

A young woman with brown hair tied back, wearing a white lab coat and blue safety goggles, is looking through a light blue microscope. She is wearing yellow gloves. The microscope has the "Limgroup" logo on its side. In the background, another person in a white lab coat is partially visible. The overall scene is a laboratory setting.

pests and diseases  
in the cultivation of asparagus



## Foreword

With great pleasure Limgroup presents you with this practical guide to pests and diseases in asparagus.

Particular attention has been paid in the book to the quality of the images, the descriptions and the practical application of the information. The book is a useful tool to help you recognise and identify pests and diseases in asparagus crops. The practical layout and clear descriptions make this publication ideal for agronomists and asparagus growers.

At Limgroup, we continually perform research into new, improved hybrid varieties, of both green and white asparagus, suitable for all climate zones. During breeding, an important objective is developing asparagus hybrids that are resistant to the main pests and diseases.

If you have any questions about the use or suitability of Limgroup's asparagus varieties, please consult the catalogue of varieties on our website [www.limgroup.eu](http://www.limgroup.eu) or contact one of our product specialists.

Limgroup hopes that this book will contribute to a successful asparagus crop.

Limgroup

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## Agriotes spp. (larvae)

## Wire worms

**Identification and symptoms:** Wireworms are the larvae of click beetles. They are golden brown, up to 2 cm long and have three pairs of legs. The relatively hard-shelled larvae are mobile on contact. The click beetles themselves are about 1 cm long and brown/black. The beetles cause virtually no damage and can be detected on the ground or on plants during the day. Click beetles fly only at night. The larvae cause mostly superficial damage by feeding on the spears below ground.

**Biology:** Under northwest European conditions the click beetle lays its eggs in May-June, in groups of 3 to 12 on moist soil or in dense vegetation where the eggs won't dry out. The larvae that hatch from the eggs in July will remain active in the soil for 3 to 5 years before pupating. In the last 2 years of the larval stage they usually cause most damage to asparagus and various other agricultural and horticultural crops. Wireworms don't like dry conditions, which is why they are most active in spring and autumn in Europe. The most harmful click beetle species in northwest Europe are *Agriotes lineatus* en *Agriotes obscurus*.

**Control / prevention:** The damage caused by wireworms in asparagus crops is often attributable to preceding crops. We advise you to thoroughly check any plot in which you intend to grow asparagus and consider using pesticides to prevent problems in the cultivation of your asparagus crop. Good weed control during the cultivation season will ensure that any click beetles have little opportunity to lay their eggs. A good way of monitoring your plot for the occurrence of wireworms is to dig halved potatoes into the topsoil and check them after about five days. Damage can also be restricted by using calcium-cyanamide (CaCN<sub>2</sub>).



## Blaniulus guttulatus

## Spotted snake millipede

**Identification and symptoms:** Spotted snake millipedes are arthropods of the order of Diplopoda, some of which live in the soil under moist conditions. *Blaniulus guttulatus* is one of the species that feed on dead organic matter but also attack live plant parts. An adult specimen is 10 to 18 mm long and light brown/red with red/orange dots on either side. Large populations of garden centipedes (*Symphyla*) may also cause damage. The damage is always underground, often consisting of many tiny superficial wounds making white asparagus spears unmarketable.

**Biology:** Spotted snake millipedes lay their eggs in cracks and holes in the ground in spring and summer. It takes a few weeks for the young millipedes to emerge from the eggs. It then takes one year for them to reach maturity. The insects can live for around three years. Optimum conditions for millipedes are high relative humidity and little light. Spotted snake millipedes thrive in soils that are not susceptible to drought, such as loam or clay. Although they prefer moist conditions, they soon drown in free water, which is why they are observed much less after a wet spring than after a dry spring.

**Control / prevention:** Spotted snake millipedes can be controlled with the insect-parasitic nematode *Steinernema carpocapsae*. Good results were also obtained by applying calcium-cyanamide (CaCN<sub>2</sub>) in spring in tests in Germany in particular.



## Brachycorynella asparagi

## Asparagus aphid

**Identification and symptoms:** Asparagus aphids are about 1.2 to 1.7 mm long and greyish green in colour. The insects are covered with a layer of grey powdery wax. The initial stage of infestation in an asparagus crop is often difficult to detect. The best way of determining whether a crop contains aphids is by shaking out foliage onto a sheet of white paper. Asparagus aphids occur mostly at the bottom of the plants. The aphids suck nutritious sap from the plant while secreting a toxic substance. This may result in severe dwarfing of the foliage or deformed fern. Heavily infested plants will produce numerous new shoots, as a result of which the plants will enter their dormant stage very late, which will severely weaken them.

