Nematode Pests of Soft Fruit Crops

Introduction

Plant-parasitic nematodes (PPNs) collectively parasitize nearly every plant species, including soft fruits, resulting in devastating adverse effects on the quality and yield of host crops. Effective management of PPNs is based on accurate detection and identification, in a bid to understand the biology of each species in the population.

Nematode damage symptoms are most noticeable at high infestation levels. However, plant-parasitic nematodes often produce symptoms that could be mistaken for nutritional deficiency, disease or a lack of water. For this reason, many infestations go unrecorded allowing serious problems to develop in crops over time.

On strawberries, infestations could also be mistaken for mite or virus damage; certain nematode species can also vector plant viruses or facilitate the entry of plant diseases.

Key Facts

- Direct feeding by PPNs can cause economic losses to soft fruit crops
- PPNs can cause a range of root and foliar symptoms
- Certain nematode species can vector plant viruses of facilitate the entry of plant diseases
- PPN infestation symptoms could be mistaken for damage caused by other pathogens or adverse conditions
- Nematodes can infest both glasshouse grown and field grown crops
- Accurate identification of the pest species is essential for effective control

Symptoms

Damage to plants can result in stunting, wilting and chlorosis of foliage leading to eventual plant death. Roots infested with PPNs exhibit irregular galls across the entire root system, gall-like swellings at primary root tips, root necrosis or localised lesions and root proliferation.

Damage to strawberries caused by leaf & bud nematodes is most noticeable on newly formed leaves. Leaves expanding from buds infested by these nematodes are often puckered and distorted, with many of the leaflets exhibiting rough, greyish or silvery areas near the base of the main veins. Affected leaf stalks are often strongly tapered and glabrous, with the serrations on the margin of the leaves frequently distorted and reduced. In some cases, leaves can be reduced in number and size, and may be virtually absent so that only very short tapered leaf stalks remain. These PPNs can also seriously affect flowering and fruiting with infested flowers often shrivelling during early development stages. When severe attacks occur, the main crown is usually killed; and weak, secondary crowns are formed. These secondary crowns often exhibit small spindly leaves with thin stalks and dark leaflets.

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Leaves of strawberry plants infested with stem nematode are deeply crinkled, with leaf margins turned towards the under-surface and becoming brittle. In severe attacks the leaf outline becomes rounded, or irregular, with fewer marginal teeth. In certain varieties, leaves turn darker and there may be a tendency for leaf stalks to redden. Leaf and flower stalks may thicken, become stunted and spongy in texture and often exhibit a brown core inside when cut lengthways.

Fruit is much reduced in size and, when ripe, may show pale patches and be soft and easily squashed. Runners from infested plants often show symptoms at an early stage and the stolons may be shortened and thickened.

Biology

Meloidogyne hapla is a UK native root-knot nematode, an obligate sedentary endo-parasite, of which the second stage juveniles invade root tips and move intracellularly to a suitable feeding site. Root-knot nematodes induce the redifferentiation of parenchyma root cells into multinucleate and hypertrophied feeding cells, named giant cells. These giant cells constitute the exclusive source of nutrients for the developing nematode. Hyperplasia of the surrounding cells leads to the formation of the typical root gall, the primary visible symptom of infection. The nematode feeds and swells in size as it develops into the adult life stage. Adult females are saccate within the root and produce large numbers of eggs (100-1000), which are laid into a gelatinous matrix which protects the eggs from adverse conditions.

Root-lesion nematodes (*Pratylenchus* spp.) are migratory endo-parasites which can be present in the growing media or feeding within plant roots. These nematodes feed primarily in the cortical parenchyma. Both root penetration and migration within the roots are probably facilitated by a combination of the feeding apparatus and enzymatic softening of the cell walls of the host visible as root necrosis. Although root-lesion nematodes may also be found feeding ectoparasiticaly, damage to host plants is more directly related to endoparasitic activity. These nematodes are poikilothermic organisms and, consequently, temperature influences the rates of physiological processes, such as movement, growth and reproduction. *Pratylenchus penetrans* is particularly pathogenic to soft fruit crops and is reported to facilitate the entry of other diseases such as *Verticillium*.

Root feeding by needle (*Longidorus* spp.) and dagger (*Xiphinema* spp.) nematodes can cause direct damage, however certain species are also vectors of plant viruses, such as strawberry latent ringspot (SLRSV), arabis mosaic (ArMV), tomato blackring (TBRV) and raspberry ringspot (RRSV) viruses.

Leaf and bud nematodes (*Aphelenchoides ritzemabosi* and *Aphelenchoides fragariae*) are pathogenic ecto- and endo-parasites which thrive in glasshouse conditions, where they can attack crops such as strawberries. These types of nematode can affect hundreds of herbaceous and woody plant species. These nematodes infest and feed on crowns, growing points as well as the epidermal layer of green stems. The nematode population can survive in plant litter between seasons.

Widely distributed in mainly temperate areas, *Ditylenchus dipsaci* is recognised as one of the plant-parasitic nematodes of greatest economic importance worldwide. Around 500 plant species are known as hosts for *D. dipsaci*. It lives mostly as an endo-parasite in aerial parts - stems, leaves and flowers, but can also attack growing points. Readily withstanding desiccation, this parasitic species can survive in this anhydrobiotic state for many years. When conditions permit, the nematodes migrate to host plants and invade hypocotyls or petioles, entering through stomata or penetrating the epidermis, where they moult to the adult stage and feed. Population growth can be rapid with females capable of laying around 500 eggs, which can hatch into infective juveniles within two days. This rapid population growth can result in severe crop damage even when the initial population density is low.

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Diagnosis

Testing for all of the above nematodes can be carried out during the growing season, or if possible damage symptoms are observed, by taking a sample of the plant and growing medium. Good on-going management of nematodes requires a proactive approach to inhibit the increase of these pests. Fera offers a unique nematode identification service, being able to confirm the identity of nematode species within population using both classical taxonomy and cutting edge molecular techniques. Management practices should be based upon correct identification and qualification, rather than solely on nematode counts. This helps growers to understand the biology and host range of each species in the population to develop effective management based on accurate data. Our methods and analysis equipment are also accredited to ISO 17025 standards.

Control

- Use of certified stock
- Regularly testing of soil or growing media
- Test runners or root stocks to ensure freedom from nematode infestation before planting
- Rotation and weed control for field grown crops
- Use of chemical sterilants or hot water treatment of dormant roots may be a consideration for infested stock
- Overhead irrigation favours the spread of an infestation by creating a film of water through which the nematodes move, while splashing can physically move nematodes from plant to plant.
- Further information on nematode tests is available through Fera Crop Health services.

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