EPPO Datasheet: *Meloidogyne graminicola*

Last updated: 2025-08-26

IDENTITY

Preferred name: *Meloidogyne graminicola*
Authority: Golden & Birchfield
Taxonomic position: Animalia: Nematoda: Chromadorea: Rhabditida: Meloidogynidae
Common names: Rice root?knot nematode
view more common names online...
EPPO Categorization: A2 list
view more categorizations online...
EU Categorization: Emergency measures
EPPO Code: MELGGC



more photos...

HOSTS

The main economically important host of *Meloidogyne graminicola* is rice (*Oryza sativa*). This root-knot nematode has primarily been found attacking irrigated and rainfed rice, lowland and upland rice, and deepwater rice. However, *M. graminicola* has a wide host range (see list below) belonging to different families, mainly Poaceae but also Asteraceae, Cucurbitaceae, Fabaceae, Solanaceae (MacGowan & Langdon, 1989). It has been found associated with other cereals as well as dicotyledonous and grass plants, including many weeds commonly present in rice fields that may constitute a major reservoir of nematodes (Bridge et al. 2005; Bridge & Starr 2007; Rich et al. 2009). In Italy, *M. graminicola* has been found associated with rice and weeds (*Alisma plantago-aquatica*, *Cyperus difformis*, *Echinochloa crus-galli*, *Heteranthera reniformis*, *Murdannia keisak*, *Oryza sativa* var. *sylvatica*, *Panicum dichotomiflorum*) growing in the vicinity of affected rice plants (Fanelli et al., 2017).

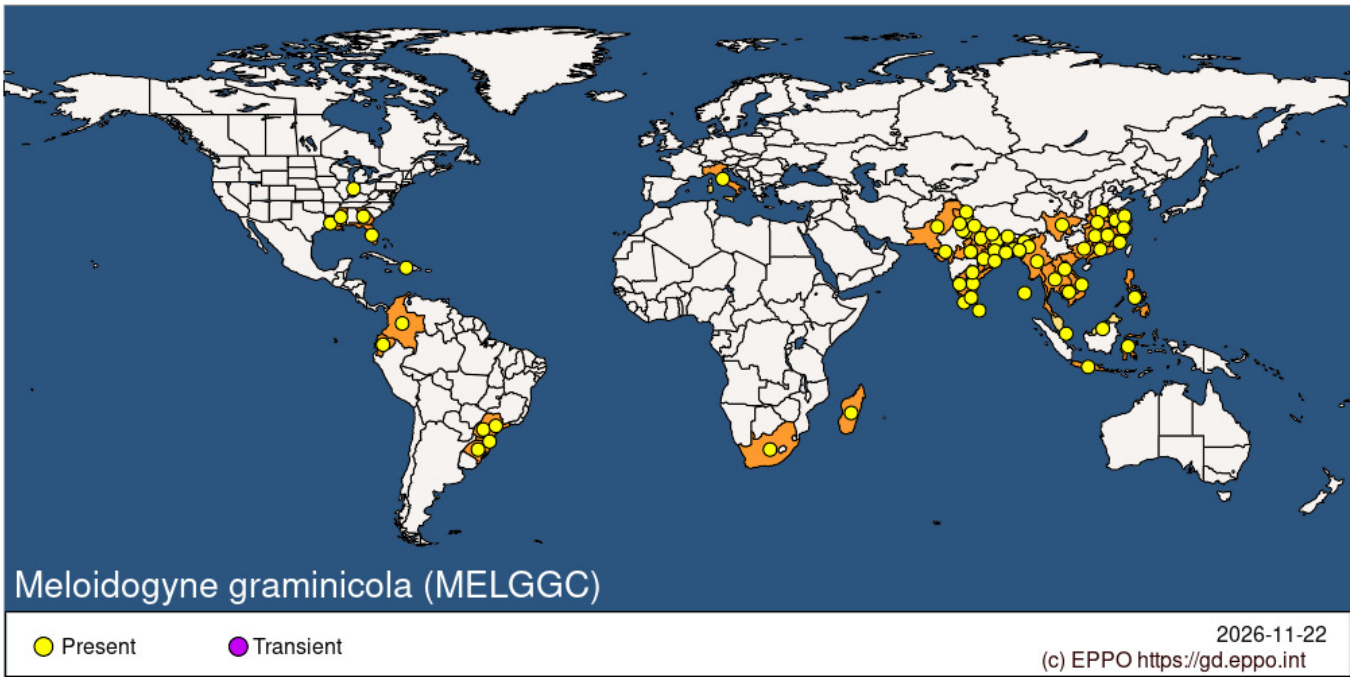
Many plants are recorded as hosts, however, it should be noted that host status depends on the host plant varieties and on the *M. graminicola* biotypes.

