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Reaction of sesame genotypes to *Meloidogyne javanica* and *Pratylenchus brachyurus*

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Abstract – The objective of this work was to determine the reaction of different sesame (*Sesamum indicum*) genotypes to *Meloidogyne javanica* and *Pratylenchus brachyurus*, as well as their host status. Two independent experiments were carried out in a greenhouse, each one evaluating a single nematode species across two trials, with eight genotypes and eight replicates per treatment. Soybean was used as a susceptible control to confirm inoculum viability. The total number of nematodes per root system, number of nematodes per gram of root, and reproduction percentage in relation to the control were evaluated. All sesame genotypes significantly reduced the reproduction percentage (remaining below 10%) of both nematode species. The exception was 'BRS Anahí' that behaved as a susceptible host to the root-lesion nematode (*P. brachyurus*), showing values of 10.36% in trial 1 and 17.14% in trial 2. In the experiment with the root-knot nematode (*M. javanica*), reductions ranged from 92 to 98% in trial 1 and surpassed 99% in trial 2. For the root-lesion nematode, the reductions ranged from 89 to 96% in trial 1 and from 82 to 100% in trial 2. Therefore, sesame is a promising rotational crop for integrated nematode management, combining agronomic benefits (such as improved soil fertility and nutrient cycling) with the economic viability associated with its growing demand in the market. However, monitoring crop reactions in naturally infested areas is essential, since nematode reproduction may differ under continuous exposure in the field.

Index terms: *Meloidogyne javanica*, *Pratylenchus brachyurus*, *Sesamum indicum*, crop rotation, root-knot nematode, root-lesion nematode.

Reação de genótipos de gergelim a *Meloidogyne javanica* e *Pratylenchus brachyurus*

Resumo – O objetivo deste trabalho foi avaliar a reação de diferentes genótipos de gergelim (*Sesamum indicum*) a *Meloidogyne javanica* e *Pratylenchus brachyurus* e a sua capacidade hospedeira. Dois experimentos independentes foram realizados em casa de vegetação, cada um avaliando uma única espécie de nematódeo ao longo de dois ensaios, com oito genótipos e oito repetições por tratamento. A soja foi utilizada como padrão de suscetibilidade (testemunha), para confirmar a viabilidade dos inóculos. Foram avaliados o número total de nematódeos por sistema radicular, o número de nematódeos por grama de raiz e o percentual de reprodução em relação à testemunha. Todos os genótipos de gergelim reduziram significativamente o percentual de reprodução (permanecendo abaixo de 10%) de ambas as espécies de nematódeos. A exceção foi à 'BRS Anahí' que se comportou como hospedeira suscetível ao nematódeo-das-lesões-radiculares (*P. brachyurus*), com valores de 10,36% no ensaio 1 e 17,14% no ensaio 2. Para o experimento com o nematódeo-das-galhas (*M. javanica*), as reduções variaram de 92 a 98% no ensaio 1 e ultrapassaram 99% no ensaio 2. Quanto ao nematódeo-das-

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lesões-radiculares, as reduções variaram de 89 a 96% no ensaio 1 e de 82 a 100% no ensaio 2. Portnto, o gergelim é cultura de rotação promissora para o manejo integrado de nematódeos, combinando benefícios agronômicos (como melhoria da fertilidade do solo e ciclagem de nutrientes) com a viabilidade econômica associada à sua crescente demanda no mercado. Contudo, é essencial monitorar a reação da cultura em áreas naturalmente infestadas, já que a reprodução dos nematódeos pode diferir sob exposição contínua em campo.

Termos para indexação: *Meloidogyne javanica*, *Pratylenchus brachyurus*, *Sesamum indicum*, rotação de culturas, nematódeo-das-lesões-radiculares, nematódeo-das-galhas.

Introduction

In recent years, Brazil has experienced a significant reduction in agricultural production because of crop damage caused by parasitic nematodes in plants. Yield losses of soybean crops can reach about US$3 billion annually (Machado, 2022). Numerous factors contribute to the increase of nematode infestation in Brazil, but the sequential cultivation of susceptible crops in annual systems is certainly a main determinant (Ramos Junior et al., 2019; Dias-Arieira et al., 2021).

