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CROP PRODUCTION

Response of wild *Oryza* spp. accessions and irrigated rice cultivars to *Meloidogyne graminicola* and *M. ottersoni*

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ABSTRACT. Root-knot nematodes (RKNs), including *Meloidogyne graminicola* and *M. ottersoni*, have recently been identified in Santa Catarina and Paraná in southern Brazil. Therefore, our study aimed to evaluate the host status of nine irrigated rice cultivars and five *Oryza* accessions inoculated with *M. ottersoni* and *M. graminicola* [initial population (IP) = 5,000 specimens] under greenhouse conditions across two experimental periods. We assessed the host status based on the nematode reproduction factor (RF) and the number of nematodes per gram of root. For both nematodes, all the rice cultivars we studied were classified as susceptible, with RF means ranging from 21.80 to 108.92 for *M. ottersoni* and 2.12 to 177.16 for *M. graminicola*. Conversely, the *Oryza* accessions displayed varied phenotypes. For example, *O. grandiglumis*, *O. glaberrima*, and *O. glumaepatula* exhibited moderate to high resistance to *M. ottersoni*, with RFs ranging from 0.53 to 4.50, while *O. latifolia* was susceptible. Additionally, *O. glumaepatula* showed moderate to high resistance levels to *M. graminicola* (RF = 0.23 – 8.88), whereas *O. alta* was susceptible, and *O. grandiglumis*, *O. glaberrima*, and *O. latifolia* demonstrated varying levels of resistance. Overall, our findings suggest that the *Oryza* accessions we studied could be promising sources of resistance for developing new cultivars in the future.

Keywords: resistance; genetic sources; root-knot nematodes; screening.

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Introduction

Rice (*Oryza sativa* L.) is a key economic cereal globally (Food and Agriculture Organization of the United Nations [FAO], 2022) and plays a significant role in Brazilian agriculture, particularly in the southern region where about 83% of the domestic rice production is concentrated, predominantly in the states of Rio Grande do Sul and Santa Catarina (Instituto Brasileiro de Geografia e Estatística [IBGE], 2023). Numerous plant parasitic nematodes (PPNs) have been linked to yield losses, with root-knot nematodes (RKNs) being particularly detrimental (Bridge et al., 2005). Among the RKNs infesting irrigated systems worldwide, *Meloidogyne graminicola* Golden & Birchfield is the most frequent and damaging (Dutta et al., 2011; Ravindra et al., 2017).

Recent surveys have reported several RKN species in Brazilian rice fields, notably *M. graminicola* and *M. oryzae* Maas, Sanders & Dede (Mattos et al., 2018; Soares et al., 2021) and the more recently identified *M. ottersoni* (Thorne, 1969) Franklin, 1971 (Leite et al., 2020). In these surveys, *M. ottersoni* was found in 19% of the sampled areas, *M. oryzae* in 10%, and *M. javanica* (Treub, 1885) Chitwood, 1949, in 0.5% of the fields in Santa Catarina (Mattos et al., 2017). Originally described in the United States (Wisconsin) and later detected in Argentina, *M. ottersoni* is difficult to diagnose as the females do not exhibit an esterase pattern (Leite et al., 2020). Despite this, there is limited knowledge about the biology of *M. ottersoni*, and its recent detection underscores the need to study its biological diversity and develop management strategies (Mattos et al., 2017).

Historically, breeding programs have focused on selecting rice genotypes of superior quality (Dimkpa et al., 2016), yet high levels of resistance to RKNs are still largely unavailable. Genetic resistance to *M. graminicola* has been reported in some genotypes from other rice species, such as *O. glaberrima* Steud, *O. longistaminata* A. Chev & Roehr (Mattos et al., 2021; Petitot et al., 2017; Soriano et al., 1999), and more recently, in some accessions of *O. glumaepatula* Steud studied in Brazil (Mattos et al., 2019). Although two

Asian rice genotypes have shown resistance to *M. graminicola* (Dimkpa et al., 2016; Lahari et al., 2019), most Brazilian irrigated rice cultivars evaluated remain susceptible (Bellé et al., 2019). Consequently, the study of rice genotypes, particularly those with the AA genome (Mattos et al., 2021), and selecting resistant cultivars for crop rotation are critical for developing management strategies against PPNs in rice (Win et al., 2016).

Based on the above, our objective was to assess the host status of *Oryza* accessions from the Embrapa Germplasm Bank and commercial irrigated rice cultivars against *M. ottersoni* and *M. graminicola*.