Host list: *Abelmoschus esculentus*, *Ageratum conyzoides*, *Agrostis stolonifera*, *Alisma plantago-aquatica*, *Allium ascalonicum*, *Allium cepa*, *Allium fistulosum*, *Allium tuberosum*, *Alopecurus carolinianus*, *Alopecurus sp.*, *Alternanthera sessilis*, *Amaranthus spinosus*, *Amaranthus viridis*, *Ammannia baccifera*, *Andropogon sp.*, *Beta vulgaris*, *Blumea sp.*, *Bonnaya ciliata*, *Bothriochloa bladhii*, *Brassica juncea*, *Brassica napus*, *Brassica oleracea var. botrytis*, *Brassica oleracea*, *Capsicum annuum*, *Capsicum frutescens*, *Catharanthus roseus*, *Cenchrus americanus*, *Cenchrus pedicellatus*, *Centella asiatica*, *Colocasia esculenta*, *Commelina benghalensis*, *Corchorus aestuans*, *Corchorus capsularis*, *Coriandrum sativum*, *Cucumis sativus*, *Cyanotis axillaris*, *Cyanotis cucullata*, *Cyanthillium cinereum*, *Cymbopogon citratus*, *Cynodon dactylon*, *Cyperus compressus*, *Cyperus difformis*, *Cyperus esculentus*, *Cyperus imbricatus*, *Cyperus iria*, *Cyperus odoratus*, *Cyperus pilosus*, *Cyperus procerus*, *Cyperus pseudokyllingioides*, *Cyperus pulcherrimus*, *Cyperus rotundus*, *Dactyloctenium aegyptium*, *Desmodium triflorum*, *Digitaria filiformis*, *Digitaria longiflora*, *Digitaria sanguinalis*, *Echinochloa colonum*, *Echinochloa crus-galli*, *Eclipta prostrata*, *Eleusine coracana*, *Eleusine indica*, *Elymus repens*, *Eragrostis racemosa*, *Eragrostis tenella* , *Euphorbia hirta*, *Fimbristylis complanata*, *Fimbristylis dichotoma var. pluristriata*, *Fimbristylis dichotoma*, *Fimbristylis littoralis*, *Fimbristylis quinquangularis subsp. quinquangularis*, *Fuirena ciliaris*, *Gamochaeta falcata*, *Gamochaeta purpurea*, *Glinus oppositifolius*, *Glycine max*, *Grangea ceruanoides*, *Hedyotis diffusa*, *Heteranthera reniformis*, *Hordeum vulgare*, *Hydrilla sp.*, *Impatiens balsamina*, *Imperata cylindrica*, *Ipomoea aquatica*, *Ischaemum rugosum*, *Juncus microcephalus*, *Kyllinga brevifolia*, *Kyllinga gracillima*, *Lactuca sativa*, *Leersia hexandra*, *Leptochloa chinensis*, *Leucas lavandulifolia*, *Lindernia sp.*, *Lolium multiflorum*, *Ludwigia adscendens*, *Mecardonia procumbens*, *Medicago polyceratia*, *Melilotus albus*, *Murdannia keisak*, *Murdannia nudiflora*, *Musa acuminata*, *Musa sp.*, *Oplismenus compositus*, *Oryza sativa*, *Oxalis corniculata*, *Panicum dichotomiflorum*, *Panicum flexuosum*, *Panicum miliaceum*, *Panicum repens*, *Paspalum scrobiculatum*, *Petunia sp.*, *Phaseolus vulgaris* , *Phlox drummondii*, *Phyllanthus niruri*, *Phyllanthus urinaria*, *Physalis minima*, *Pisum sativum*, *Poa annua*, *Pontederia vaginalis*, *Portulaca oleracea*, *Ranunculus pusillus*, *Ranunculus sp.*, *Rungia parviflora*, *Saccharum officinarum*

