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Rice Root-Knot Nematode - Major Threat to Rice

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ABSTRACT

More than half of the world's population relies primarily on rice (*Oryza sativa* L.) as a food source. Majorly rice crop was affected by biotic factors such as weeds, insects, diseases, and nematodes which contribute to lower productivity. Among these biotic factors, rice root-knot nematode *Meloidogyne graminicola* infestation causes up to 72% yield loss in rice crop production. The rice root-knot nematode adapted well to flooding conditions and causing risk to all rice ecosystem. Recently, it is found in Italy and added to the EPPO (European and Mediterranean Plant Protection Organization) Alert List.

INTRODUCTION

Meloidogyne graminicola is commonly known as rice root-knot nematode belongs to Phylum Nematoda and family Meloidogynidae. First reported in Louisiana (US) from oats and grasses during 1965. Later, it has been observed mostly in irrigated rice (*Oryza sativa*) fields in Asia, as well as in several regions of the America and Africa. *M. graminicola* is an obligate sedentary endo-parasite that causes a yield loss of Rs. 23 million in rice (Kumar *et al*., 2020). It is reported to cause 10 % yield loss and also reduced the crop value by less than 0.2% (Ahmad *et al*., 2022). A pre-plant population of 1,500 second-stage juveniles (J2s) of *M. graminicola*/kg of soil may reduce the rice yield by 27 to 35%.

HOST

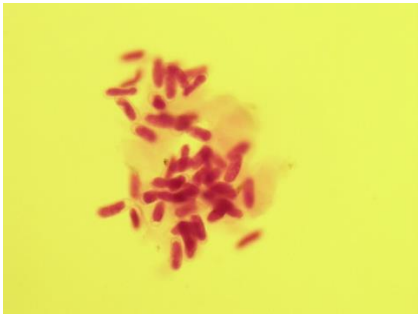
The major host is rice and also infect barely, wheat, sorghum, sugarcane, pearl millet, onion, garlic and weeds like *Echinochloa colonum, Cyperus rotundus, E. crusgalli* and *Phalaris minor* (Mantelin *et al*., 2017). In 2019, reported that this nematode was also found in purple nutsedge at Wimauma, Florida.

SYMPTOMS

In below ground symptom *M. graminicola* infect the root system and cause swelling. This leads to the development of the characteristic symptoms such as terminal 'hook shaped' gall or 'ring like' at the tip of the roots. Due to this lateral, rootlets and root hairs were started to develop. In above ground symptoms are reduced tillering, stunting, yellowing, unfilled spikelets and poor yield. Symptoms usually appear as patches in the field. It causes a yield loss of 15 to 30% in upland rice and severe damage upon 65% yield reduction.

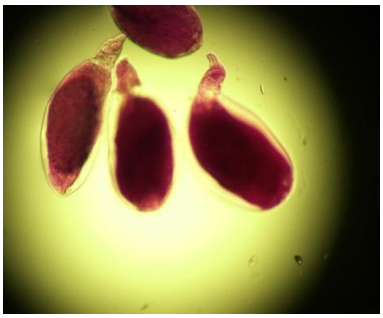
CASUAL ORGANISM AND EPIDEMIOLOGY

M. graminicola is obligate sedentary endo parasite. Female usually enclosed within root system along with the eggs. The infective stage is J2, it attacks the elongation zone behind the root tip and establishes the feeding site in cortical region of the root. The newly hatched juveniles moved intercellularly and establish the feeding site (giant cell) within the root. After harvest,



M. *graminicola* eggs

M. *graminicola* juveniles



M. *graminicola* females

Rice root infected with M. *graminicola*

Healthy root without infestation

Stained nematodes inside root

they may survive and continues to reproduce in rice stubbles or in weeds or remain as egg stage in soil. The life cycle of *M. graminicola* is completes within 20 days 22–29 °C in upland rice.

MANAGEMENT

NURSERY TREATMENT

- Rice yield can be increased by soaking the rice seeds in 0.1% carbosulfan solution for 12 hours. This has a negative impact on *M. graminicola's* ability to produce large quantities of eggs.
- Neem cake, mixed at a rate of 100 g/m^2, is added to the nursery area 15 days before planting to reduce the population level of the rice root-knot nematode.
- Carbofuran can applied to nursery beds at a rate of 0.3 g a.i./m^2 and to fields at a rate of 1 kg a.i./ha 40 days after transplantation to suppress nematode populations.
- Nematode populations are decreased by using the bioagent *Pseudomonas fluorescens* at a rate of 20 g/m^2 as a nursery bed treatment.

MAIN FIELD

- Crop rotation with non-host crops such as mustard, groundnut and black gram helps to decline the population level.
- The use of resistant genotypes such as INRC–2002, CR–94, CCRP–51 can reduce the population build-up.

CONCLUSION

Rice root-knot nematode is an emerging problem in our country. It not only causes yield loss to rice and also started to infest the onion and garlic in West Bengal, Gujarat and Haryana (Gupta and Pandey, 2018). In single growing rice season, this nematode will able to complete several generations leads to rapid build-up of population in soil. Therefore, nematode management is appropriate and essential to avoid the agricultural losses.

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