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Reaction of forage species to *Pratylenchus brachyurus* root lesion nematode

Reação de espécies forrageiras ao nematoide das lesões radiculares Pratylenchus brachyurus

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Abstract. The *Pratylenchus brachyurus*, also known as root lesion nematode, is a soil inhabitant phytonematode that in recent decades caused serious damages to several crops in the Cerrado region. Taking into consideration the relevance of the nematode, this study aimed to evaluate the reaction of nineteen forage species to *P. brachyurus*. The experiment was conducted under controlled conditions in pots and in a randomized design, with six repetitions. Assessments were made at 60 days after inoculation and the reproduction factor (RF) and number of nematodes per gram of root were calculated. Within the same gender, different cultivars presented different behavior, referring to the degree of susceptibility and resistance to *Pratylenchus brachyurus*. Between the evaluated species, only *Cynodon nlemfuensis*, Millet 'ENA 01'*, B. humidicola, B. Brizantha* 'marandu' and forage peanut showed reproduction factor less than 1, being considered resistant to nematodes.

Keywords. Forage, integrated crop-livestock, resistance

Resumo. O *Pratylenchus brachyurus*, também conhecido como nematoide das lesões radiculares, é um fitonematoide habitante de solo que nas últimas décadas vem causando sérios danos a diversas culturas na região do Cerrado. Em função da atual importância desse nematoide, este trabalho teve como objetivo avaliar a reação de dezenove espécies forrageiras a *P. brachyurus*. O experimento foi realizado em condições controladas em vasos e delineamento inteiramente casualizado, com seis repetições. As avaliações foram feitas aos 60 dias após a inoculação e calculado o Fator de Reprodução (FR) e o número de nematoides por grama de raízes. Dentro de um mesmo Gênero, cultivares diferentes apresentaram comportamentos distintos, referentes ao grau de suscetibilidade e resistência ao *Pratylenchus brachyurus*. Das espécies avaliadas, apenas a *Cynodon nlemfuensis,* Milheto 'ENA 01', *B. humidicola, B. brizantha 'marandu'*e o amendoin forrageiro apresentaram fator de reprodução menor que 1, sendo consideradas resistentes ao nematoide.

Palavras-chave. Forrageiras, integração lavoura-pecuária, resistência

Introduction

The root lesion nematode belongs to the genus *Pratylenchus*, which includes about seventy species distributed worldwide, parasitizing and commiting the productive potential of different plant species (Castillo & Vovlas, 2007). The most important species in Brazil are *Pratylenchus zeae* Graham, *P. coffeae* Filipjev (Zimmermann) & S. Stekhoven and *P.brachyurus* (Godfrey) Filipjev & S. Stekhoven, considering the economic losses, geographical distribution and the large number of host plants (Goulart, 2008).

The phytossanitary problems caused by the *P. brachyurus* nematode in the main economic crops such as soybeans and corn (Dias et al, 2010;. Inomoto, 2011;. Franchini et al, 2011) have increased in recent years, mainly in the Brazilian midwest region. Studies also show the multiplication capacity of this nematode species in forage plants such as *Brachiaria* species (Stanton

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et al., 1989; Inomoto et al, 2006;. Neves, 2013; Carvalho et al, 2013).

The increase of this problem can possibly be attributed to the intensive production system, the use of irrigation, maintenance of the crops in the field during the year, the rotation or consortium with host crops and crop-livestock integration systems, tillage systems with cover crops, for example, corn, millet and forage grasses, the occurrence of voluntary plants between seasons of host crops allowing the survival of the nematodes during the crop year and the increase use of sandy areas of the Cerrado region. The use of forage grasses in crop-livestock integration systems under conventional or no tillage systems is common in Brazilian regions. This system is important for the yield maintenance and also for forage recovery. The crop-livestock integration is a grain and animal production in the same area, at the same time with sequential or rotational growth that can interact and complement each other (Karam et al, 2009; Macedo, 2009).

Most of the grasses used in this system belongs to *Panicum* and *Brachiaria* genus (Corrêa & Santos. 2003; Valle et al, 2004) and several studies have shown the ability of the *P. brachyurus* nematode to multiply in these plant species and also the use in other species of integration systems, such as sorghum and millet cultivars (Inomoto et al, 2006; Dias-Arieira et al, 2009; Neves, 2013; Carvalho et al, 2013).

It was also observed that the main annual crop production of grain used in this system is the corn that is highly susceptible to *P. brachyurus* (Inomoto, 2011; Chiamolera et al, 2012). Thus, the corn in rotation or consortium with those susceptible grasses may increase or maintain the high population of this nematode in the area, compromising the system.

The hospitability of forage grasses species for the *P. brachyurus* nematode have been demostrated by several authors. Dias-Arieira et al. (2009) and Inomoto et al. (2007) evaluated the response of forages to the nematode and observed that the species *Panicum maximum, Brachiaria* spp. and *B. decumbens* presented reproduction factor (FR) higher than 1, hosting the nematode and allowing the increase in population density in the field.