, Sacciolepis indica, Schoenoplectiella articulata, Scoparia dulcis, Setaria italica, Sida acuta, Solanum lycopersicum , Solanum melongena, Solanum nigrum, Solanum sisymbriifolium, Solanum tuberosum, Sorghum bicolor, Spergula arvensis, Spermacoce articularis, Sphaeranthus senegalensis, Sphaeranthus sp., Sphenoclea zeylanica, Spinacia oleracea, Stellaria media, Trifolium repens, Triticum aestivum subsp. aestivum, Triticum durum, Urena lobata, Urochloa mutica, Urochloa ramosa, Vandellia sp., Vicia faba, Vigna mungo, Vigna radiata, Zea mays

GEOGRAPHICAL DISTRIBUTION

M. graminicola was first isolated in India by Israel et al. (1963), but it was described in 1965 from the roots of barnyard grass (*Echinochloa colonum*) in Baton Rouge, Louisiana, USA (Golden & Birchfield, 1965). Until 2016, *M. graminicola* was only known to occur in Asia, Madagascar and South Africa, and in part of the Americas. In the EPPO region, *M. graminicola* was first reported in 2016 in northern Italy in rice fields in Piedmont (provinces of Biella and Vercelli) (Fanelli et al., 2017), followed in 2018 by other outbreaks in Lombardy (province of Pavia) (EPPO, 2018).



EPPO Region: Italy (mainland)
Africa: Madagascar, South Africa
Asia: Bangladesh, Cambodia, China (Anhui, Fujian, Guangdong, Guangxi, Hainan, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Zhejiang), India (Andaman and Nicobar Islands, Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkand, Karnataka, Kerala, Madhya Pradesh, Manipur, Odisha, Punjab, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal), Indonesia (Java, Sulawesi), Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam
North America: United States of America (Florida, Georgia, Indiana, Louisiana, Mississippi)
Central America and Caribbean: Haiti
South America: Brazil (Parana, Rio Grande do Sul, Santa Catarina, Sao Paulo), Colombia, Ecuador

BIOLOGY

M. graminicola is a root-knot obligate sedentary endoparasite. Like the other *Meloidogyne* species, its life cycle comprises the developmental stages: eggs, four juvenile stages and adults. The eggs are laid in egg masses inside the root cortex, although for a few host plants (e.g. *Lolium multiflorum*) egg masses have also been observed outside roots (Negretti *et al.*, 2014); the first juvenile stage (J1) develops inside the egg and moults to the second one (J2), which hatches under favourable environmental conditions. After hatching, the J2s may be either

move into the soil or remain inside the tissues of the same root gall. The J2s outside the root move through the soil to find a suitable host, actively penetrate the root near the tip towards the meristematic zone and start feeding, inducing a permanent feeding site in the stele with the formation of syncytium and galls (Gheysen & Mitchum, 2011). The J2s which stay inside the maternal gall, either remain there or migrate intercellularly through the parenchymal cortex tissue towards new feeding sites within the same root, with the consequent formation of new galls (Mulk 1976; Bridge & Page, 1982; Kyndt *et al.*, 2012), allowing *M. graminicola* to complete its life cycle without leaving the host under flooded conditions when roots are submerged.