Material and methods

All experiments were conducted under greenhouse conditions at Embrapa Clima Temperado, Pelotas, in Rio Grande do Sul State, Brazil. The response of cultivars and accessions to *M. ottersoni* (experiments 1 and 2) and *M. graminicola* (experiments 3 and 4) was evaluated twice. For *M. ottersoni*, the experimental periods were from December 15, 2020 to February 26, 2021 (experiment 1), and from November 30, 2021 to February 16, 2022 (experiment 2). For *M. graminicola*, the studies were conducted from December 18, 2020, to March 5, 2021 (experiment 3), and from December 2, 2021, to February 21, 2022 (experiment 4). In experiments with *M. ottersoni*, temperatures ranged from 19°C to 28°C (experiment 1) and from 18.5°C to 29°C (experiment 2). For experiments with *M. graminicola*, temperatures varied from 19 to 28°C (experiment 3) and from 19 to 29°C (experiment 4). Six and five replicates were used for *M. ottersoni* and *M. graminicola*, respectively.

The cultivars 'IRGA 424 CL' and 'BRS Querência' are susceptible controls for *M. ottersoni* (Leite et al., 2020) and *M. graminicola* (Bellé et al., 2019), respectively. The purity of the inoculum used was confirmed using horizontal electrophoresis (Carneiro & Almeida, 2001).

Plant material, inoculum, and inoculation

The seeds of the rice cultivars ('BRS Querência', 'Cachinho', 'Guri Inta CL', 'BRS A701 CL', 'EPAGRI 109', 'IRGA 431 CL', 'IRGA 424 CL', 'SCS 116 Satoru', and 'SCS 122 Miura') and wild *Oryza* accessions [*O. glaberrima* (BGA 2712), *O. glumaepatula* (BGA 14179), *O. latifolia* Desv. (BGA 005572), *O. alta* Swallen (BGA 14258), and *O. grandiglumis* (Döll) Prod. (BGA 13958)] were sown in commercial Fertile Peat substrate. After 15 days, seedlings were transferred to 3 L pots (*M. ottersoni*) and 1 L pots (*M. graminicola*) containing autoclaved soil (120°C for 1 hour).

The inoculum was prepared from roots of infected rice following the method of Hussey and Barker (1973), modified by Boneti and Ferraz (1981), and quantified using Peter's slides under an optical microscope. Inoculations were performed one week after transplanting, targeting seedlings with four true leaves. Each plant received 5,000 specimens [eggs plus second-stage juveniles (J2s)] into two holes (2 cm deep) near the plants. Ten days post-inoculation, the plants were flooded. After the experimental period [72-76 days post-inoculation (dpi)], each root system was separated from the aerial part, washed, the galls counted (NG), and the nematodes extracted [Final population (FP)] (Hussey & Barker, 1973; Boneti & Ferraz, 1981). Nematodes were estimated later using a Peter's slide under a light microscope, and the number of nematodes per gram of roots (nema g^{-1}) and the reproduction factor (RF = FP/IP) was calculated (Oostenbrink, 1966).

Experimental design and statistical analysis

The experiments were arranged in a randomized block design, with each unit consisting of one plant per pot. Data were analyzed using R software version 4.2.1 (R Development Core Team, 2022). The Shapiro-Wilk test checked for normality and the Bartlett test for homoscedasticity. When necessary, data were transformed using Box-Cox, log_10 (x+0.5), and log_10(x+1) transformations through the MASS (Venables & Ripley, 2002) and bestNormalize v. 1.8.3 packages (Peterson, 2021). Analysis of variance (ANOVA) was performed using the "easyanova" v 8.0 package (Arnhold, 2013), and the means were compared using the Scott-Knot test ($p \leq 0.05$). As in other studies (Hussey & Janssen, 2002; Leite et al., 2020; Mattos et al., 2021), genotypes were rated based on resistance levels as highly resistant (RF < 1.0), resistant (RF < 10% of control), moderately resistant (RF 11-20%), low resistance (RF 21-30% of the susceptible control), and susceptible (> 30%).

Results

Table 1 details the genotype host status of *M. ottersoni*. In the first evaluation, genotypes with the highest number of galls (NG) were 'IRGA 424 CL', 'BRS A701 CL', 'BRS Querência', 'SCS 116 Satoru', 'SCS 122 Miura', and *O. alta*. Conversely, the lowest NG values were recorded for 'IRGA 431 CL', 'EPAGRI 109', 'Guri Inta CL', 'Cachinho', *O. latifolia*, *O. glaberrima*, and *O. grandiglumis*. In the second evaluation, the highest NG values were noted for 'BRS A701 CL', 'IRGA 431 CL', 'Guri Inta CL', and 'SCS 122 Miura', whereas the lowest values were observed for *O. glumaepatula*, *O. alta*, and *O. glaberrima* ($p < 0.001$).