**Biology:** Under southern European conditions the first winged parthenogenetic females hatch at the end of March. They go in search of young asparagus spears, where they form colonies. The colonies may expand tremendously under hot conditions in summer. The winged members of the population will spread to nearby areas. The parthenogenetic females will remain in the field and hibernate on plant debris or wild asparagus plants. Colonisation may be very severe in late summer in particular. The size of the aphid population will depend largely on the temperature; the severest infestations are to be expected in dry summers with high temperatures.

**Control / prevention:** It is important to closely monitor your crop, because an aphid infestation is often difficult to detect in its initial stage. Chemical control is generally highly effective.



## Crioceris asparagi

## Asparagus beetle

**Identification and symptoms:** Asparagus beetles are 5 to 6 mm long and bluish black with three cream-coloured marks on either side of their backs and a red thorax. The larvae are dark grey with a shiny black head, three pairs of legs and a length of 2 to 8 mm, depending on their age. The larvae secrete a black liquid on contact. The adult beetles are often first observed at the edges of asparagus fields during fern growth. In the initial stage of infestation the larvae are found in the tops of the plants. The beetles cause relatively little damage which is restricted to superficial grazing on the stem. The larvae, however, may cause severe damage within a short space of time. They will often start gnawing the fern, and as they grow they will move on to thicker stem parts. The damage can be recognised by brown sections of fern where the epidermis has disappeared completely. In green production marketable yield can be reduced as beetle eggs are laid on the tips of asparagus spears.

**Biology:** Under northwest European conditions the first asparagus beetles will crawl out of their hiding places in April to mate in asparagus fields. The eggs are laid from the end of April onwards. They are 'glued' perpendicularly onto all stem parts, often in rows. The eggs hatch after 6 to 12 days and the larvae are then active for 14 to 20 days. The mature larvae then drop to the ground and pupate in the soil. After a few weeks the next generation of beetles will appear.

**Control / prevention:** Keeping plots free of weeds during the winter period will restrict the possibilities of the beetles hibernating. The nematode *Steinernema feltia* seems to be suitable for biologically controlling asparagus beetles. If an infestation is discovered in time, the beetles and their larvae can usually be effectively controlled with pesticides.



## Crioceris duodecimpunctata

## Spotted asparagus beetle

**Identification and symptoms:** The spotted asparagus beetle is 4 to 5 mm long and clearly recognisable by its two distinctive orange wing covers, each with six black dots. The grey larvae with three pairs of legs are virtually indistinguishable from the larvae of *Crioceris asparagi*. The beetles cause relatively little damage, restricted to grazing on mostly young, soft plant parts. The larvae feed on the berries of the asparagus plants, causing distinctive holes in the fruit.

**Biology:** *C. duodecimpunctata* often appears a bit later in spring than *C. asparagi*. Like *C. asparagi*, *C. duodecimpunctata* attacks only asparagus crops. The female *C. duodecimpunctata* beetles start laying eggs when the asparagus plants have formed berries. The eggs are not deposited perpendicularly in rows like those of *C. asparagi*, but singularly and horizontally, often hidden beneath the scales of an asparagus stem, close to the berries. It will then take 7 to 12 days for the eggs to hatch. The larvae immediately go in search of a berry and will bore into the berry to feed on the flesh of the fruit. The larval stage lasts for about 3 to 4 weeks, during which time a larva may consume the entire contents of 4 berries. When the larvae are mature, they drop to the ground and pupate in the soil. After 12 to 20 days the new generation will emerge from the soil. The beetles hibernate among foliage debris or in other sheltered, preferably dry places.

**Control / prevention:** Keeping asparagus plots free of weeds, also throughout winter, will restrict the possibility of the beetles hibernating. As Limgroup sells exclusively 100% male varieties, *C. duodecimpunctata* is rarely encountered in asparagus fields planted with Limgroup varieties. Chemical control of the beetles and larvae is possible, but will be less necessary than in the case of infestations with *C. asparagi*.



## Delia platura

## Bean seed fly

**Identification and symptoms:** The first generation bean seed fly larvae can cause severe damage in asparagus crops. The distinct holes, often in the bottom half of the white asparagus stems, and the curved spears that sometimes result from the damage may make the asparagus spears unmarketable. Although bean seed flies are only a little smaller than common houseflies (*Musca domestica*), they are very difficult to detect in the field. The insects feed mainly on nectar of flowers of a wide variety of trees and plants. Damage to asparagus will often peak for 6 to 10 days and then decrease in intensity.