Inside the root, the J2s become sedentary and flask-shaped moulting to the third juvenile stage (J3), fourth juvenile stage (J4), and adult male or female stages (Gaur, 2003). The J3s and J4s do not have a functional stylet, hence they do not feed. Females are pear-shaped with a small neck (Mulk, 1976) and vermiform non-infective male specimens are both present in the same gall. Later, adult males leave the root and move into the soil, not able to attack plants.

Typically, about 15-20 (occasionally up to 30) females of *M. graminicola* each bearing hundreds of eggs occur in one gall (Peng *et al.*, 2018). *M. graminicola* is a facultative meiotic parthenogenetic species in which amphimixis can occur at a low frequency (approximately 0.5%) (Triantaphyllou, 1969; Mantelin *et al.*, 2017). In paddy fields of northern Italy, only J2s were observed inside the roots at the second/beginning third leaf stage, mostly J3s, J4s, and males at the end third/beginning fourth leaf stage and females from the fourth leaf unfolded stage of rice plants (Sacchi *et al.*, 2021).

In experiments under glasshouse condition at room temperature, J2 *M. graminicola* entered the rice roots within 24 hrs. The duration of the life cycle from egg to J2, J3, J4, adult male and female stages was respectively 1-5, 6-8, 9-12, 23 and 26 days. The total duration, including the pre-parasitic stage, from egg to female was 25-28 days and females laid about 250-300 eggs in an egg sac inside the root tissues (Narasimhamurthy *et al.* 2018). Other studies reported that, compared with other *Meloidogyne* species, *M. graminicola* is characterized by a relatively fast life cycle, completed in 19–27 days depending on the soil temperature, which usually ranges from 22 to 29 ºC in the areas in which *M. graminicola* is found (Yik & Birchfield, 1979; Bridge & Page, 1982; Dutta *et al.*, 2012).

M. graminicola J2s remain inside the root under flooded conditions but quickly leave the root and infest root tips of other plants when soils are drained (Manser, 1968); J2s that are already in the soil can survive for several weeks, in flooding condition, but they will not infest roots until the water is removed (Bridge & Page, 1982), therefore their presence in soil is dependent on the watering system of the rice crop. The survival of egg masses and J2s in soil was studied by various authors: Roy (1982) observed, *in vitro*, that numbers of egg masses decline rapidly after 4 months under waterlogged and moist conditions, and that some egg masses survive for longer periods remaining viable for at least 14 months in waterlogged soil; Bridge & Page (1982) highlighted the J2s surviving in flooded soil for at least 5 months; Soomro (1989) reported that J2s of *M. graminicola* could survive and remain viable in moist soil, without a host plant, for up to 5 months, highlighting the nematode's ability to persist between rice cropping seasons, potentially impacting future rice yields; Padgham *et al.* (2003) verified, in greenhouse experiments, the survival and infectivity of *M. graminicola* up to 12 weeks incubation, demonstrating that both are significantly higher in flooded than in non-flooded soils; Soomro (1994) observed a 5 months survival of the rice root-knot nematode, in moist soil at 20-30°C without any host, greater at the lowest temperature.

In most cases *M. graminicola* survives in the roots of infested plants after the rice harvest and in the root system of weed hosts.

DETECTION AND IDENTIFICATION

Symptoms

The symptoms of *M. graminicola* infestation are shown in the whole root system as characteristic swollen hook-shaped galls of different shapes and sizes, mainly at the root tips, which can also be club-shaped (Fanelli *et al.*, 2017). Hook-shaped deformations are also typical of *Meloidogyne oryzae*, while *Meloidogyne salasi* produces oval or hook-shaped galls mainly restricted to the root tips (Sancho *et al.*, 1987; López, 1991).

