DIFFERENTIAL SET

ROOT KNOT NEMATODES (RKN MIG; Ma, Mi, Mj) - TOMATO

Root-knot nematodes, belonging to the genus Meloidogyne, comprise a large group of different species. Economically, the most relevant species are *Meloidogyne incognita* (Mi), *M. javanica* (Mj) and *M. arenaria* (Ma), which are highly related. For this reason, these are groups within a species complex (Meloidogyne Incognita Group - MIG).
Other important species within RKN are MIG-related *M. enterolobii* and more distant *M. hapla.*
As MIG species are highly polyphagous, isolates originating from tomato can infect pepper and vice versa.

Resistance to MIG species is present in tomato. The most common used resistance gene is named *Mi1 and* provide resistance towards all three MIG species. For this reason, the resistance claims for these species are grouped by the Industry.
Resistance breaking strains are reported in both tomato and pepper (Castagnone-Sereno et al., 1992) however, resistance breaking in tomato does not automatically result in resistance breaking in pepper or the other way around.
Mi1 does not protect against other Meloidogyne species like *M. hapla* or *M. enterolobii.*

Need for a harmonized classification system.
To describe differences between populations of Meloidogyne species, a classification system has earlier been described by Barker et al, 1985.

The NC differential host test relies on combinations of resistant and susceptible hosts reactions to nematodes of *Capsicum annuum* L.(pepper) cv. California Wonder, *Gossypium hirsutum* L. (cotton) cv. Deltapine16, *Arachis hypogaea* L. (peanut) cv. Florunner, *Solanum lycopersicon*. (tomato) cv. Tiny tim, *Nicotiana tabacum* L. (tobacco) cv. NC95 and *Citrullus vulgaris* Schrad (watermelon) cv. Charleston Grey, (Taylor and Sasser, 1978).

A shortcoming of this differential host set is that it does specify the host varieties and presence of resistance genes. For this reason, this classification system does not describe the virulence of populations in relation to resistance genes, present in commercial crops. For this reason, a classification system, based on resistance genes is preferred and used by the Industry in the communication of nematode resistances.
Resistance breaking isolates can be grouped in races that can be characterized by the common differentials listed in the table below:

Differentials	ISF Code and races Gene (s)	Ma/Mi/Mj (now MIG): 0	Ma/Mi/Mj (now MIG): 1
St Pierre		S	S
Piersol	Mi-1	HR	Sus

Explanatory Note:
In evaluating plant varieties for resistance to specific pathogens or pests, the following classifications are used to describe their response:
S = Susceptible; HR= Highly Resistant

You can find further information on this definitions in the following ISF document https://worldseed.org/document/definitions-of-the-terminology-plants-pests-v-o-seed-industry-2022/

All isolates and differentials are used by the industry

References

Barker et al., 1985 An Advanced Treatise on Meloidogyne. Vol. II. North Carolina State University An Advanced treatise on meloidogyne : Free Download, Borrow, and Streaming : Internet Archive

Castagnone-Sereno et al., 1992. Differential expression of root-knot nematode resistance genes in tomato and pepper: evidence with Meloidogyne incognita virulent and avirulent near-isogenic lineages. Annals of Applied Biology 120(3):487 - 492 https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1744-7348.1992.tb04908.x

Sasser, J.N., 1954. Identification and host-parasite relationships of certain root-knot nematodes (Meloidogyne spp.). Md Agr Exp Sta Bull A.77, 31p

Taylor, A.L. and Sasser, J.N. (1978) Biology, Identification and Control of Root-Knot Nematodes. International Nematology Project, North Carolina State University, Graphics, Raleigh, 111.

Szitenberg et al., 2017. Comparative Genomics of Apomictic Root-Knot Nematodes: Hybridization, Ploidy, and Dynamic Genome Change Genome Biol. Evol. 9(10):2844–2861.

Protocol

CPVO. See http://www.cpvo.europa.eu/ for a protocol on disease resistance testing

For more information contact the ISF Secretariat at isf@worldseed.org

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