Some of the most damaging nematodes for annual crops include root-knot (*Meloidogyne javanica* and *M. incognita*) and root-lesion (*Pratylenchus brachyurus*) nematodes, which are native to Brazil and widely distributed across the country's soybean-growing regions (Favoreto et al., 2019; Diniz et al., 2026a). This is largely because both genera have a wide host range and the ability to reproduce well on weeds (Favoreto et al., 2019; Silva et al., 2019).

Because of these factors, controlling the mentioned nematodes is a complex task, and the use of antagonistic plants or "poor hosts" is an effective strategy to reduce nematode populations (Miamoto et al., 2018; Silva et al., 2024). For instance, sesame (*Sesamum indicum*) may be a valuable crop in this regard, as previous research showed this species potential to reduce populations of *Meloidogyne* spp. (Ibrahim et al., 2019; Chávez et al., 2025). Additionally, sesame crops offer several benefits to agricultural systems, such as improved soil fertility and nutrient cycling (Basílio et al., 2025). Sesame is a short-cycle oilseed (90 to 120 days) well adapted to hot and dry climate conditions (Santos et al., 2021; Wacal et al., 2024). Its initial growth is slow, with the first 45 days post-planting representing a critical period for crop success. After this phase, the crop shows good tolerance to adverse conditions and can produce satisfactorily, even in medium-fertility soils, if it is well drained (Cruz et al., 2019).

Reflecting the growing interest in sesame cultivation in Brazil, the area under this crop increased by about 83%, expanding from 361,000 to 660,000 ha between 2023 and 2024, and it has since stabilized at about 608,000 to 660,000 ha through the 2025/2026 season (Conab, 2026). Sesame has also become a common rotational crop, being planted in rotation with cotton, corn, common bean, soybean, peanut, castor bean, and sorghum (Wacal et al., 2024). However, despite the recent surge in commercial interest in sesame, many cultivars have not yet been evaluated for agronomic performance, tolerance to different environments, and pathogen response, which represents a challenge for the continuous expansion of the crop (Saene et al., 2024).

The objective of this work was to determine the reaction of different sesame genotypes to *Meloidogyne javanica* and *Pratylenchus brachyurus*, as well as their host status.

Materials and Methods

Two experiments were carried out in a greenhouse (23º47'28.4"S, 53º15'24.0"W, at 379 m altitude), following a completely randomized design, with eight treatments corresponding to the 'BRS Anahí', 'BRS Seda', 'IAC G 224', 'IAC G 225', 'K3', 'Short I', 'Short II (dwarf)', and 'Trebol' sesame genotypes, and eight replicates per treatment, each one consisting of one pot containing a single plant. The greenhouse was maintained at an average temperature from 25 to 30°C, and relative humidity from 60 to 70%, using a greenhouse evaporative cooling system.

The first experiment was conducted with *M. javanica*, and the second one, exclusively with *P. brachyurus.* The *M. javanica* experiment lasted from September to November, 2024 (trial 1), and it was repeated from March to April 2025 (trial 2). The *P. brachyurus* experiment was conducted from November 2024 to January 2025 (trial 1), and it was repeated from February to April 2025 (trial 2).

The 'M 6410 IPRO' soybean genotype was used as a susceptible control, to assess inoculum viability in

both experiments, as this cultivar is susceptible to both nematode species under study. Each experimental unit consisted of a polystyrene cup containing about 900 mL of a soil/sand mixture (2:1 v/v) previously autoclaved for 2 hours at 120°C. Sesame genotypes were first sown in 64-cell seed trays containing a commercial substrate (PlantMax) for seedling production, which were transplanted into pots 15 days after emergence. Two days later, two holes − at about 3 cm soil depth and 2 cm from the plant base − were made in the soil of each experimental unit. In the first experiment, each plant was subjected to the inoculation of 2 mL of a suspension containing approximately 2,000 eggs and second-stage juveniles (J2) of *M. javanica*. In the experiment 2, plants were subjected to the inoculation of 2 mL of a suspension containing approximately 500 specimens of *P. brachyurus*.