Root infestation by nematodes, including *M. graminicola*, reduces the absorbent function of the roots leading to above-ground symptoms such as poor growth, stunting, leaf chlorosis, decreased leaf size, internode shortening,

dwarfism, reduced tillering in cereal crops, delayed earhead emergence, poor/absent flowering, empty or poorly filled spikelets, and can lead to the death of plants in the case of exceptionally large-scale infestations (McClure, 1977; Bridge & Page, 1982; Fanelli *et al.*, 2017; Peng *et al.*, 2018; Fanelli *et al.*, 2022). In rice fields infested by *M. graminicola*, in early summer, the symptoms generally occur in patches in young plants prior to flooding, but may also present along a linear gradient, caused by the direction of cultural practices in the crop. In late summer and autumn, the above-ground symptoms may regress after flooding and application of fertiliser, because the patches can be covered by the vegetation of other rice plants. At this stage, rice fields can appear more uniform, but the infested plants show either a poor caryopsis production and empty spikelets or, in case of heavy infestation, they remain submerged and unable to elongate rapidly, causing plant death and leaving patches of open water in the flooded fields (Bridge & Page, 1982; Peng *et al.*, 2018).

Severe infestation and large galls can also be observed on weeds. In Italy, the weeds found infested (see Hosts) showed the same above-ground symptoms as rice plants (Fanelli *et al.* 2017). The symptoms of *M. graminicola* infestation are shown in the whole root system as characteristic swollen hook-shaped galls of different shapes and sizes, mainly at the root tips, which can also be club-shaped (Fanelli *et al.*, 2017). Hook-shaped deformations are also typical of *Meloidogyne oryzae*, while *Meloidogyne salasi* produces oval or hook-shaped galls mainly restricted to the root tips (Sancho *et al.*, 1987; López, 1991).

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Morphology

The description of males, females and J2s are reported in the EPPO Diagnostic Standard PM 7/158 (1) *Meloidogyne graminicola* (EPPO, 2025) and in CABI Compendium, Datasheet on *Meloidogyne graminicola* (CABI, 2021).

Inspection and detection methods

Visual field inspection

Inspected areas should be chosen considering the biology of this species and its main hosts. Particular attention is needed in rice paddies and arable land close to infested areas. Fields have to be inspected from plant emergence to the end of tillering, verifying the presence of chlorotic patches and/or lack of plants and, in general, a poor growth of the crop. If above-ground symptoms are verified, visual inspection is carried out by uprooting symptomatic plants and verifying the presence of hook-shaped root galls, because the rice roots can contain many more nematodes than soil (Bridge & Page, 1982).

Sampling

15/20 symptomatic plants, including root systems and rhizosphere soil, are collected for laboratory analysis, with at least 5 g of roots showing galls and 200 mL of rhizosphere soil. In asymptomatic plots, 15/20 random plants with roots and adhering soil can be sampled in different points of each plot, forming a single sample for the nematological analysis. Samples should be kept moist in a plastic bag in cold conditions to keep nematodes alive as long as possible, especially when extraction methods based on motility will be used (EPPO, 2013; Italian NPPO, 2023).

Root-gall inspection

The roots of rice plants are gently washed, dried and observed with the naked eye and under a stereomicroscope, to check for the characteristic swollen hook/club-shaped galls, mainly at the root tips.

Extraction

To detect *M. graminicola* in soil/growing medium, roots or water, nematodes should be extracted first. Extraction methods are detailed in the EPPO Standards PM 7/119 Nematode extraction (EPPO, 2013) and PM 7/158 (EPPO, 2025).

Identification

Identification of *M. graminicola* is detailed in the EPPO Diagnostic Standard PM 7/158 (EPPO, 2025) and the diagnostic protocol of the European Union Reference Laboratory for Plant Parasitic Nematodes (2024).