Table 1. Host status of rice cultivars and *Oryza* accessions inoculated with *Meloidogyne ottersoni* (initial population = 5,000 specimens) in terms of number of galls (NG), number of nematodes (nema g^{-1}), and reproduction factor (RF).

	NG		Nematode per gram (nema g^{-1})		RF[1]		Host status[2]	
Genotype	Experiment 1	Experiment 2	Experiment 1	Experiment 2	Experiment 1	Experiment 2	Experiment 1	Experiment 2
'IRGA 424 CL'***	24.30 ± 18.90 b	42.17 ± 18.37 b	5,224 ± 3,147 a	6,849 ± 3,708 b	66.20 ± 29.48 a	43.78 ± 26.57 b	S	S
'BRS A701 CL'	30.50 ± 20.05b	118.83 ± 62.58 a	4,940 ± 2,090 a	11,456 ± 3,680 a	57.90 ± 24.89 a	64.05 ± 15.87 a	S	S
'IRGA 431 CL'	10.20 ± 9.11 c	94.67 ± 34.90 a	6,520 ± 3,246 a	15,361 ± 17,161 a	54.73 ± 23.17 a	97.44 ± 41.66 a	S	S
'BRS Querência'	24.50 ± 9.37 b	70.83 ± 39.94 b	3,137 ± 3,340 b	13,619 ± 17,161 b	37.20 ± 34.36 a	45.50 ± 37.89 b	S	S
'Epagri 109'	13.30 ± 12.64 c	63.50 ± 37.73 b	1,884 ±1,107 b	6,448 ± 3,639 b	30.50 ± 20.65 b	41.66 ± 19.93 b	S	S
'Guri Inta CL'	8.20 ± 5.56 c	117.00 ± 92.41 a	3,269 ± 2,494 a	10,348 ± 6,147 b	28.20 ±15.58 b	45.21 ± 14.11 b	S	S
'Cachinho'	6.70 ± 3.44 c	75.83 ± 34.30 b	1,781 ± 703 b	6,725 ± 3,103 b	25.40 ± 27.10 b	58.28 ± 21.33 a	S	S
'SCS116 Satoru'	21.80 ± 18.38 b	55.00 ± 36.73 b	1,309 ± 559 b	4,118 ± 3,748 b	22.70 ± 7.05 b	29.17 ± 37.33 b	S	S
'SCS122 Miura'	19.30 ± 20.93 b	148.00 ± 78.88 a	1,397 ± 1,930 b	31,109 ± 28,606 a	21.80 ± 25.49 b	108.92 ± 48.18 a	S	S
O. latifolia	11.80 ± 5.15 c	26.83 ± 3.92 c	479 ± 302 c	587 ± 309 c	6.80 ± 4.09 c	4.12 ± 1.99 c	LR	S
O. glumaepatula	11.83 ± 5.15 c	12.66 ± 5.27 d	191 ± 205 c	69 ± 28 e	4.50 ± 5.06 c	0.53 ± 0.56 e	MR	HR
O. alta	47.30 ± 8.62 a	10.83 ± 8.65 d	169 ± 65 c	104 ± 89 e	3.90 ± 1.37 c	0.56 ± 0.44 e	MR	HR
O. glaberrima	6.30 ± 3.61 c	12.33 ± 7.78 d	234 ± 193 c	205 ± 167 d	3.86 ± 2.97 c	1.01 ± 0.64 d	MR	HR
O. grandiglumis	4.70 ± 1.63 c	20.67 ± 10.55 c	297 ± 255 c	151 ± 99 d	3.60 ± 2.58 c	0.81 ± 0.40 d	MR	HR

Averages followed by the same lowercase letters within columns do not significantly differ from each other by the Scott & Knott test at a 5% probability; original values were transformed to Box-Cox and log_10 (x + 1). ***Control. [1]Reproduction factor = Final population/ Initial population. [2]Resistance/ susceptibility reaction (Hussey & Janssen, 2002; Mattos et al., 2021): highly resistant (HR) when RF < 1.0, resistant (R) when RF < 10% of the control, moderately resistant (MR) when intermediate RF (11 to 20%), low resistance (LR) for RF of 21 to 30% of the susceptible control, and when RF> 30% the genotypes were considered susceptible.