Nematodes were obtained from pure populations maintained on soybean plants. Nematode extraction was performed according to the method proposed by Hussey & Barker (1973), as adapted by Boneti & Ferraz (1981). For *M. javanica*, extractions were performed with sodium hypochlorite, which is required to dissolve the gelatinous egg masses produced by this species. Extractions of *P. brachyurus* were performed without sodium hypochlorite, as this species does not produce egg masses. The concentration of nematode suspensions was adjusted in a Peters chamber under a light microscope at 100X magnification.

Plants were irrigated manually, based on visual assessment of soil and plant conditions, following a fixed schedule of five daily observations to determine irrigation needs. At 60 days after the inoculation of *M. javanica*, and 70 days after inoculation of *P. brachyurus*, plants were removed from the pots, and shoots and roots were separated. Roots were thoroughly washed, placed on absorbent paper to remove excess water, and weighed. Subsequently, they were subjected to the previously described nematode extraction methods. The suspensions were examined in a Peters chamber, under a light microscope, to determine the total number of nematodes per root system. This value was divided by root weight, to obtain the number of nematodes per gram of root (population density). The reproduction factor (RF = final population/initial population) was calculated. The reproduction of nematodes on sesame genotypes in comparison with those in soybean was also calculated and expressed (%) as relative reproduction.

Data normality and homogeneity of variance were assessed using the Shapiro-Wilk and Levene tests, respectively. When either assumption was violated ($p<0.05$), data were transformed using $\sqrt{(x+1)}$ to meet the requirements for analysis of variance (ANOVA), performed at 5% probability. When the F test was significant, means were compared using the Scott-Knott test, also at 5% probability. Given that the control was used to confirm inoculum viability, it was not included in the statistical analysis, which was aimed at comparing responses among sesame genotypes. Statistical analyses were performed using the SISVAR software (Ferreira, 2019).

Results and Discussion

Soybean (susceptible control) allowed for the reproduction of *M. javanica*, with an RF value of 8.54 in trial 1, and 26.74 in trial 2, and for population densities of 1355 nematodes g^{-1} root in trial 1, and 3904 nematodes g^{-1} root in trial 2. These results confirmed the viability of nematode inocula. The 'BRS Seda', 'K3', and 'Short I' sesame genotypes exhibited the highest reproduction of *M. javanica* in trial 1, with RF values of 0.38 for 'BRS Seda', 0.45 for 'K3', and 0.40 for 'Short I'. These genotypes differed significantly from the others, whose RF values ranged from 0.04 to 0.20. In trial 2, there were no differences among genotypes, with RF values ranging from 0.02 to 0.08 (Table 1).

Regarding *M. javanica* population density, 'Short I' exhibited significantly higher values (100 nematodes g^{-1}) than the other genotypes in trial 1 (Table 1). In trial 2, 'Short I' and 'Short II' were recorded with the highest population densities, with 15 nematodes g^{-1} for 'Short I' and 11 nematodes g^{-1} for 'Short II'.

The relative reproduction of sesame genotypes ranged from 1.17 to 7.91% in trial 1, and from 0.09 to 0.32% in trial 2 (Table 1). These results indicate that all genotypes behaved as poor hosts to *M. javanica*, as the reproduction index remained below 10% in comparison with the control (Hadisoeganda & Sasser, 1982, as adapted by Cortada et al., 2008). A previous work reported sesame to be a poor host to *Meloidogyne* spp., in comparison with tomato (Chávez et al., 2025). In a work conducted in a naturally infested experimental area of the Cerrado biome, sesame was also found to be

a poor host to *Meloidogyne* spp. (Sharma & Amabile, 2004).

It should be noted that *M. javanica* reproduction differed among the tested sesame genotypes. Thus, although this crop typically behaves as a poor host to the nematode, different genetic materials may exhibit differences for susceptibility, ultimately affecting yield (Atungwu et al., 2008; Chávez et al., 2025). Nevertheless, the low levels of *M. javanica* reproduction observed in the sesame root system reinforce the potential and relevance of this crop as a rotational crop for integrated management in nematode-infested areas (Sharma & Amabile, 2004; Ibrahim et al., 2019; Chávez et al., 2025).

In the experiment 2, soybean showed the highest *P. brachyurus* population density, with 794 nematodes g^{-1} root in trial 1 and 107 nematodes g^{-1} root in trial 2. The RF values were 16.95 in Trial 1 and 6.5 in Trial 2, confirming the viability of the nematode inoculum.