**Biology:** Under northern European conditions the first bean seed flies lay 70 to 90 eggs in a period of 3 to 4 weeks, preferably on moist soil in a sheltered spot, for example on decaying organic matter or small weeds. Examples of host plants are spinach, potato, peas, onion and gherkin. The flies feed mostly on the nectar of a wide variety of trees and plants. Under normal conditions the larvae will hatch from the eggs after 2 to 4 days. The larvae that cause damage are yellowish white, legless and tapered at one end. It is impossible to make out the head without magnification. The larval stage in which asparagus crops are damaged lasts for about 12 to 16 days. The damage will however often peak for 6 to 10 days and then decrease in intensity. By the time that severe damage is detected the first larvae will often already be pupating beneath the surface of the soil. It then takes 10 to 20 days for the next generation of bean seed flies to appear. The pests are most active when there is little wind and at temperatures above 15°C.

**Control / prevention:** Bean seed flies tend to lay their eggs on uncovered asparagus plots or on plots that are covered at a late stage. However they also seem to lay eggs on beds which have been uncovered for a few hours, as damage has also been observed in plots that were covered at an early stage. Chemical control is often impossible. Good preventive measures include controlling weed growth and ensuring asparagus ridges are covered. In some cases good results have also been achieved with calcium-cyanamide (CaCN<sub>2</sub>) in spring.



## Deroceras r., Arion h.



**Identification and symptoms:** Slugs are easiest to detect in wet weather, especially at the base of plants. Under dry conditions slugs will often be hidden under lumps of soil. They feed on the stem, causing superficial damage that may cover dozens of centimetres. In regions of heavy soils the damage may occur all over a plot. In regions of sandy soil, however, the damage will usually be greatest along the edges of a plot.

**Biology:** There are several slug species that may cause damage in crops. *Deroceras reticulatum* and *Arion hortensis* are examples of well-known species causing damage in northwest Europe. Slugs lay their transparent/white eggs in clusters under clods or organic debris and can lay between 200 and 400 eggs within a period ranging from a few days to a few weeks. At a temperature of 18°C the egg stage lasts for about 18 to 20 days. The young slugs grow into adults in around 12 to 16 weeks. A slug will live for on average 1 to 2 years, depending on the species. The occurrence of slugs is largely dependent on the type of soil. Heavy soil types have a greater moisture-retaining capacity and contain more places for slugs to hide. Sandy soils are more susceptible to drought, implying a much smaller chance of slugs surviving.

**Control / prevention:** The fact that slugs like moist conditions makes weed control an effective preventive measure. Rolling the soil before harvest will make it difficult for slugs to find places to hide. Chemical control with granular products (slug pellets) is possible, providing you start at the right time.



## Lygus pratensis

## Lygus bug

**Identification and symptoms:** Lygus bugs are hard to detect in the field. The green/brown insect, which is 4 to 6 mm long, escapes when approached. Lygus bugs are easily recognised by the distinctive triangle on their backs. Most distinctive is however the damage they cause, which resembles the wilting of the tops of plants often seen as a result of drought stress. The bugs cause damage by piercing young, unbranched parts of the stem and simultaneously secreting a toxic substance. This causes the stems to shrivel around the puncture and the part of the stem above the puncture to wilt. Fresh punctures can be recognised by round, white spots. Damage may be quite substantial in first-year plots in particular. In some cases up to 70% of the plants may be affected.

**Biology:** Lygus bugs are fairly widespread throughout large parts of Europe. In northern Europe they produce one generation a year, whereas two generations a year are observed in central and southern Europe. Lygus bugs are commonly found in herbaceous crops and even in trees and shrubs. Where only one generation occurs, the adult bugs are usually observed fairly late in summer. In regions where two generations are normal, the adult insects are active from May. The adult bugs hibernate in sheltered, dry places, often under dead plant debris. They emerge in spring, after which the female lays her eggs with her piercing ovipositor. The larvae hatch from the eggs after 8 to 10 days. The larval stage lasts for about 2 to 3 weeks. Lygus bugs are very mobile and may cover large distances in their search for food.

**Control / prevention:** Good monitoring is essential, because the insects are difficult to detect. They generally cause less damage in wet summers. When damage is observed the pests can be chemically controlled.