PATHWAYS FOR MOVEMENT

M. graminicola is associated with the roots of its host plants or with soil (or growing media). The natural spread of *M. graminicola* in the soil is limited to short distances towards roots, up to ca. 1-2 m per year (Tiilikkala *et al.* 1995). *M. graminicola* may also move locally with waterbirds, wind transporting soil, and surface water (Torrini *et al.*, 2020; EPPO, 2023). In paddy fields, passive transport may be facilitated by water flowing from one infested field to others nearby dispersing the pest over short and medium distances. Irrigation water is considered important for local spread but is considered to have a moderate role for spread of nematodes to new areas (Padgham *et al.*, 2003; Torrini *et al.*, 2020). The number of infective *M. graminicola* juveniles in the soil oscillates throughout the year (Win *et al.*, 2013). High levels of infested volunteer rice plants, susceptible weeds and forage growing in rice fields represent a high risk of infestation and damage for the host crops in rotation, because they may also host *M. graminicola* and allow nematodes to survive and reproduce in off-seasons without a rice crop (Medina *et al.*, 2009) contributing to an increase in the population level in the soil and rice infestation in the following crop season (Pokharel *et al.*, 2007).

The potential pathways for entry *M. graminicola* into new areas are the following (Torrini *et al.*, 2020; EPPO, 2023): host plants for planting and bulbs, tubers, corms and rhizomes of host plants, intended for planting, with or without soil or growing media; soil or growing medium in which infested host plants have been grown (which may contain eggs, J2s and males); soil attached to equipment and agricultural machinery (EPPO, 2023); passengers coming from areas where the pest is present by means of soil attached to footwear. Rice production in many EPPO countries is currently based on direct seed sowing and not on the use of transplants, and in such cases *M. graminicola* would not be introduced with infested rice plants. The pathway(s) which led to the introduction of *M. graminicola* in Italy is/are

not known. Fanelli *et al.* (2022) suggest, based on phylogenetic analysis, that the two Italian outbreaks are related to two different introductions.

PEST SIGNIFICANCE

Economic impact

Damage data is mainly reported on rice and limited information is available for other hosts (EPPO, 2023). *M. graminicola* is a pest of international importance to rice around the world and is a major concern for yield loss due to nematode infestation in rice and wheat crops under rice–wheat cropping systems (MacGowan & Langdon 1989; Jain *et al.*, 2012), causing yield losses of up to 70% (Plowright & Bridge, 1990; Bridge *et al.*, 2005; Khan *et al.*, 2014).

In Asia *M. graminicola* represents one of the major constraints in rice production due to rice cropping intensification and increasing scarcity of water supply (Prasad & Somasekhar, 2009; Somasekhar & Prasad, 2009). In fact, the practice of direct sowing or transplanting in wet conditions, intermittent regulated irrigation and soil aeration are all practices very favourable to *M. graminicola* infestation and economic losses (Prot *et al.*, 1994; Soriano & Reversat, 2003; Jain *et al.*, 2012; Khan *et al.*, 2014). In Italy, in 2016, in Piedmont, one paddy field suffered a decrease of 30-40% in rice production, while in 2018 in Lombardy, the yield losses in infested fields reached 50% of ordinary rice production (Torrini *et al.*, 2020).

Crop losses depend on the nematode population density, rice cultivation system (flooded or dry), environmental conditions and soil structure. Yield losses caused by *M. graminicola* are estimated in a range from 20% to 80% in upland rice and 11% to 73% in intermittently flooded conditions (Plowright & Bridge, 1990; Soriano *et al.*, 2000). In upland rice, it is estimated to have a 2.6% decrease in grain yield for every 1000 J2s in the soil around young seedlings; while 10% loss in yield of upland rice is caused by population levels of *M. graminicola* of 120, 250 and 600 eggs/plant respectively at 10-, 30- and 60-days age of plants in direct seeded crops (Rao *et al.*, 1984; Rao *et al.*, 1986). Other investigations have shown that a nematode population higher than 1000 J2s/g rice root with 12-16 galls/plant, shows a 65% decrease in rice yield (Win *et al.*, 2011) and more than 75% roots infested by *M. graminicola* causes a decline in rice yield (Nugaliyadde *et al.*, 2001). Furthermore, in a paddy field, these losses may be increased if combined with other biotic or abiotic stresses, such as drought. Mantelin *et al.* (2017) observed that *M. graminicola* infestation could often be underestimated, with the atypical above-ground symptoms wrongly attributed to nutritional and water-associated disorders or to secondary diseases.