The total number of *P. brachyurus* specimens did not differ among sesame genotypes in trial 1. In trial 2, however, 'IAC G 224' and 'Short I' had zero nematodes in the root system, differing from the other treatments. Most of the other genotypes had a low total for nematode numbers, ranging from 200 to 300 nematodes. The highest *P. brachyurus* number was recorded in 'BRS Anahí' (Table 2).

The highest population density in trial 1 was observed in 'Short I' (249 nematodes g^{-1} root), differing significantly from the other genotypes, whose means ranged from 33 to 111 nematodes g^{-1} root. In trial 2, 'IAC G 224' and 'Short I' differed from the other genotypes, as no nematodes were detected in their root systems. The RF of *P. brachyurus* on sesame ranged from 0.51 to 1.80 in trial 1, and from 0 to 1.20 in trial 2.

The relative reproduction factor of sesame genotypes ranged from 3.20 to 10.36% in trial 1, and from 0.0 to 17.14% in trial 2. In both trials, the highest relative percentages were observed for 'BRS Anahí'. This was the only genotype with values greater than 10% relative to the control, being classified as a susceptible host (Cortada et al., 2008). According to Cortada et al. (2008), the reproduction index (RI, here referred to as the relative reproduction factor) can be used to classify genotypes as follows: poor hosts (RI < 10%), moderately resistant (10% < RI < 50%), or susceptible (RI > 50%).

While the status of sesame as a poor-host to *Meloidogyne* spp. has been repeatedly documented in the literature (Sharma & Amabile, 2004; Chávez et al., 2025), works evaluating the reaction of sesame genotypes to *P. brachyurus* remain scarce, despite the growing agronomic relevance of this species in Brazilian cropping systems (Diniz et al., 2026b). Thus, the present findings contribute to the genotype-specific evidence on the potential of sesame as a rotational crop for *P. brachyurus* management.

Nonetheless, the low reproduction of both *M. javanica* and *P. brachyurus* observed here, in most genotypes, may be attributed to the presence of

Table 1. Total number of nematodes, population density (PD), reproduction factor (RF), and relative RF of *Meloidogyne javanica* in sesame genotypes, at 60 days after nematode inoculation[1].

Sesame genotypes	Total number of nematodes		PD (nematodes g^{-1} root)		RF		Relative RF (%)	
	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
Soybean[2]	17,075	53,480	1,355	3,904	8.54	26.74	-	-
BRS Anahí	125b	46a	20b	1b	0.06b	0.02a	1.46	0.09
BRS Seda	750a	51a	24b	1b	0.38a	0.03a	6.73	0.10
IAC G 224	300b	146a	24b	3b	0.15b	0.07a	2.34	0.27
IAC G 225	400b	83a	32b	2b	0.20b	0.04a	4.10	0.16
K3	900a	66a	46b	4b	0.45a	0.03a	7.91	0.12
Short I	800a	74a	100a	15a	0.40a	0.04a	7.91	0.14
Short II (dwarf)	300b	169a	45b	11a	0.15b	0.08a	2.63	0.32
Trebol	75b	69a	11b	1b	0.04b	0.03a	1.17	0.13
CV (%)	13.30	57.61	61.65	34.85	7.72	2.68	-	-

[1]Means followed by equal letters do not differ significantly by the Scott-Knott test, at 5% probability. [2]Soybean was included as a susceptible control. CV, coefficient of variation. Original data transformed by $\sqrt{(x + 1)}$.

bioactive compounds with nematicidal activity. Sesame is known to contain phenolic compounds (lignans and derivatives) such as sesamin, sesamolin, and sesamol (Hadipour et al., 2023). These compounds exert toxic or inhibitory effects against nematodes, impairing the development and reproduction of *Meloidogyne* spp. (Radwan et al., 2009; Couch et al., 2017). Additionally, these compounds were shown as negatively affecting egg hatching, juvenile motility, and root penetration, reducing nematode colonization and gall formation (Chávez et al., 2025). Although mainly concentrated in seed, these bioactive substances can be released into the soil through the decomposition of plant residues, exerting nematicidal and/or nematostatic effects on populations of plant-parasitic nematodes (Couch et al., 2017).