## Ophiomyia simplex



**Identification and symptoms:** The damage caused by the heat-loving miner fly will be visible on stems just above and beneath the soil. Fresh channels mined immediately beneath the epidermis are pale green. Older mines take on a cork-like texture, resulting in irregular spotted patterns at the base of stems. Closer inspection of the damaged areas will often reveal pupated larvae beneath the stem's epidermis. Such superficial damage will rarely lead to losses in spear yields, but it may serve as an infection site for *Fusarium culmorum*.



**Biology:** Under European conditions the miner flies will appear from mid-May onwards and will lay their eggs at the base of stems. Being only about 0.5 mm long, the eggs are very difficult to detect with the naked eye. The white larvae that hatch from the eggs feed on the asparagus stems, just beneath the epidermis. At first, they feed upwards in a meandering pattern, but as they grow older they start to feed in a downward direction. The larvae pupate under the stem's epidermis, usually under the ground. The brown pupae are about 5 mm long and clearly visible. Under favourable hot conditions the second generation of flies will appear after about 4 weeks and the cycle will be repeated. Under unfavourable conditions the pupae will hibernate in asparagus debris in the soil and the flies won't emerge until the next spring.



**Control / prevention:** The most important preventive measure is to cultivate asparagus debris into the soil or to remove or burn it after the fern growth season. There is rarely any sense in using pesticides.

## Asparagus miner fly



## Parahypopta caestrum

## Asparagus moth

**Identification and symptoms:** The damage caused by the larvae of asparagus moths initially resembles that caused by drought because the flow of sap to the aboveground plant parts is obstructed. Shortly after this symptom, however, the plants die completely; the aboveground stems wilt and healthy root buds are destroyed. The pupae emit a distinctive odour from their vertical position in the soil. Infestation is almost always first observed at the edges of asparagus fields and may spread across an entire plot in a few years' time. Asparagus moths are most common in areas of sandy soil in the Mediterranean.

**Biology:** Adult asparagus moths are observed from the end of May until July. In this period the insects lay their eggs against the asparagus stems just beneath the surface of the soil. An adult moth may lay up to 40 eggs. Adult moths have 4 wings with a span width of up to 4 cm. The wings are light grey to brown in colour. The yellow larvae hatch after 3 to 4 weeks and then form groups in the soil to search for food. They first feed on sub surface stem and root buds and then move on to the fleshy asparagus roots. In August and September the larvae, which will then be up to 5 cm long and 1.5 to 2 cm thick, crawl deeper into the soil to depths of up to 50 cm, where they hibernate. The larvae will start to crawl back up again around early to mid-April, and will then pupate just beneath the surface of the soil. This stage takes 3 to 5 weeks, and the first new asparagus moths will be active from around mid-May onwards.

**Control / prevention:** Asparagus moths cannot be effectively controlled. Removing and burning the foliage in autumn can assist in preventing infestation. Burning the foliage destroys larvae contained in the stem below ground, but by autumn many larvae may have already moved deeper into the soil.



## Platyparea poeciloptera

## Asparagus fly

**Identification and symptoms:** In European conditions, this 0.6 cm long fly, can be seen at the tips of unbranched stems on windless, hot days. It has distinctive grey-white spotted wings and is easiest to identify in the morning, before the adults have started to fly. Affected spears and fern will often be deformed and hence partly curved. Severe infestation causes the foliage to turn yellow and die. When the asparagus stems are cut the tunnels caused by the larvae are clearly visible. The damage caused by asparagus flies serves as an infection site for *Fusarium spp.*

**Biology:** The flies are most active in windless conditions with temperatures above 20°C. The asparagus fly only produces one generation a year and under northwest European conditions it is active from mid-April until the end of July. In that period the flies lay several eggs, which are about 1 mm long, on the tips of asparagus spears. Milky white larvae hatch from the eggs and feed on the stem, tunnelling into it vertically downwards. After 3 to 4 weeks the larvae pupate in the stem, 5 to 10 cm beneath the surface of the soil, and turn dark brown. The pupae may survive in the soil for up to 2 years before the flies emerge again in April.

**Control / prevention:** Good monitoring is very important as infestation may vary substantially in intensity from one region to another. Asparagus fields in which no asparagus is harvested in the period from mid-April until mid-July are most vulnerable (in northwest Europe that will be one- and two-year-old plots). Removing and burning the foliage in autumn may reduce infection the following year. Sticky traps may be useful in detecting the flies and determining the best time to treat the crop with pesticides.



