae. Usually found tunnelling in fresh cow dung.
- ▲ ***Hister 4-maculatus*** Histeridae. Red spots may join up on each elytron. Feeds on fly maggots and other scavenging insects in horse and cow-dung. There are several similar species, all somewhat flattened with shiny, truncated elytra, elbowed antennae, and strongly toothed front tibiae (tooth pattern may help to separate species). Some live in carcasses instead of dung. Many lack red spots. Apart from the short elytra, they resemble small scarabs (p. 264), but antennal club is solid and not composed of flaps.

BURYING BEETLES *Silphidae* Scavenging and carnivorous beetles with clubbed antennae and a very good sense of smell. The elytra are often strongly truncated, but most species fly well.

Nicrophorus species are the true burying beetles, burying small carcasses (mice, birds, etc) by digging a shaft underneath them and hauling them down. They usually work in pairs and female lays eggs close to the buried corpse. Adults and larvae feed on the carrion and also on the other scavenging insects. They are also known as sexton beetles. Adults are seen mainly in spring and summer and are often attracted to lights at night. The antennae are very abruptly clubbed in this genus.

- ▲ ***Nicrophorus humator*** is one of few species with all-black elytra, but it can be recognised by the orange clubs on its antennae.
- ▲ ***N. vespillo*** is one of several species with orange-banded elytra. Both bands are almost complete in this species and the hind tibiae are strongly curved.
- ▲ ***N. investigator*** has the posterior orange band narrowly broken in the mid-line where the elytra join.
- ▲ ***N. interruptus*** has both orange bands clearly interrupted.
- ▲ ***N. vespilloides*** has a broadly interrupted posterior orange band – often reduced to a small spot on each elytron – and entirely black antennae. ▲ ***N. vestigator*** is similar but has orange antennal clubs.
- △ ***Necrodes littoralis*** resembles *Nicrophorus humator* but the antennae are not abruptly clubbed. Each elytron has 3 strong ridges and a large 'pimple' towards the back. Size is very variable. Usually on large carrion, which is not buried. Most often near the coast: frequently among stranded seaweeds on the shore. Summer.
- ▲ ***Oiceoptoma thoracicum***. Elytra silky, each with 3 longitudinal ridges. A non-burying species found mainly in woodland – under dung and carcasses and also in rotting fungi. Feeds on other insect larvae. Summer.
- ▲ ***Dendroxena 4-maculata*** lives mainly in oakwoods, feeding on moth larvae in the trees and on the ground. Most numerous in autumn and spring.
- ▲ ***Silpha atrata***. Very glossy. A predator of snails, reaching deep into the shells to devour them. Woods and other damp, shady places.

ROVE BEETLES *Staphylinidae*. A very large family, with well over 1000 species in Europe. A wide range of sizes, with many very tiny species. The elytra are very short, leaving most of the abdomen exposed. Despite the short elytra, the hindwings are usually well developed and most species fly well. Many of the smaller ones fly by day, but the larger ones are mainly nocturnal. They are predators and omnivorous scavengers.

- ▲ ***Creophilus maxillosus***. Elytral and abdominal pattern formed by grey and black hairs. Head and pronotum hairless. 5-10. Preys on other insects on dung and carrion and in rotting vegetation.
- △s ***Emus hirtus***. Very large and very hairy. 4-8. Feeds on other insects around fresh horse and cow dung. S & C.
- ▲ ***Staphylinus caesareus***. Patches of golden hair on abdomen. 4-9. Usually on dung and carrion, where it feeds on other insects.
- ▲ **Devil's Coach-horse** *S. olens* is clothed with fine black hairs. Hides under stones and debris by day and hunts slugs and other invertebrates at night. Also called the cocktail because, when disturbed, it raises its rear end and opens its jaws wide in a threatening attitude. Common in woods, gardens, and hedgerows, and also in out-buildings.

BURYING and ROVE BEETLES

