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Meloidogyne javanica-Rhizoctonia solani disease complex of peanut

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Summary – The interaction of *Meloidogyne javanica* and *Rhizoctonia solani* was studied on peanut in greenhouse and field microplot experiments. The effects of *R. solani* on reproduction of *M. javanica* was variable, with nematode *Pi* having a greater effect on nematode reproduction than did the presence of *R. solani*. In microplot tests with a factorial design with four nematode *Pi* and two levels (1995) or three (1996) levels of *R. solani*, peanut pod rot and root colonization by *R. solani* were increased by the presence of *M. javanica* ($P \leq 0.05$), and the total amounts of pod rot and root colonization were positively related ($r^2 > 0.85$) to *Pi* of *M. javanica*. Pod yield was more suppressed by both pathogens than by either pathogen alone, and was negatively related ($r^2 > 0.86$) to *Pi* of *M. javanica* in both microplot experiments. The data confirm the interaction of *M. javanica* and *R. solani* on peanut. © Orstom/Elsevier, Paris

Résumé – ***Le complexe pathogène de l'arachide* Meloidogyne javanica - Rhizoctonia solani** – L'interaction entre *Meloidogyne javanica* et *Rhizoctonia solani* a été étudiée sur arachide en serre et en microparcelles au champ. L'action de *R. solani* sur la reproduction de *M. javanica* est variable, la *Pi* du nématode ayant une plus grande influence sur sa reproduction que la présence de *R. solani*. Lors d'expériences en microparcelles ayant une disposition factorielle et comportant quatre niveaux de *Pi* du nématode et deux (1995) ou trois (1996) niveaux de *R. solani*, la pourriture des gousses d'arachide et la colonisation des racines par *R. solani* sont accrues en présence de *M. javanica* ($P \leq 0{,}05$) ; les valeurs totales de la pourriture des gousses et de la colonisation des racines sont corrélées positivement ($r^2 > 0{,}85$) à la *Pi* de *M. javanica*. La récolte en gousses est plus affectée en présence des deux agents pathogènes que si un seul d'entre eux est présent, et cette récolte est corrélée négativement ($r^2 > 0{,}86$) aux *Pi* de *M. javanica* dans l'une et l'autre expériences en microparcelle. Ces données confirment donc l'interaction entre *M. javanica* et *R. solani* sur l'arachide. © Orstom/Elsevier, Paris

Keywords: *Arachis hypogaea*, disease complex, *Meloidogyne javanica*, peanut, *Rhizoctonia solani*, root-knot nematode.

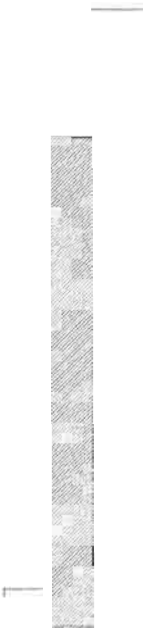
Nematode-fungal disease complexes, especially those involving *Meloidogyne* spp., are common on many crops (Golden & Van Gundy, 1975; Diomandé *et al.*, 1981; Abawi & Barker, 1984; Starr *et al.*, 1989). The association of nematodes and fungi on plants may cause synergistic, additive, or antagonistic effects with respect to disease development and yield suppression. Synergistic associations are generally attributed to the enhancement of fungal infections due to the physiological effects on the plant of nematode parasitism (Golden & Van Gundy, 1975; Starr & Aist, 1977). In the synergistic association of *Meloidogyne incognita* and *Rhizoctonia solani* on okra and tomato, roots of both crops were colonized to a greater extent by *R. solani* in the presence of *M. incognita* compared to colonization of plants exposed to *R. solani* alone (Golden & Van Gundy, 1975). Siddiqui and Husain (1992) reported a similar effect of *M. incognita* on the colonization of chickpea roots by *Macrophomina phaseolina*. Infection of cotton by *M. incognita* increased the susceptibility of wilt-susceptible and wilt-resistant cotton genotypes to *F. oxysporum* f. sp. *vasinfectum* (Starr *et al.*, 1989; Jeffers & Roberts, 1993).