## Prodioplosis longifila

**Identification and symptoms:** The damage caused by *Prodioplosis longifila* can be easily recognised in the field by deformed growing points of asparagus spears. The midges are usually most active at dusk and during the night, when they can virtually not be detected. It is advisable to use traps to determine whether a crop is infested with the midges and assess the size of their population. *Prodioplosis longifila* affects asparagus crops mostly in Peru.

**Biology:** Adult citrus gall midges are black and yellow and about 1.5 mm long. The transparent eggs are invisible to the naked eye. The eggs hatch a few days after they have been laid. At first, the larvae are also transparent, but as they grow they acquire a yellowish colour. After around 6 to 9 days the larvae are mature. They then drop from the plants to the ground, where they pupate. After 5 to 7 days the new generation of midges then appears. At an average temperature of 22°C this cycle will take about 15 days. The midges lay their eggs on the growing points of asparagus plants and many other crops such as artichokes, sweet peppers, tomatoes, potatoes, beans, etc. The damage caused by the gnawing larvae penetrating the growing points results in stunted growth and malformed stems.

**Control / prevention:** Citrus gall midges are difficult to control because of their rapid life cycle and the absence of effective pesticides. Reasonably good results have been achieved with light traps. An important aspect of any control strategy is encouraging natural enemies. Varieties that develop foliage quickly are less susceptible.

## Citrus gall midge



## Scarabaeidae

*Melontha melontha*, *Amphimallon solstitiale*, *Anomala dubia*

**Identification and symptoms:** Damage is caused by larvae feeding on stems and root buds. The larvae, which are known as chafer grubs and may be 3 to 4 cm long, depending on their age, have a rust-coloured head and an ivory-coloured body that is bluish grey towards the end. The larvae live exclusively underground. They cause damage to asparagus as they feed. The damage is clearly recognisable in the form of fairly coarse wounds in the stem's epidermis. Other pathogens occurring in the soil such as *Fusarium* spp. may then infect the plants via the wounds. As the chafer grubs live in the soil for a long time they may cause damage for several years, resulting in substantial financial losses.

**Biology:** In Western Europe, chafer grubs causing damage in asparagus crops are usually understood to be the larvae of cockchafer beetle (*Melontha melontha*), summer chafers (*Amphimallon solstitiale*, also known as European June beetles) or dune chafer beetles (*Anomala dubia*). These pests are widespread throughout almost the whole of Europe, in particular in regions of light sandy soil and wooded areas. The larvae of garden chafers (*Phyllopertha horticola*) and Welsh chafers (*Hoplia philanthus*) are also referred to as chafer grubs. In summer, the female cockchafer beetle lays 10 to 20 eggs at a depth of about 20 cm in the soil. The eggs hatch after 4 to 6 weeks and the larvae then remain in the soil for 3 years before reaching maturity, during which time they pupate twice. If the soil temperature is high enough the adult beetles then leave the soil and go in search of plants on which to graze.

**Control / prevention:** Effective control is extremely difficult. It is possible to reduce a population in an asparagus plot by using insect-parasitic nematodes, but this will take several years.



## Thrips tabaci

## Thrips

**Identification and symptoms:** In asparagus crops, thrips usually cause most damage to seedlings, but they may also damage fully grown asparagus foliage. In seedlings, thrips damage leads to deformed fern, inhibited growth and silvery marks that make the plants appear greyish. The damage is caused by adult thrips and thrips larvae which puncture the epidermis and feed on the cell contents. Thrips larvae are white at first and turn a rusty colour as they grow older. Adult insects are brown to black and about 1 mm long. Both the larvae and the adult thrips are difficult to detect in a crop. A good method is to shake out foliage over a sheet of blue paper.

**Biology:** The thrips life cycle comprises six stages: an egg stage, 2 larval stages, a prepupal stage and a pupal stage, followed by the adult insect. Under hot, dry conditions the insects may develop very quickly. At 25°C it takes about 2 weeks for the insect to grow from the egg stage to an adult thrips. Under favourable conditions several generations will develop per year. Thrips are polyphagous, which means that they can feed on many crops, e.g. leeks, onions and maize.

**Control / prevention:** Thrips in asparagus can be effectively controlled with pesticides.





## Botrytis cinerea



**Identification and symptoms:** The first symptoms will often be observable on dead flowers suspended in the crop and can be seen in the form of grey mycelium covering the dead flowers and other parts of the plant. At a later stage the outside of the fern will still be slightly green while the centre contains a mass of grey mycelium. The disease can spread rapidly, and will often be most severe in plots where crops dry slowly.