Regarding nematodes per gram of root (nema g^{-1}), the lowest values were recorded for the *Oryza* accessions [169 to 479] in the first experiment, with no statistical differences. The highest values were observed for 'IRGA 424 CL', 'BRS A701 CL', 'IRGA 431 CL', and 'Guri Inta CL', showing significant differences among these and distinct from 'BRS Querência', 'EPAGRI 109', 'Cachinho', 'SCS 116 Satoru', and 'SCS 122 Miura' ($p \leq 0.001$). In the second experiment, the highest values were recorded for 'BRS A701 CL', 'IRGA 431 CL', and 'SCS 122 Miura'. Among the accessions, the lowest values were noted for *O. glumaepatula* and *O. alta*.

In terms of the reproduction factor (RF), the cultivars exhibited higher values in the first evaluation (ranging from 21.80 to 66.20), with 'IRGA 424 CL', 'BRS A701 CL', 'IRGA 431 CL', and 'BRS Querência' being the most susceptible. The lowest RF values were observed for wild *Oryza* genotypes (3.60 to 6.80). In the second evaluation, the highest RF values (58.28 to 108.92) were noted for 'SCS 122 Miura', 'BRS A701 CL', 'IRGA 431 CL', and 'Cachinho', while the lowest values were found for *O. glumaepatula* and *O. alta* (0.53 and 0.56, respectively) ($p \leq 0.001$).

Table 2 details the genotype host status of *M. graminicola*. In the first evaluation, the highest NG values were observed in the cultivars 'IRGA 431 CL' and 'SCS 122 Miura'. The lowest NG values were found in *O. alta*, *O. grandiglumis*, *O. latifolia*, *O. glaberrima*, and *O. glumaepatula*. For nema g^{-1} roots, 'BRS Querência' exhibited the highest value, while *O. glumaepatula* had the lowest, showing significant differences from the other accessions including *O. grandiglumis*, *O. latifolia*, *O. glaberrima*, and *O. alta*. In the second evaluation, the highest values of nema g^{-1} were observed across all cultivars, whereas the lowest values were found in *O. glaberrima, O. grandiglumis*, and *O. glumaepatula*.

Regarding RF, for *M. graminicola* in the first evaluation, the most susceptible cultivars, with RF ranging from 105.96 to 177.16, included 'IRGA 424 CL', 'EPAGRI 109', 'IRGA 431 CL', 'BRS Querência', and 'Cachinho'. Most wild *Oryza* accessions exhibited low to moderate resistance (RF between 8.88 and 15.00), except for *O. alta*, which was categorized as susceptible. In the second evaluation, all the rice cultivars and *O. alta* were susceptible while *O. grandiglumis, O. glumaepatula*, and *O. glaberrima* were highly resistant, with RF between 0.15 and 0.37 ($p \leq 0.001$).

Table 2. Host status of rice cultivars and *Oryza* accessions inoculated with *Meloidogyne graminicola* (initial population = 5,000 specimens) in terms of number of galls (NG), number of nematodes (nema g^{-1}), and reproduction factor (RF).