Most sesame genotypes behaved as poor hosts. However, some genotypes allowed of relatively higher levels of multiplication. For instance, 'K3' and 'Short I' reached 7.91% relative reproduction with the control in the *M. javanica* experiment, whereas 'BRS Anahí' (10.36% in trial 1, and 17.14% in trial 2) and 'Short I' (9.66%, in Trial 2) exhibited higher relative reproduction than the other genotypes. These results indicate that, even for plant species considered less susceptible, the variability among cultivars may allow nematodes to complete their life cycle and maintain viable populations in cropping systems. Furthermore, under field conditions, plants remain exposed to nematode reproduction for longer periods. These factors reinforce the need for continuous monitoring in sesame-growing areas, particularly in rotation with susceptible crops such as soybean, to prevent residual nematode populations from compromising yield.

When considering the integration of sesame into a cropping system, it is important to consider the numerous effects of non-host or poor host plants in agricultural systems. In addition to contributing to nematode management, these plants may act as green manure, enhancing organic matter input and nutrient cycling, improving soil fertility, and promoting a more balanced and active microbiota (Miamoto et al., 2018; Volsi et al., 2022). These benefits may subsequently reflect in enhanced soybean yield within rotation systems (Gardiano-Link et al., 2022).

Another important advantage of sesame is that it adds commercial value to agricultural systems because of the crop high market potential. Currently, Brazil has approximately 608,000 ha cultivated with sesame, with an estimated production of 399,400 Mg, and 657 kg ha^{-1} mean yield of. The state of Mato Grosso is the largest national producer, accounting for 288,900 Mg of the total production (Conab, 2026). Moreover, the facts that sesame is well-adapted to semiarid conditions, exhibits tolerance to drought, and

Table 2. Total number of nematodes, population density (PD), reproduction factor (RF), and relative RF of *Pratylenchus brachyurus* in sesame genotypes, at 70 days after nematode inoculation[(1)].

Sesame genotypes	Total number of nematodes		PD (nematodes g^{-1} root)		RF		Relative RF (%)	
	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
Soybean[(2)]	9,295	3,250	794	107	16.95	6.5	-	-
BRS Anahí	963a	600a	53b	18a	1.80a	1.20a	10.36	17.14
BRS Seda	616a	200b	44b	14a	1.29a	0.40b	6.63	6.15
IAC G 224	463a	0c	33b	0b	1.11a	0.00c	4.98	0.00
IAC G 225	660a	300b	55b	22a	1.63a	0.60b	7.10	9.23
K3	643a	250b	111b	16a	0.51a	0.50b	6.92	7.69
Short I	898a	0c	249a	0b	1.11a	0.00c	9.66	0.00
Short II (dwarf)	297a	-	102b	-	1.11a	-	3.20	-
Trebol	614a	300b	46b	10a	0.94a	0.60b	6.61	9.23
CV (%)	46.35	48.9	52.72	55.4	19.19	10.65	-	-

[(1)]Means followed by equal letters do not differ significantly by the Scott–Knott test, at 5% probability. [(2)]Soybean was included as a susceptible control. CV, coefficient of variation. For trial 1, original data were transformed by $\sqrt{(x + 1)}$. For trial 2, RF data were transformed by $\sqrt{(x + 1)}$. No data are presented for the Short II genotype in trial 2, due to germination failure.

has a short cycle make it a viable option for cultivation in the Cerrado (Cruz et al., 2019; Wacal et al., 2024).

Conclusions

1. Sesame (*Sesamum indicum*) behaves as a poor host to *M. javanica* in all evaluated genotypes (RF < 10%), which confirms its potential as a rotational crop for integrated management of this nematode in Brazilian cropping systems.

2. Sesame genotypes also behave predominantly as poor hosts to *P. brachyurus*, which indicate that these genotypes are suitable in rotation strategies targeting this species.

3. 'BRS Anahí' was the only sesame genotype classified as a susceptible host to *P. brachyurus* (relative reproduction above 10%), indicating that genotype selection is a critical factor, when using sesame for nematode management in infested areas.

4. The genotype-dependent variability observed for both nematode species highlights the importance of continuous monitoring of sesame reaction infield conditions, particularly in rotation with susceptible crops such as soybean.

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