**Biology:** The widespread fungus *Botrytis cinerea* is dispersed by the wind. Besides asparagus, the disease also attacks such crops as strawberries, grapes and tomatoes. Under wet conditions the conidia (spores) will enter a plant via wounds, petals or dead plant parts and then cause the plant's tissue to rot. Grey conidiophores are formed shortly after infection, new spores then develop which are readily dispersed by the wind. Botrytis is especially favoured by hot, humid conditions and can spread very rapidly when these occur. In an unfavourable environment, such as drought or low temperatures, the fungus may survive for a long time by forming sclerotia.



**Control / prevention:** Where possible, plant your rows of asparagus in the direction of the prevailing wind to ensure rapid drying of your crop. If you decide to use fungicides, apply them when flowers begin to drop or when mechanical damage occurs. Varieties with open foliage such as Avalim and Grolim are less susceptible.

## Botrytis blight



## Colletotrichum gloeosporioides

## Asparagus anthracnose

**Identification and symptoms:** Typical symptoms are elongated lesions on the main stem, at the point at which the fern first branches. At first, the lesions are slightly pink, but they later turn brown and spores then become visible in the concentric rings of the lesion. In Europe, the fungus is only encountered in Mediterranean areas and sporadically elsewhere.

**Biology:** Colletotrichum thrives under hot conditions. Its optimum temperature is around 25°C. The fungus is dispersed by wind and water but also via contact of healthy plant parts with infected plant parts. Spores will virtually not germinate in an environment with a relative humidity of less than 97%.

**Control / prevention:** We strongly advise you not to use seed of infected plants. There are a few fungicides for controlling this fungus.



## Fusarium culmorum

## Fusarium

**Identification and symptoms:** Infection is usually detected fairly late in the fern growth stage. A typical symptom is a single dead plant stem. Closer inspection will reveal a desiccated, elongated, pale red/orange lesion just below or close to the surface of the soil. When the stem is cut a typical purple discolouration of the vascular bundles will often be observed.

**Biology:** *Fusarium culmorum* is quite common and affects many crops. The fungus remains viable deep within in the soil for many years in the form of chlamydospores. Water is the ideal medium for transporting the fungus, which explains why infection is observed most often under wet conditions or after long periods of rain. The fungus usually infects plants via wounds, spreading upwards through the stem. Damage caused in harvest, growth cracks, phytophthora infection or damage caused by pests such as spotted snake millipedes (*Blaniulus guttulatus*) or asparagus miner flies (*Ophyomia simplex*) serve as infection sites for this fungus. It thrives under moist, hot conditions and is more common in areas of sandy soil than on heavier soil types.

**Control / prevention:** There is no known effective method for controlling *Fusarium culmorum*. The best ways of preventing infection are avoiding damage via which the fungus may enter plants and ploughing away the ridges (in the case of the cultivation of white asparagus) after harvest.



## Fusarium spp.

*F. oxysporum f. sp. asparagi*, *F. proliferatum*, *F. redolens*, *F. moniliforme*

## Crown and root rot



**Identification and symptoms:** The first symptoms of *Fusarium spp.* are almost always brown oval lesions in the longitudinal direction of roots, which subsequently cause the fleshy roots to rot and die. In an advanced stage of infection the fleshy parts of the roots will have disappeared completely and only the core and wall of the roots will remain. A fusarium infection in the crown of a plant differs from a phytophthora infection in that the affected tissue usually remains dry, whereas phytophthora infection tends to cause wet rot.



**Biology:** *F. oxysporum f. sp. asparagi* en *F. proliferatum* are the two most important soil-borne fusarium species that can weaken asparagus plants and severely shorten the plants' economic life by affecting the root system and the crown. *F. oxysporum* causes most damage in more temperate climates, whereas *F. proliferatum* is most common in hotter regions. The fungus is extremely persistent; chlamydospores of *F. oxysporum f. sp. asparagi* have been found on root debris even in plots in which no asparagus had been grown for 15 years. *Fusarium spp.* enters plants via the tips of their roots. Microconidia are transported through the vascular bundles and may germinate and cause mycelium to grow elsewhere. Low soil temperatures and high pH values are unfavourable for fungal development.



**Control / prevention:** It is not possible to control *Fusarium spp.* directly. Indirect ways of preventing fusarium infection are ensuring an adequately high pH (6 or higher) and a good soil structure and fertilisation status. Biological soil disinfection has yielded good results in tests; it is now also applied in practice in the Netherlands and other countries. The use of NaCl salt seems to indirectly affect the level of infection. Limgroup tests all its seeds on *Fusarium spp.* and we produce our seed exclusively in protected greenhouses. The varieties Backlim and Herkolim show a high level of tolerance.