Thus, studies are needed to evaluate the reaction of forage plant species to *P. brachyurus* nematode in crop-livestock integrated systems. The objective of this study was to evaluate the reaction of forage species to *P. brachyurus*, in order to provide concise information related to the susceptibility and tolerance of these plants to the nematode, identifying resistant plants that could be used in breeding programs or for the immediate use by growers.

Materials and methods

The experiment was conducted under greenhouse conditions in the experimental area of the Goiano Federal Institute - Campus Ceres, Goiás, Brazil, located at latitude 15 ° S 21 '03' 'W longitude 49º 35' 37 " and altitude of 564 m. The study was conducted from March to May, 2012 in a completely randomized design with eighteen treatments, six species (*Brachiaria. brizantha* 'xaraés', *B.brizantha* 'piatã', *B. brizantha* 'MG5 Vitória', *B. ruziziensis*'ruziziensis', *B. humidicola* e *B. brizantha* 'marandu'), four *Panicum* species (*P. maximum* 'aruana', *P. maximum* 'tanzânia', *P. maximum*'mombaça' e *P. maximum* 'massai'), three *Cynodon* cultivars (*C.* spp. 'tifton', *C. dactylon* 'Coast cross', *C. nlemfuensis*), one *Andropogon gayanus* Kunth 'planaltina', two millet cultivars ('DR 500' and 'ENA 01'), one corn cultivar ('AG8088 YG') and one sorghum cultivar ('DKB 551'), for these last both species, six repetitions were used .

The corn and millet cultivars were used as control, presenting as good or bad nematode hosters. The plots were composed of two seedlings of each species obtained by direct sowing, with the exception of the species *Cynodon* spp. 'Tifton', *C. dactylon* 'Coast cross', *C. nlemfuensis* wich seedlings obtained from an agrostologic field. The planting was performed in plastic pots with a capacity of 500 ml, containing the mixture of soil and sand (1:1). Initially, species from seedlings were transplanted and after five days the species obtained from seeds were sown. After 15 days, all plots were inoculated with an initial population (Pi) of 300 species of juvenile and adult specimens of *P. brachyurus* in 2 cm depth, close to the plantlet neck. Cultural practices were carried out as necessary.

At 60 days after inoculation the shoot was cut close to the soil and the roots were sent to the laboratory for processing, according to the methodology described by Coolen & D'Herde (1972). The extracted nematodes were counted with the aid of a Peters blade under an optical

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microscope and the final population (Pf) was estimated, this value was divided by the initial population (Pi), which in this study was 300 specimens per plot and the reproduction factor (FR) and the number of nematodes per gram of root per treatment were also calculated.

The obtained data, related to RF and number of nematodes per gram of roots were transformed to $\sqrt{x+0.5}$ and submitted to variance analysis. The averages were compared using the Scott-Knott test at 5% of probability. The statistical analysis were performed with the aid of the R software (R CORE TEAM, 2010).

Results and Discussion

The data relating to the reproduction factor (RF) and number of nematodes per gram of root (nem. g^{-1}) are shown in Table 1. The mean test separated the treatments into groups: resistant, intermediate and susceptible. The FR ranged from 0.5 to 7.09 between the studied plants, and among these, five presented FR factor less than 1, being considered resistant to nematodes. The corn used in the study was the species that presented the highest FR, being considered in this study as a susceptibility standard. The Sorghum 'DKB 551' and *B. brizantha* 'xaraés' were considered susceptible and did not differed statistically from corn 'AG 8088YG'. Studies in Brazil evaluating the *P. brachyurus* reaction to plants species demonstrated that there are differences in pathogenicity in the same gender and when these plants are compared to each other, some have low capacity to multiply this nematode and presents lower FR, promoting lower multiplication of the nematode in the area, and this fact occurs for different plants such as corn, soy, millet and forage plants
(Smolik & Wicks 1987, Yu & Potter 1997, Inomoto et al. 2006, Inomoto et al. 2007, Dias-Arieira et al. 2009, Inomoto 2011 and Neves 2013).

