

Natural enemies, their lifestyles and how to promote them

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A diversity of invertebrate species inhabit farmland. Some are pests, but many are beneficial providing ecosystem services that support agricultural production. Earthworms, springtails and millipedes break down organic matter, ensuring nutrients are recycled back to the soil. Bumblebees, hoverflies and solitary bees are key visitors to crop flowers increasing yields in insect pollinated crops such as oilseed rape, raspberries and field beans. Then there are the wide variety of predatory and parasitic invertebrates that provide a crucial first line of defence against pests such as slugs, aphids and pollen beetles. With the range of pesticides available to farmers becoming increasingly limited, it has never been more important to promote these crucial natural enemies.

The role different natural enemies play in farmland

Just as many pests are active in specific areas of a crop, so are the wide variety of predators and parasites that help keep these pests at bay. Spiders, ground beetles, ladybird larvae and parasitic wasps all play slightly different roles in agricultural ecosystems and all have slightly different lifestyles. They differ in where and when they are active, what they prey on and what resources they require. Supporting a diversity of these natural enemies will help to ensure they are able to control a wide range of pests and will help stabilise biocontrol under different environmental conditions. Managing farmland to support these beneficial invertebrates is an important component of Integrated Pest Management (IPM). Understanding the ecology of these natural enemies is our first step to protecting and increasing their populations.

Ground Beetles (Carabidae)

Size: 3-30mm, though larger species (>20mm)

require stable habitats and are rarely seen in intensively managed farmland.

Prey: Aphids, fly eggs and larvae, slug eggs and newly hatched slugs.

More than 70 species occur on Scottish farmland, feeding mostly at ground level as adults and in the soil as larvae.



Rove Beetles (Staphylinidae)

Size: 1-25mm

Prey: Aphids, fly eggs and larvae.

Rove beetles are easily recognised as their wing cases are shortened, exposing their long, narrow segmented abdomen. Mostly feed at ground level as adults or in the soil as larvae.



Determining where in a crop these natural enemies are active gives us an insight into the pests they will effectively control. Ladybirds, money spiders, hoverfly larvae and parasitic wasps are frequently active in the crop canopy and are therefore important in controlling pests such as aphids, cereal leaf beetles and pollen beetles. Ground active predators, such as rove beetles, ground beetles and wolf spiders will busily patrol the ground but tend to be reluctant to climb into the canopy. These ground-dwelling predators are therefore vital at controlling pests active at ground level such as leatherjackets and slugs. Often overlooked, however, is the fact that they also play an important role in controlling canopy dwelling species such as pollen beetle by preying on larvae as they drop to the ground to pupate (Dainese, et al. 2017).



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Hoverflies (Syrphidae)

Size: 10-12mm (adults and larvae)

Prey: The larvae of many hoverfly species feed on aphids in the crop canopy where they consume up to 20% of the aphids in a typical wheat field.

Adult hoverflies are important pollinators of crops such as oilseed rape.

Two of the most common species, the Marmalade hoverfly *Episyrphus balteatus* and the Migrant hoverfly *Eupeodes corollae* are both migratory, moving long distances north in the spring.



There is even evidence that predators in different areas of the crop can work in synergy increasing the efficiency of biocontrol. For example, ladybirds active on the crop canopy cause aphids to fall to the ground where they are consumed by ground active predators (Losey & Denno 1998). Multiple enemies may also attack pests at different stages of their lifestyle. While parasitic wasps play an important role in controlling pollen beetle larvae in the crop canopy, ground-active predators, such as ground beetles, consume the larvae as they fall to the ground to pupate (Dainese et al., 2017). Such ground active predators therefore play an important role in reducing the density of adult beetles.

How to support natural enemies on your farm

Agri-environmental habitats, such as hedgerows, beetle banks and grassy and floral-rich field margins provide key resources for natural enemies increasing their abundance resulting in reductions in pest populations and improvements in agricultural yield (Tschumi et al. 2015). These different semi-natural habitats, however, provide different resources and thus vary in which natural enemies they primarily support.

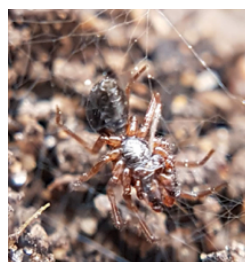


Wolf Spiders (Lycosidae)

Size: 5-8mm

Prey: Flies and other small insects including aphids.

Unlike most spider species, Lycosids don't build webs to catch their prey. Instead they actively hunt on the ground or lower vegetation using speed and stealth.



Money Spiders (Linyphiidae)

Size: 2-4mm

Prey: Aphids, flies and other small insects.

Linyphiid spiders build sheet like webs which can cover up to half the surface area of a wheat crop. They disperse by releasing fine strands of web into the air which catch the wind carrying the spiders long distances.

We clearly need to support a diversity of natural enemies to effectively control the wide range of pests that damage crops. This can be quite difficult to achieve as these natural enemies require slightly different resources and these resources often vary throughout their lifecycle. For example, while the larvae of the marmalade hoverfly are ferocious predators of aphids, the adults feed on pollen and nectar particularly preferring broad flowerheads composed of many small flowers (e.g. common hogweed and angelica). Aphid eating hoverflies therefore need to forage in flower-rich field margins, before the adults move into crops to lay their eggs amid unsuspecting aphid colonies. With parasitic wasps also requiring pollen and nectar as

adults, they similarly benefit from the presence of floral-rich field margins.