## Helicobasidium purpureum

(syn. Rhizoctonia violacea)

Red rot

**Identification and symptoms:** There are no recognisable aboveground symptoms of this disease. A typical consequence of infection is the complete disappearance of plants in specific parts of a plot, resulting in open, often oval areas that increase in size every year as the disease spreads from one plant to another. If you study the crown you will see red/purple hyphae combined with black sclerotia on the roots. Another typical feature of the disease is that the core of the root may remain healthy for a long time. The fungus tends to affect asparagus more often in southern Europe than in colder northern regions.

**Biology:** This soil-borne fungus may survive in the soil for many years in the form of sclerotia, even without suitable host plants. Examples of other crops that are also susceptible to this fungus are carrot, chicory, sugar beet and lucerne. Weeds such as couch grass (*Elytrigia repens*), creeping thistle (*Cirsium arvense*) and field bindweed (*Convolvulus arvensis*) are good host plants. The optimum temperature for disease development is around 20°C.

**Control / prevention:** Don't grow asparagus in plots that have previously been affected by this disease. Preferably remove any affected plants from the plot by hand. In plots which are already infected, avoid mechanical treatments which may spread the fungus through the field. The fungus seems to thrive in soils with a low pH and a high humus content.



## Phomopsis asparagi

## Stem blight

**Identification and symptoms:** 7 to 14 days old spears are the most susceptible to this infection. Symptoms, in the form of pale oval lesions with a watery edge are often first observed at the base of young spears, just above the surface of the soil. At a later stage the lesions turn dark brown and their edges become more sharply defined. Pycnidia, visible as black spots, form in the lesion. Stem death occurs when the lesion has girdled the entire stem.

**Biology:** The fungus, which is particularly common in China and (sub)tropical regions, survives on plant debris on and in the soil. Spores may come into contact with parts of the spear via water splash or mechanical treatments. Life cycle: under favourable temperature and humidity the time from infection to the discharge of new spores may be less than 14 days. The black pycnidia in the lesions on affected stems may then produce spores for up to 40 days. This short cycle and the long period of spore discharge can cause the infection to spread very rapidly. Under the right conditions a cycle may be repeated 8 to 10 times a season.

**Control / prevention:** We advise you not to plant asparagus in plots that have previously been affected by *P. asparagi*. Even seeds from infected plants may be potentially hazardous sources of infection. Burning or removing the affected, dead foliage can greatly reduce the risk of the fungus overwintering. The varieties Gijnlim, Thielim and Backlim are only moderately susceptible to infection by this fungus.



## Phytophthora megaspermae

## Root rot disease

**Identification and symptoms:** Phytophthora can be recognised by oval, watery, often slightly sunken lesions on the stems, at the transition from the soil to the air. The lesions, which feel wet, will often rapidly girdle the entire stem, causing the stem to curve and the foliage to drop from the plants. In the case of severe infection and heavy rainfall, fungal spores may also reach the crown which causes the bud and root systems to rot. Unlike fusarium infections of the crown, a phytophthora infection will often lead to wet rot accompanied by a distinctive sweet odour.

**Biology:** This soil-borne pathogen is most active under cool, wet conditions. Temperatures in the range of 12 to 15°C combined with heavy rainfall or high soil moisture contents are ideal. Phytophthora is an oomycete that can survive in the soil for a long time in the form of thick-walled oospores. Under favourable ambient conditions it may also produce zoospores, which can move in free water and then infect plant parts. Under dry conditions the pathogen is virtually immobile and will then produce dormant spores that may survive for many years.

**Control / prevention:** The best form of preventive control is to grow your asparagus in vigorous, well-drained soil. Drainage and the avoidance of soil compaction may reduce the risk of phytophthora. If you are growing green asparagus, small ridges on top of the plants may create a drier environment above the plant and thus prevent or reduce infection.



## Puccinia asparagi

## Asparagus rust

**Identification and symptoms:** *Puccinia asparagi* is commonly known as asparagus rust. Under European conditions an infection caused by this fungus is often only seen in late summer, from July onwards, when the typical rust-coloured blisters form on parts of the foliage. The conspicuous colour of this fungal infection makes it easy to identify.

