

Purple false brome (*Brachypodium distachyon*), a potential model host for studying pathogen interactions with root-knot nematodes.

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Model organisms are species that share many essential biological properties with organisms of specific interest and have advantageous characteristics such as small size, short generation time, large number of progeny or compact genome. For the past few decades *Arabidopsis thaliana*, a member of the mustard family, has been widely studied as a model for flowering plants in plant biology, in particular for basic research in genetics and molecular biology. However, as a dicotyledon, there are limitations to the validity of information obtained regarding monocotyledons which comprise many of the major food crops.

The small annual grass species *Brachypodium distachyon* is native to the Mediterranean region although now it occurs worldwide. It is of no agronomical importance but it is closely related to cool season cereal crops, forage and turf grasses that are taxonomically grouped in the grass subfamily *Pooideae*. Similar to *Arabidopsis* it has a number of favorable intrinsic characteristics that has propelled its status from an obscure wild plant to an increasingly popular model for grain and biofuel grasses.

The objective of our study was to determine its research utility for studies with root-knot nematode species (*Meloidogyne* spp). This group of nematodes has a worldwide distribution and parasitizes almost every plant species. Nearly 100 *Meloidogyne* species are known but less than 10 are of major economic importance. They account for approximately half of the \$110 billion economic impact attributed annually to the activity of all plant parasitic nematodes worldwide.

Resistant plant cultivars are primary tools to manage root-knot nematode populations and to mitigate their crop damage. Information obtained from studies with the host/pathogen combination *Brachypodium/Meloidogyne* may therefore foster breeding efforts in some of the related crops with economic importance.

Second stage juveniles of root knot nematodes invade roots typically just behind the root tip. They initiate a permanent feeding site by injecting small metabolites into cells near the central cylinder that turn into nurse cells on which the nematodes will feed for the rest of their life. In some plants these cells may enlarge to nearly 100-fold and cause the root to develop knots or galls. While those symptoms are quite easy to detect on tomato or melon roots, root galls on grasses are either very small or absent. Consequently we were interested to utilize soil-free growth pouches that allow non-destructive observation of plant/nematode interaction through their transparent plastic film. In addition we used the Ray Leach "Cone-tainer" system (Stuewe & Sons, Tangent, OR).



Tall growth cells are cone-shaped, drain well and are arranged in sturdy 98-cell rack that allows for excellent plant growth with minimum space requirements.

Seeds of various *B. distachyon* inbred lines were imbibed in water and surface decontaminated in 10% commercial bleach. After a week of moist incubation at 4°C the seed was planted in plastic cones with pasteurized sandy soil or soil-free growth pouches. Both growth systems were infested with second-stage juveniles of either *M. incognita* or *M. graminis*. Individual pouches and cone cells were arranged in a randomized complete block design with 6 replications and incubated at 26±2°C in ambient light in a greenhouse.

In the growth pouches, slight root swellings caused by nematode parasitism were observed under a dissecting scope after 15-17 days. Eventually the enlarging posterior of *Meloidogyne* females broke through the root surface.

After approximately 27 days a jelly-like mass extruded from the female that contained eggs. This glycoprotein sack produced by rectal glands in the females protects the eggs against biotic and abiotic hazards such as predation and desiccation. The extent of root knot nematode egg production among the *B. distachyon* lines differed considerably. *Meloidogyne graminis* had a higher egg reproduction than *M. incognita* with approximately 300 eggs/female and 5-fold higher egg population density per root length than *M. incognita*.

In many growth pouches fungal growth was observed after two to three weeks that grew out of the *Brachypodium* seeds and produced abundant dark and hairy, ball-shaped fruiting bodies (perithecia). ITS rDNA sequence analysis identified the fungus as *Chaetomium globosum*, a common plant endophyte belonging to the Phylum Ascomycota. Although no obvious effects on root-knot nematodes were observed, endophytic activity may increase plant resistance to plant pathogens. The fungus has been previously described as a potential biocontrol agent against various plant pathogens including root knot nematodes. Its potential influence on pathogen-host interactions in *Brachypodium* requires further studies.

In summary, *B. distachyon* is a suitable host for *M. graminis*. Large differences in *Meloidogyne* reproduction of tested inbred lines indicated useful genetic variability that could be of interest for resistance breeding research. Identification of resistance genes in *Brachypodium* against *Meloidogyne graminis* and possible other root knot nematode species might allow the detection of similar gene sequences in turf grasses that are inherited from a shared ancestor. Effective fungicidal seed coatings might be useful to reduce the potential influence of *C. globosum* in future resistance screening tests.