Not all associations of nematodes with soilborne fungal pathogens result in synergistic effects. Starr *et al.* (1996) reported that the effects of *Sclerotium rolfsii* and *M. arenaria* on yield of peanut and incidence of southern blight were additive over a range of different inoculum levels of both pathogens. Jorgenson (1970) reported antagonistic effects for the association of *Heterodera schachtii* and *F. oxysporum* with respect to growth of sugar beets.

Meloidogyne javanica (Tomaszewski *et al.*, 1994) and *R. solani* (El-Wakil *et al.*, 1984) are important pathogens of peanut (*Arachis hypogaea*) in Egypt and have been reported to be involved in disease complexes either together or with other organisms on several crops (Batten & Powell, 1971; Golden & Van Gundy, 1975; Sankarialingman & McGawley, 1994; Walker, 1994), but their association on peanut has not been investigated previously. The objective of this study was to quantify the effect of the association of these two pathogens on peanut.

Materials and methods

Rhizoctonia solani was isolated from peanut roots exhibiting symptoms of root rot and root galling and Koch's postulates fulfilled (data not shown). The isolate of *R. solani* used for all experiments was identified



estimate the percentage of rotted pods, 100 pods were selected randomly from the yield of each microplot and examined for symptoms of pod rot. The percentage root colonization by *R. solani* for each treatment was determined in 1996. One hundred root segments (each 1 to 2 cm long) were taken arbitrarily from the roots of each microplot, rinsed with tap water, surface sterilized with 0.5 % NaOCl for 1.5 min, rinsed with sterilized water, placed in 10 cm diam. Petri dishes containing tannic acid-benomyl-agar medium, a selective medium for *R. solani* (Flowers, 1976), and incubated at 27 °C. Percentage of peanut roots colonized by *R. solani* was estimated based on the number of root segments from which colonies of *R. solani* developed.

Data from different experiments were subjected to analysis of variance using the general linear model procedures of SAS (SAS Institute, Cary, NC 27511, USA) to determine the effects of treatments on nematode population densities, pod rot, root colonization by *R. solani*, and pod yield. Mean separations were made using Fisher's LSD.

Results

Rhizoctonia solani did not affect the reproduction of *M. javanica* at nematode *Pi* of 5, 10, or 50 eggs/pot, but at a *Pi* of 100 eggs/pot in greenhouse tests, the final number of nematode eggs per gram roots was greater ($P \leq 0.05$) in the presence of *R. solani* compared to that in the absence of *R. solani* (Fig. 1). At a *Pi* of 500 *M. javanica* eggs/pot, the final number of eggs per gram roots was reduced ($P \leq 0.01$) by 98 % in the presence of *R. solani* compared to that produced in the absence of *R. solani.*

In microplot experiments, the midseason Rf values of *M. javanica* were not affected ($P \leq 0.05$) by the presence of *R. solani* (data not shown). At crop maturity, there was a general trend for *Rf* values to decline with increasing *Pi* (Fig. 2). The effect of *R. solani* was to increase *Rf*, but this trend was significant only in 1996 ($P \leq 0.05$).

No symptoms of pod rot were observed in plots not infested with *R. solani*. The percentage of pods with symptoms of rot caused by *R. solani* was greater ($P \leq 0.05$) in plots also infested with *M. javanica* than in plots infested only with *R. solani* (Fig. 3), and was positively related to the *M. javanica Pi* in both years ($r^2 = 0.86$ for 1995 and $r^2 = 0.89$ for 1996; $P \leq 0.01$). An increase in the concentration of inoculum of *R. solani* from 0.01 to 0.02 g/500 cm^3 did not affect the percentage of rotted pods in 1996 ($P \leq 0.05$).