Genotype	NG	Nematode per gram (nema g^{-1})		RF[1]		Host status[2]	
		Experiment 3	Experiment 4	Experiment 3	Experiment 4	Experiment 3	Experiment 4
'BRS Querência'***	9.80 ± 3.70 c	40,639 ± 13,318 a	834 ± 578 a	142.20 ± 39.24 a	2.73 ± 2.00 c	S	S
'Epagri 109'	10.00 ± 4.35 c	24,933 ± 12,410 c	680 ± 535 a	163.16 ± 87.79 a	2.84 ± 2.26 c	S	S
'IRGA 424 CL'	6.20 ± 3.49 d	31,048 ± 3,006 b	954 ± 281 a	177.16 ± 29.93 a	3.26 ± 0.91 c	S	S
'Cachinho'	15.00 ± 6.51 b	32,354 ± 20,893 b	704 ± 398 a	141.32 ± 86.79 a	2.69 ± 1.79 d	S	S
'IRGA 431 CL'	47.80 ± 7.59 a	23,820 ± 9,257 c	1,755 ± 1,202 a	105.96 ± 37.16 a	4.74 ± 3.24 b	S	S
Guri Inta CL	33.00 ± 43.60 a	18,441± 10,763 d	689 ± 285 a	86.6 ± 53.65 b	2.12 ± 1.06 d	S	S
'BRS A701 CL'	21.60 ± 5.72 b	23,318 ± 9,257 c	1,305 ± 1,857 a	85.84 ± 33.94 b	3.52 ± 4.76 c	S	S
'SCS116 Satoru'	22.20 ± 26.24 b	15,483 ± 4,804 e	3,830 ± 6,618 a	84.4 ± 15.37 b	7.49 ± 9.33 a	S	S
'SCS122 Miura'	31.40 ± 2.96 a	15,804 ± 15,667 e	884 ± 382 a	76.08 ± 71.85 b	3.71 ± 1.59 c	S	S
O. alta	5.00 ± 1.41d	11,482 ± 5,771 f	736 ± 77 a	42.20 ± 16.97 c	1.75 ± 0.23 d	S	S
O. grandiglumis	5.40 ± 1.34 c	2,111 ± 2,664 g	56 ± 59 b	15.00 ± 20.85 d	0.15 ± 0.12 f	LR	HR
O. latifolia	9.00 ± 4.47 c	2,308 ± 2,521 g	506 ± 301 a	13.88 ± 15.73 d	1.17 ± 1.06 e	LR	HR
O. glaberrima	7.00 ± 3.08 e	1,984 ± 2,095 g	82 ± 49 b	11.68 ± 13.60 d	0.37 ± 0.22 f	LR	HR
O. glumaepatula	3.40 ± 1.91 d	1,027 ± 1,700 h	54 ± 22 b	8.88 ± 11.19 d	0.23 ± 0.08 f	MR	HR

Averages followed by the same lowercase letters within columns do not significantly differ from each other by the Scott & Knott test at a 5% probability; original values were transformed to Box-Cox and log_10 (x + 1). ***Control. [1]Reproduction factor = Final population/Initial population. [2]Resistance/susceptibility reaction (Hussey & Janssen, 2002; Mattos et al., 2021): highly resistant (HR) when RF < 1.0, resistant (R) when RF < 10% of the control, moderately resistant (MR) when intermediate RF (11 to 20%), low resistance (LR) for RF of 21 to 30% of the susceptible control, and when RF > 30% the genotypes were considered susceptible.

Discussion

The emergence of *Meloidogyne*, particularly *M. graminicola*, as a significant pest in rice fields has become a growing concern across various production regions globally (Rusinque et al., 2021). Given the limited management options for combating *Meloidogyne* species in rice, host resistance has become increasingly important. Resistant varieties offer cost-effective benefits and reduce ecological impacts (Boerma & Hussey, 1992). Effective breeding programs must align with the current prevalence of *Meloidogyne* species to mitigate losses, as the success of these programs hinges on understanding the population variability of root-knot nematodes (RKNs) (Roberts, 1995). Although some phenotypic variation and partial resistance to *M. graminicola* have been documented in *O. sativa* cultivars (Cabasan et al., 2014; Cabasan et al., 2012), most cultivars remain susceptible (Bridge et al., 2005). Consequently, identifying resistance genes is crucial for the management of these pests.

In general, plants inoculated with *M. ottersoni* displayed higher NG values than those inoculated with *M. graminicola*. Although root galls are commonly observed in susceptible plants, some Poaceae may exhibit less noticeable galls even under severe parasitism (Ferraz & Brown, 2016). This observation is supported by Devaraja et al. (2023), who noted low NG (5 to 12) but high RF values (16 to 134) in some rice genotypes inoculated with *M. graminicola*, aligning with our findings. For nematode numbers, Guri Inta CL' and 'IRGA 424 CL' presented differing results for *M. graminicola* compared to the lower nema g^{-1} values reported by Bellé et al. (2019).

In terms of RF, Bellé et al. (2019) evaluated 22 rice cultivars for susceptibility to *M. graminicola*, finding that all cultivars displayed RF values greater than 1, which corroborates our findings. However, our results differ concerning the response of wild *Oryza* accessions compared to what is documented in the literature. For instance, studies have shown that some *O. alta* accessions possess high resistance to both *M. ottersoni* (RF = 0.48 and 0.45) and *M. graminicola* (RF = 0.79 and 0.16) (Mattos et al., 2021). Additionally, Mattos et al. (2019) found *O. alta* accessions to be moderately resistant, while an *O. grandiglumis* accession was deemed susceptible. However, Leite et al. (2020) and Mattos et al. (2021) rated *O. grandiglumis* as resistant to *M. ottersoni* (RF = 3.33 and 2.01) and *M. graminicola* (RF = 3.14 and 1.62), yet other accessions of this species were classified as susceptible (RF = 14.77) and moderately resistant (RF = 2.17) to *M. graminicola* (Mattos et al., 2019).

