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Meloidogyne and *Pratylenchus* species in sugarcane fields in the state of Alagoas, Brazil

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ABSTRACT: *The objective of this study was to accomplish a survey on populations of **Meloidogyne** and **Pratylenchus** species in sugarcane farming areas in the state of Alagoas, Brazil. Twenty samples of soil and roots were processed to extract and quantify nematodes; however, the identification of **Meloidogyne** species was performed using only 12 samples. **Pratylenchus** spp. were reported at moderate population levels of 68-1556 specimens 50g^{-1} of roots and 2-298 specimens 100cm^{-3} of soil in twenty analyzed samples. For **Meloidogyne** spp., these values were of 12-487 specimens 50g^{-1} of roots and 0-140 specimens 100cm^{-3} of soil. Based on electrophoresis of esterase isozymes, **M. incognita** was reported to be the most frequent species, followed by **M. javanica** and **M. arenaria**. **Pratylenchus** species identified through morphometrical and morphological characteristics were **P. zeae** and **P. brachyurus**, with predominance for the first species. No significant correlation (P≤0.05) were reported between nematode populations and sugarcane cropping systems.*
Key words: *field survey, plant-parasitic nematodes, **Saccharum** spp.*

Espécies de *Meloidogyne* e de *Pratylenchus* em áreas cultivadas com cana-de-açúcar no estado de Alagoas

RESUMO: *O objetivo deste trabalho foi realizar um levantamento de espécies de **Meloidogyne** e de **Pratylenchus** existentes em áreas de cultivo de cana-de-açúcar, no estado de Alagoas. Vinte amostras de solo e raízes foram processadas para a extração e quantificação, sendo a identificação das espécies de **Meloidogyne** realizada em 12 amostras. Detectou-se a presença de **Pratylenchus** spp. em níveis populacionais médios de 68-1556 espécimes 50g^{-1} de raízes e 2-298 100cm^{-3} de solo, em todas as amostras. Para **Meloidogyne** spp., esses valores foram de 12-487 50g^{-1} de raízes e 0-140 100cm^{-3} de solo. Com base na eletroforese da isoenzima esterase, **M. incognita** foi a espécie mais frequente, seguida por **M. javanica** e **M. arenaria**. As espécies de **Pratylenchus** identificadas pelas características morfológicas e morfométricas, foram **P. zeae** e **P. brachyurus**, com predomínio da primeira espécie. Não houve correlações significativas (P≤0,05) entre as populações de nematoides e as características dos sistemas de cultivo de cana-de-açúcar.*
Palavras-chave: *levantamento, fitonematoides, **Saccharum** spp.*

Among the plant-parasitic nematodes in sugarcane fields throughout the world, the most economically significant should be considered the genus ***Meloidogyne*** Goeldi, particularly ***M. javanica*** (Treub) Chitwood and ***M. incognita*** (Kofoid & White) Chitwood, as well as ***Pratylenchus zeae*** Graham (BARBOSA et al., 2013; STEVEN et al., 2014). Yield losses range from 20 to 30% in the first cut in susceptible sugarcane cultivars, due to the presence of ***M. javanica*** and ***P. zeae***. Additionally, ***M. incognita*** can cause higher losses, of around 40% (DINARDO-MIRANDA, 2005).

In Alagoas State, the genera ***Pratylenchus*** and ***Meloidogyne*** have been previously detected; however, the nematodes' species were not identified (CRUZ et al., 1986). Thus, the objective of this study was to update this information identifying and quantifying ***Meloidogyne*** and ***Pratylenchus*** species in the major sugarcane producing areas from Alagoas State.

During 2012, soil and root samples were collected from 20 sugarcane farms located in 16 municipalities, which represented the major sugarcane growing areas in the state of Alagoas (SINDAÇÚCAR, 2012). Four samples were collected from each field, with approximately 1.0kg of soil and 100g of sugarcane roots. Soil samples were homogenized, and 100cm^3 of each sample were processed as described by JENKINS (1964); whereas, 50g of root was used for nematode

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extraction according to COOLEN & D´HERDE (1972). Pearson and Spearman correlation analyses (P≤0.05) were performed between nematode populations and sugarcane crop stage, application of nematicide and vinasse, irrigation, and the harvest method.

Pratylenchus spp. were identified to the species level by morphological characters and morphometric measurements according to CASTILLO & VOVLAS (2007). For isozyme characterization, young egg-laying females of ***Meloidogyne*** spp. were removed from tomato galls [(***Solanum lycopersicum*** Mill.) Santa Cruz cv. Kada Gigante] and macerated in extraction buffer (KUNIEDA DE ALONSO & ALFENAS, 1998). Females of ***M. javanica*** were used as reference phenotype. Electrophoresis was performed in a vertical slab in polyacrylamide gels (ESBENSHADE & TRIANTAPHYLLOU, 1985; ALFENAS et al., 1991).