Table 1. Reproduction factor (FR) and number of nematodes per gram of root (Nen g^{-1}) for *P. brachyurus* in forage grasses [(1)]

Treatment	FR	Nem g^{-1}
Corn 'AG 8088 YG'	7.09 a	212.8 a
Sorghum 'DKB 551'	6.80 a	290.2 a
Brachiaria brizantha 'xaraés'	6.67 a	222.1 a
Brachiaria brizantha 'piatã'	3.76 b	126.0 b
Cynodon spp. ' tifton'	3.11 b	97.4 c
Brachiaria brizantha ' MG5 Vitória'	2.36 c	98.9 c
Panicum maximum 'aruana'	2.07 c	100.9 c
Panicum maximum 'tanzânia'	1.97 c	106.9 c
Brachiaria ruziziensis 'ruziziensis'	1.94 c	60.0 a
Andropogon gayanus Kunth 'planaltina'	1.91 c	160.1 b
Cynodon dactylon 'Coastcross'	1.90 c	60.6 d
Panicum maximum 'mombaça'	1.56 c	46.8 d
Panicum maximum 'massai'	1.57 c	56.7 d
Millet 'ADR 500'	1.43 c	49.5 d
Cynodon nlemfuensis	0.93 d	29.0 d
Millet 'ENA 01'	0.93 d	42.9 d
Forage peanut	0.91 d	58.8 d
Brachiaria humidicola	0.74 d	29.5 d
Brachiaria brizantha 'marandu'	0.56 d	18.0 d
CV%	32.55	

[1] Means followed by the same letter in the column are not different ($p<0.05$), according to Scott-Knott´s test.

Among the Brachiaria species, it can be observed that the *B. brizantha* 'xaraés' presented the highest FR (6.6), except for *B. humidicola* and *B. brizantha* 'marandu' that were resistant (FR <1), the other *Brachiaria* species also showed similar behavior when compared to *B. brizantha* 'xaraés' and are considered susceptible to *P. brachyurus*. Neves (2013) also observed low RF for *B. brizantha* 'xaraés' in a greenhouse study, with values less than 1, being considered a resistant species to the nematode.

It was observed in this study that the species of the *Brachiaria* genus presented widely variation for the FR, with the largest value of 6.67 for the species *B. brizantha* 'xaraés' and the lowest for *B. brizantha* 'marandu' with a RF of 0.56. This behavior for species of this genus were also observed by other authors. Inomoto et al. (2007) evaluated the reaction of five *Brachiaria* cultivars and observed that there was great variation within the same genus of plants with FR ranging from 1.0 to 3.5. Neves (2013) also observed different behaviors between *Brachiaria* cultivars with FR ranging from 0.52 to 1.4.

Inomoto et al. (2007) evaluated the pathogenicity of two different populations of *P. brachyurus* (Pb20 and Pb24) in different forage species and found that the species of *Brachiaria* were more susceptible to this phytonematode, when compared to forage species from the *Panicum* genus, however the species *B. ruziziensis* 'ruziziensis' was considered moderately resistant, presenting FR of 1.66, which are in accordance to the results presented in the present study, while Neves (2013) observed even lower FR values in studies under controlled conditions, with RF of 0.52 for this species. Thus, the behavior of this species can be considered moderately resistant.

The cultivars of the *Panicum* genus behave as moderately resistant to *P. brachyurus* and among all the studied species, the FR ranged from 1.5 to 2.1, and the species *P. maximum* 'massai' was the most resistant, with a FR value of 1.5. In studies conducted in controlled conditions, Inomoto et al. (2007) observed high FR for the species *P. maximum* 'tanzania' and *P. maximum* 'mombaçca' with 12.17 and 7.07, respectively.

For the three cultivars of the genus *Cynodon*, the FR ranged from 0.9 to 3.1 and the species *C. nlemfuensis* was resistant, with FR of 0.9. For *Andropogon*, it was observed that it was moderately resistant, with low RF (1.9). In the study of Dias-Arieira et al. (2009) the response of forage grasses to *P. brachyurus* was observed and it was found that *Andropogon gayanus* cultivar planaltina was a species that multiplied the nematode (2.3), in accordance to the results observed in this study.

Among the millet species, the cultivars 'ENA 01' and' 'ADR 500' presented FR of 0.9 and 1.4 and in this study the cultivar 'ENA 01' was more resistant than cultivar 'ADR 500', which is considered resistant by other authors. NEVES (2013) found FR of 0.61, considering this cultivar as resistant in studies conducted under controlled conditions.

The root lesion nematodes are polyphagous and the use of crop rotation or succession of crops systems in areas infested by these nematodes is hampered by the wide range of hosts (Lordello, 1984). The species of plants that presented RF for the nematode higher than 1 should be avoided for the consortium, succession or straw formation in tillage systems, as reported by several researchers (Goulart, 2008;. Dias et al, 2010; Franchini et al., 2011).

The obtained results in this study and the observed by other researchers in some cases can differ, which can be explained by the adoption of different evaluation methodologies and/or by the difference in the degree of aggressiveness between the communities of this nematode in different regions of the country. Thus, it is important to continue the research, refining the results in order to find sources of resistance to the nematode or tolerant genotypes with confirmed results in different growing conditions

Conclusions

Cynodon nlemfuensis, millet 'ENA 01', Forage peanut, *B. humidicola* and *B. brizantha* 'marandu' with reproduction fator less than 1 are considered resistant to *P. brachyurus* nematode.

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