Floral-rich margins, however, do not provide all the resources natural enemies need. In addition to an ample supply of flowers, many parasitic wasps require permanent grassy habitats to overwinter. Predatory species such as ground beetles, spiders and rove beetles overwinter in the dense, tussocky, vegetation of hedgerows and permanent grassy field margins. When arable fields are ploughed, natural enemies retreat to these undisturbed habitats to find shelter and alternative food sources. Here they overwinter emerging in spring and migrating into the crop where they provide an important first line of defence against pests helping to regulate populations without the use of insecticides.

It is therefore recommended that a diversity of farmland habitats is required to provide forage and resources for the range of natural enemies that protect our crops. With many natural enemies limited in their dispersal capabilities we should consider what habitats are present not only within the farm itself, but also surrounding individual fields. At the field scale farmers should consider combining habitats that are rich in floral resources (e.g. floral-rich field margins) with those that provide shelter and overwintering sites (e.g. tussocky grassy field margins and hedgerows). Furthermore, with the positive impacts of predators tending to decrease towards the field centre the introduction of beetle banks in larger fields could help ensure protection throughout the entire field.

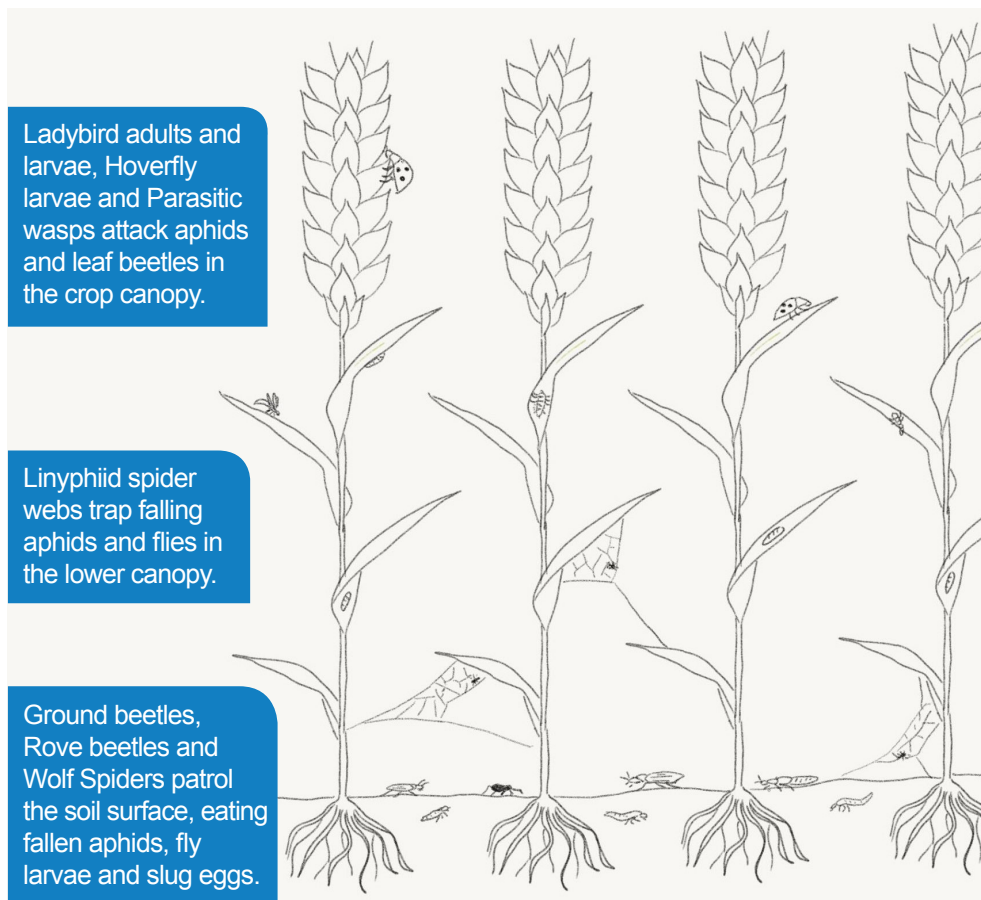


Parasitic wasps
(Ichneumonoidea)
Size: 3-30mm

Prey: Lay their eggs on specific host species, which the larva then devours.

Almost all crop pests, from aphids and flies to leatherjackets and slugs have their own parasitic wasps which in some cases provide sufficient control to prevent outbreaks on their own.

The maintenance of a diversity of farmland habitats will not only favour natural enemies but also other economically important groups such as insect pollinators and wider biodiversity.



Ladybirds (Coccinellidae)
Size: 1-10mm

Prey: aphids and the eggs and larvae of cereal leaf beetles.

The seven-spot ladybird is the most common species in agricultural fields where the larvae and adults are ferocious predators of aphids. Ladybirds overwinter as adults crevices in trees, leaf litter and vegetation where they often cluster together.

References

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