Other studies verified that different rice cultivars subjected to the same nematode pressure, has different levels of infestation by *M. graminicola* (Amarasinghe *et al.*, 2007; Amarasinghe, 2011). In addition, different nematode populations showed a different harmfulness towards the same rice variety, suggesting intraspecific variability and the existence of different races of *M. graminicola* (Pokharel *et al.*, 2007; Bellafiore *et al.*, 2015).

No information is available on *M. graminicola* damage in protected conditions, but host experiments conducted in greenhouses on rice, weeds, vegetables and ornamental plants show that the pest can develop in protected conditions (Yik & Birchfield, 1979), showing a decrease in rice yield of 17% to 80% (Tandingan *et al.*, 1996; Soriano *et al.*, 2000).

Control

The wide host range of *M. graminicola* and its ability to survive for long periods in environments with low oxygen content, make its control difficult (Torrini *et al.*, 2020). Indeed, it has been observed that waterlogged conditions in either direct seeded or transplanted rice had no effects on the survival of the endoparasitic stages (Prasad *et al.*, 1985). Increasing soil fertility can compensate for some damage by *M. graminicola*.

Some cultivars from India, Thailand and the USA are reported to be resistant to this nematode (Bridge *et al.*, 1990), although resistance may vary with the water regime (Soriano *et al.*, 2000). The screening of germplasm for resistant/tolerant genotypes, identification of sources of resistance in wild accessions of rice and the development of resistant/tolerant cultivars seem promising for an effective and economic control of *M. graminicola* (Dutta *et al.*,

2012; Pokharel *et al.*, 2012; Mantelin *et al.*, 2017; Kumari *et al.*, 2016)

The damage induced by *M. graminicola* is lower under flooding than in shallow intermittently flooded fields (Mantelin *et al.*, 2017; Sacchi *et al.*, 2021). Early flooding after sowing prevents or limits root invasion by this nematode (Bridge & Page, 1982) and promotes the establishment of the rice crop, minimizing yield losses due to *M. graminicola* in irrigated and wet seeded rice. Continuous flooding during either the whole rice growth season until harvesting (Soriano *et al.*, 2000) or even up to 18 months, seems to be one of the most effective technique in controlling *M. graminicola* population (Sacchi *et al.*, 2021), as observed in Vietnam (Dang-ngoc Kinh *et al.*, 1982) and in Italy, where Torrini *et al.* (2020) reported a flooding period at least from spring to the following winter as being effective. Nevertheless, some limitations in the application of this method are due to the poor water retention capacity of sandy, sandy-silty and loamy soils, which represent the most favourable soil categories for the development of *Meloidogyne* species (Braasch *et al.*, 1996; Soriano *et al.*, 2000). The infested Italian rice fields mainly have coarse and medium soils (Torrini *et al.*, 2020; Sacchi *et al.*, 2020) and prolonged flooding is very difficult to apply.

In infested fields, removal of infested volunteer rice plants and host weeds in a weed management programme (Padgham *et al.*, 2004; Rusique *et al.*, 2021) and crop rotation with non-host or poor host crops (e.g. castor, cowpea, soybean, sunflower, sesame, onion, turnip, common bean) (Rao *et al.*, 1986) help to decrease nematode populations to low levels.