In this study, the accession of *O. glaberrima* was classified as moderately resistant to *M. ottersoni*, while it was deemed slightly resistant to *M. graminicola*. Mattos et al. (2021) reported consistent findings; they noted low RF values (from 1.23 to 0.13) for *M. graminicola*. Previous research involving *O. glaberrima* accessions (TOG5681, TOG5674, and TOG5675) has also demonstrated resistance to *M. graminicola*, characterized by reduced penetration and developmental inhibition of these nematodes (Cabasan et al., 2012; Dimkpa et al., 2016). Moreover, other studies have documented the resistance of this species to other plant parasitic nematodes (PPNs), such as *M. incognita* (Kofoid & White, 1919) Chitwood, 1949, and *Heterodera sacchari* Luc & Merny, 1963 (Plowright et al., 1999). Although certain accessions of *O. glaberrima* permitted some reproduction of *M. graminicola*, others, such as TOG5674, demonstrated resistance (Cabasan et al., 2012; Dimkpa et al., 2016).

Petitot et al. (2017) suggested that the low level of nematode infection in the TOG5681 accession could be attributed to a delayed hypersensitivity response, which reduces penetration yet impedes female nematode development. Other researchers propose that resistance may manifest at different stages of infection—initially during the pre-infection phase by diminishing the attraction and penetration into the host, and subsequently during the post-infection phase by restricting nematode migration, development, and reproduction (Lahari et al., 2019). These pre-infection mechanisms, primarily characterized by physical barriers that prevent nematode penetration, have been observed in *O. glaberrima* accessions resistant to *M. graminicola* (Cabasan et al., 2016).

Additionally, Mattos et al. (2019) observed a response in *O. glumaepatula* that resembled hypersensitivity, with a notable accumulation of phenolic compounds in cells adjacent to PPNs, and the development of giant cells was restricted with few feeding sites observed (Phan et al., 2018; Mattos et al., 2019). Dash et al. (2021) suggested that resistance to PPNs in mutant rice could be due to the upregulation of several genes involved in recognizing damage-associated molecular patterns and the biosynthesis of secondary metabolites, including phytoalexins and genes related to plant defense mechanisms (Desmedt et al., 2022). Another accession demonstrating some resistance is *O. glumaepatula*, which supports previous findings (Mattos et al., 2019). For example, two *O. glumaepatula* accessions (BGA.013954 and BGA.01421) exhibited high resistance to *M. graminicola* (Mattos et al., 2019).

The discrepancies between our findings and those previously documented in the literature could be attributed to variations in physiological characteristics, host resistance, and environmental conditions. Additionally, Devaraja et al. (2023) highlighted that temperature plays a crucial role in the resistance of rice genotypes to RKNs, as increasing temperatures influence the expression of resistance genes in different genotypes. Another study by Pokharel et al. (2010) demonstrated that various isolates of *M. graminicola* have adapted to flooded conditions and can parasitize rice, with RF values ranging from 38.0 to 352 for 'Labelle' and 231.5 for 'LA 110'.

Genes from parental species should be integrated into *O. sativa* through breeding programs to develop new cultivars that exhibit multiple resistances to *Meloidogyne* species (Mattos et al., 2019). Given that the use of resistant cultivars is a vital strategy in management protocols, this study plays a significant role in documenting the responses of nine rice cultivars commonly used in southern Brazil and the resistance of five *Oryza* accessions from the Embrapa Germplasm Bank. Specifically, it evaluates their reactions to *M. ottersoni* and *M. graminicola* under flooded conditions.

Conclusion

The cultivars with the highest RF values for *M. ottersoni* were 'IRGA 424 CL', 'BRS A701 CL', 'IRGA 431 CL' and 'BRS Querência', while those most susceptible to *M. graminicola* were 'SCS 116 Satoru', 'IRGA 424 CL', 'IRGA 431 CL', 'BRS Querência' and 'Cachinho'. Accessions of *O. grandiglumis*, *O. latifolia* and *O. gablerrima* showed low or high resistance to *M. graminicola*, apart from *O. glumaepatula*, which was moderately resistant or highly resistant. Accessions of *O. glumaepatula*, *O. gablerrima* and *O. grandiglumis* were moderately resistant or highly resistant to *M. ottersoni*.

Data availability

The dataset was derived from experiments conducted by the authors themselves. The analysed data is available upon request from the corresponding author.

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