**Biology:** The characteristic rusty colour is caused by the aescidia contained in the blisters. When the blisters burst the spores are dispersed, causing the infection to spread rapidly. Primary infection will have taken place at an earlier stage. From May onwards colourless spring spores (basidiospores), formed by winter spores, infect the young foliage, usually at the base of the stem. This infection is often undetected as there are few visual symptoms until the rusty brown blisters are formed in late summer. The fungus' winter spores are easily recognisable. In autumn the fungus produces black winter spores (teleutospores). These dormant spores can be clearly recognised as black thickened lesions on dead foliage. The severity of infection may vary substantially from one year to another because of the environmental requirements of the disease. Short periods of wet foliage alternating with hot (more than 15°C), dry conditions are ideal for this fungus. An infection will weaken the foliage, and hence the plant's ability to photosynthesise.


**Control / prevention:** A good way of reducing the infection risk is to reduce the number of overwintering spores by burning the foliage. There are also specific fungicides for controlling this fungus.







## Pythium spp.

## Pythium root rot

 **Identification and symptoms:** Symptoms are observed only in drilled crops sown by asparagus growers or in sown production fields and can be seen shortly after seedling emergence. The first symptom is that the initial spear will turn brown and die. Closer inspection of the stem will show girdling at the surface of the soil. The second stem may grow normally, depending on the stage of infection.

 **Biology:** Pythium species produce different types of spores. The thick-walled oospores, or dormant spores, offer the fungus a possibility of surviving unfavourable growing conditions. Relatively low temperatures and wet, oxygen-poor conditions are favourable for this fungus' development. The oospores will then germinate near a root. Water may transport zoospores to roots and stem bases, where they form mycelium that will affect the plant. New zoosporangia and oospores will form on and in the affected plant parts.

 **Control / prevention:** Good growing conditions are very important, especially a good soil structure. Herbicides may cause the plants' growth to stagnate, making it easier for Pythium species to infect the plants. An oxygen-rich top layer is less favourable for the fungus' development.



## Sclerotinia sclerotiorum

## White mould

**Identification and symptoms:** *Sclerotinia sclerotiorum* infections are not often observed in asparagus crops and are rarely a threat under northwest European conditions. The most distinctive symptom is white discolouration of the main stem or lateral stems over lengths of up to 25 cm. This discolouration is caused by mycelium that can easily be wiped off the asparagus. In a later stage black sclerotia resembling rat droppings are formed in the mycelium. Affected stem parts will then die. This disease is almost exclusively observed fairly late in the fern growth stage.

**Biology:** Hot, moist conditions are favourable for the fungus' development. Dormant spores produce apothecia (fruiting bodies), which release ascospores. They may germinate in leaf axils. Under the right conditions healthy tissue may then be affected. The fungus will enter the plant and form mycelium, causing plant parts above it to die. Thick-walled sclerotia form in the mycelium. In those sclerotia the fungus may survive for up to 10 years.

**Control / prevention:** There is rarely any sense in attempting to control the fungus in asparagus plots in northwest Europe. There are however fungicides that can be used to control the disease.



## Stemphylium botryosum

### Purple spot

**Identification and symptoms:** Stemphylium can be recognised from its small (2-6 mm), oval, sharply defined brown lesions which affect all parts of the stem. The centre of the lesion is often pale brown. In the initial stage of infection, Stemphylium lesions are often first observed at the base of the stem, close to the soil. Shortly after this initial stage lesions will spread on to the fern as well. The spore survives over winter on the dead foliage and can be identified as small black spots.

**Biology:** Stemphylium is a fungal disease that can severely affect a healthy crop under the right conditions. In principle, Stemphylium occurs all over the world. It can grow in a temperature range from 2 to 30°C, but the most ideal conditions for the fungus are temperatures of 22 to 25°C and periods of more than eight hours leaf wetness. At a temperature of 20°C, symptoms will become visible 2 to 5 days after infection. The fungus does not tolerate long dry periods combined with high temperatures. Stemphylium overwinters on foliage debris and ascospores often initiate the first infections with symptoms becoming observable at the base of the stem, just above the soil, from mid-May to around mid-June. Under favourable conditions the fungus can rapidly spread to the foliage, accompanied by severe sporulation. Rapid spread of the infection in the foliage may lead to death.

**Control / prevention:** Efforts to control infection must first of all concentrate on thoroughly cultivating all foliage debris into the soil before winter. During the growing season, fungicides may prevent and/or stop an infection. Under European conditions the varieties Avalim, Vitalim and Grolim are less susceptible to this disease.





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