Chemical control of *M. graminicola* in dry rice crops is generally uneconomic and, furthermore, the existing effective chemical nematicides are now banned at least in the European Union. Recent studies have investigated other possible control methods (Dallavalle *et al.*, 2020; Chavan *et al.*, 2023). The cultivation of rice plants as trap-crops is one of the most promising and effective practices suggested to the farmers for the management of the rice root-knot nematode, especially in the rice-growing areas with water shortages (Sacchi *et al.*, 2021).

Many biological control agents attack root-knot nematodes (Kerry, 1987) including *M. graminicola*, such as the bacteria *Bacillus megaterium* (Padgham & Sikora, 2007), *Bacillus subtilis* and the rhizobacterium *Pseudomonas fluorescence*; the fungi *Trichoderma harzianum, T. viride*, and other *Trichoderma* spp. (Huong *et al.*, 2009; Amarasinghe & Hemachandra, 2020), *Purpureocillium lilacinum* (sin. *Paecilomyces lilacinus*) (Haque *et al.*, 2018), *Arthrobotrys oligospora* and *Dactylaria eudermata* (Simon & Anamika, 2011) but no specific organisms have been recommended for control of *M. graminicola* in the field (Torrini *et al.*, 2020).

Phytosanitary risk

The main phytosanitary risk in the EPPO region is to areas where rice can be produced, and in such areas, climate will probably not be a limiting factor to the establishment of the pest (EPPO, 2023). It has already established in rice fields in limited areas of northern Italy, in Piedmont and Lombardy. Other EPPO countries have substantial rice growing areas (EPPO, 2023). In addition, *M. graminicola* is able to infest many plant species belonging to different families (mainly Poaceae but also Asteraceae, Cucurbitaceae, Fabaceae, Solanaceae) including economically important crops grown in rotation with rice in the EPPO region, such as barley (*Hordeum vulgare)*, maize (*Zea mays*), oat (*Avena sativa*), soybean (*Glycine max*), tomato (*Solanum lycopersicum)*, and wheat (*Triticum* sp.) or in clover (*Trifolium* sp., *T. repens*) which is often used in rotation. Other economically important hosts of *M. graminicola* in the EPPO region are for example aubergine (*Solanum melongena*), onion (*Allium cepa*), cabbage (*Brassica oleracea*), cucumber (*Cucumis sativus*), ryegrass (*Lolium multiflorum*), pea (*Pisum sativum*), common bean (*Phaseolus vulgaris*), potato (*Solanum tuberosum*), broad bean (*Vicia faba*).

PHYTOSANITARY MEASURES

The EPPO PRA report on *M. graminicola* (EPPO, 2023) recommends phytosanitary measures for several pathways. Options for rice plants for planting with roots (with or without soil or growing media) include pest free area, pest-free place of production, pest-free production site, and consignment freedom based on inspection and testing of asymptomatic plants after harvest. Soil (on its own) should come from a pest free area, pest-free place of production or pest-free production site, or be treated. Used equipment and machinery should be cleaned (ISPM 41 – FAO, 2017). Public awareness and cleaning of footwear are relevant options in relation to passengers (EPPO, 2023).

In the EU, *M. graminicola* is subject to the emergency measures established by the Commission Implementing

Regulation (EU) 2022/1372 amended in 2025 (European Commission, 2022 and 2025). In cases of outbreaks, measures aim to control the spread and to minimise yield losses, such as: intensive sampling and testing of soil and all host plants in the infested area and in buffer zones (100 m around an infested area); cleaning of equipment and machinery, tools and footwear moving from an infested field to the neighbouring ones; uprooting and destruction of infested plants; prohibition of growing host plants in infested areas; periodic elimination of host weeds; not moving infested material out of the infested area, including both host and non-host plants with roots grown in infested soil; flooding rice field for a long time, possibly more than 18 months (Torrini *et al.*, 2020); rice plants cultivated as trap-crops in three cycles for about two months (Sacchi *et al.*, 2021).

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