The genera ***Pratylenchus*** and ***Meloidogyne*** were observed in roots and/or soil from all sampled areas (Table 1) and it is in accordance to other studies in Brazil (CHAVES et al., 2009; BELLÉ et al., 2014). ***Pratylenchus*** spp. had the highest mean population densities in roots from a sugarcane farm located in the county of Teotônio Vilela (1,556 specimens $50g^{-1}$ roots) while in the soil the highest value was observed in the county of Maceió (298 specimens $100cm^{-3}$ of soil). According to STIRLING & BLAIR (2000), ***P. zeae*** population densities higher than 250 specimens per 200g of soil, detected six months after planting, can expressively reduce sugarcane yield.

When considering the sugarcane cultivar, the highest ***Pratylenchus*** spp. populations occurred in 'RB 92579' (Table 1). For ***Meloidogyne*** spp., the highest population densities (487 juveniles $50g^{-1}$ roots) were observed in 'SP 813250', followed by 'SP 753046' (389 juveniles $50g^{-1}$ roots) and 'RB 92579' (262 juveniles $50g^{-1}$ roots) (Table 1). The susceptibility of the RB 92579 cultivar to ***M. incognita*** has been previously reported under greenhouse condition (SILVA et al., 2012), representing 50% of all cultivars evaluated in this study.

Electrophoresis separation of esterases revealed four distinctive phenotypes: phenotype I1 with one band (Rm 1.00), phenotype I2 with two bands (Rm

Table 1 - ***Pratylenchus*** and ***Meloidogyne*** species on sugarcane growing areas in Alagoas State, Brazil.

Municipality - Fields	Sugarcane Cultivar	-----***Pratylenchus*** spp.-----		--------***Meloidogyne*** spp.--------		***Meloidogyne*** species/esterase phenotypes	***Pratylenchus*** species
		----------Mean density----------					
		Root (50g)	Soil ($100cm^3$)	Root (50g)	Soil ($100cm^3$)		
Anadia	SP791011	716*	125	45	8	-	Pz
Atalaia	RB92579	299	65	74	3	-	Pz
Campo Alegre (1)	RB92579	328	155	85	39	Mi (I2)	Pz
Campo Alegre (2)	RB92579	1,002	15	49	0.8	Mj (J3)	Pz
Igreja Nova	RB92579	263	54	73	15	Mi (I1, I2)	Pz
Maceió	RB92579	297	298	69	35	-	Pz
Marechal Deodoro	SP813250	258	0.8	487	4	Mj (J3); Mi (I2)	Pz
Matriz de Camaragibe	SP813250	260	126	158	63	Mi (I1); Ma (A2)	Pz
Novo Lino	RB92579	716	11	68	0	-	Pb; Pz
Paripueira	SP921631	873	93	166	27	-	Pz
Penedo (1)	RB93509	961	50	140	12	Mi (I1, I2)	Pz
Penedo (2)	RB98710	653	6	120	3	Mi (I1, I2); Ma (A2)	Pb; Pz
Pilar	RB92579	503	15	97	8	Mi (I1, I2)	Pz
Porto Calvo	RB92579	360	11	78	0	-	Pz
Rio Largo	RB92579	157	113	23	14	-	Pz
São José da Laje	SP791011	448	5	108	0	-	Pz
São Miguel dos Campos	SP813250	192	3	415	12	Mj (J3)	Pz
Teotônio Vilela (1)	SP921631	108	33	68	19	Mi (I2); Mj (J3)	Pz
Teotônio Vilela (2)	RB92579	1,556	140	262	36	Mi (I2); Mj (J3)	Pz
Teotônio Vilela (3)	SP753046	68	2	389	0.8	Mi (I2)	Pz

*Each value is a mean of four samples. Ma = ***Meloidogyne arenaria***; Mi = ***M. incognita***; Mj = ***M. javanica***; Pb = ***Pratylenchus brachyurus***; Pz = ***P. zeae***.

1.00 and 1.09) specific to ***M. incognita***, phenotype J3 with three bands (Rm 1.00, 1.07, and 1.17) characteristic of ***M. javanica***, and phenotype A2 with two bands (Rm 1.17 and 1.28) specific to ***M. arenaria***. Of these three species, ***M. incognita*** was the most recurrent, either alone or in association with ***M. arenaria*** or ***M. javanica*** (Table 1). These observations are not in accordance with previous reports (SEVERINO et al., 2008) where ***M. javanica*** was reported as being the predominant species in several sugarcane fields in Brazil.

Regarding the genus ***Pratylenchus*** the predominant species was ***P. zeae***, either alone or in mixed population; whereas, ***P. brachyurus*** occurred in only two areas (Table 1). In survey conducted by BELLÉ et al. (2014), within this genus, ***P. zeae*** was the most common species associated with sugarcane crop.

Pratylenchus zeae, P. brachyurus, M. javanica, ***M. incognita*** and ***M. arenaria*** prevailed in sugarcane fields in Alagoas State. Out of the five species, ***P. zeae*** and ***M. incognita*** were the most frequently observed. No significant correlations ($P \leq 0.05$) were reported between nematode populations and sugarcane cropping systems.

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