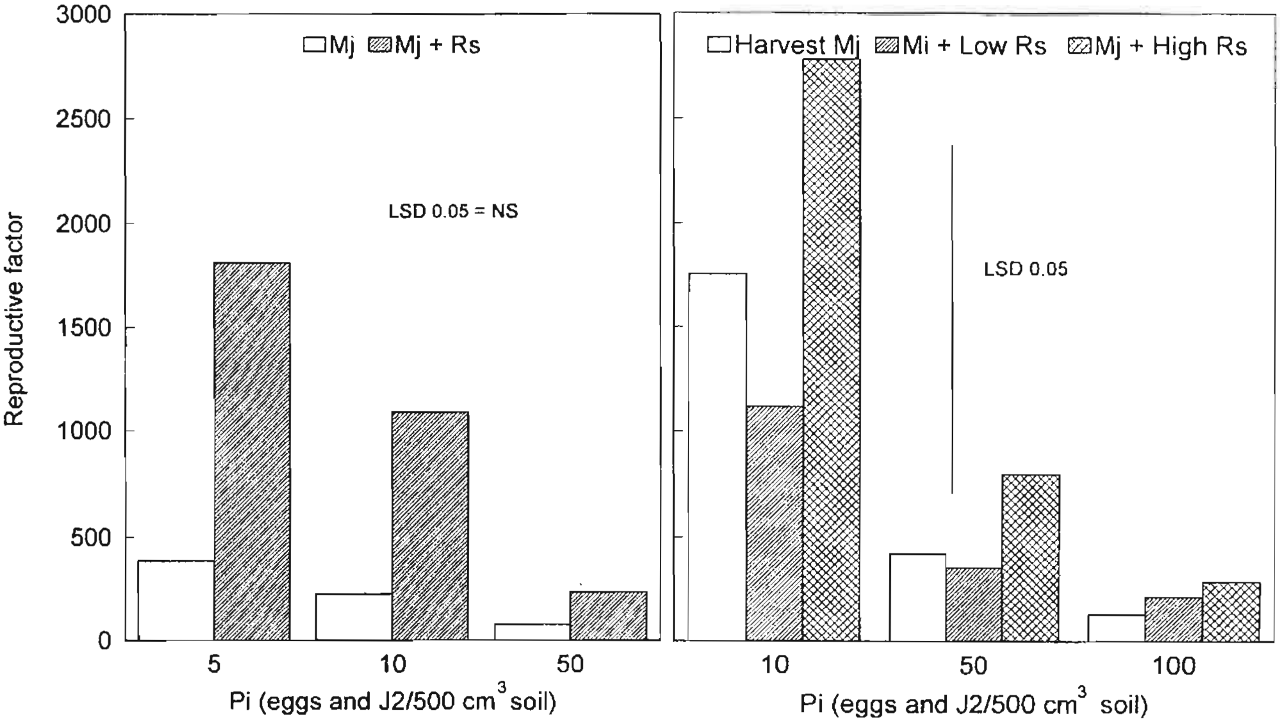
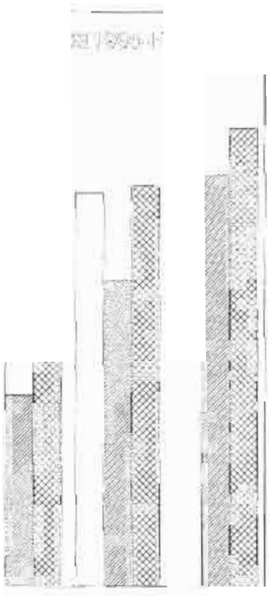


Fig. 2. *Effect of root and pod rot caused by* Rhizoctonia solani *(Rs) on the reproductive factor (Rf) of* Meloidogyne javanica *on peanut in field microplots (Left: 1995. Right: 1996. Low Rs and High Rs = 0.01 g and 0.02 g of inoculum per 500 cm^3 soil, respectively).*



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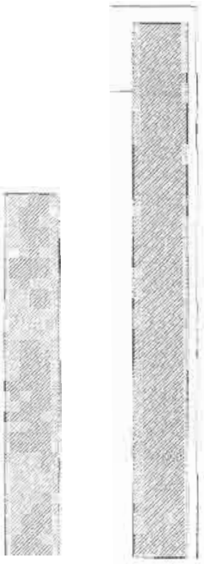

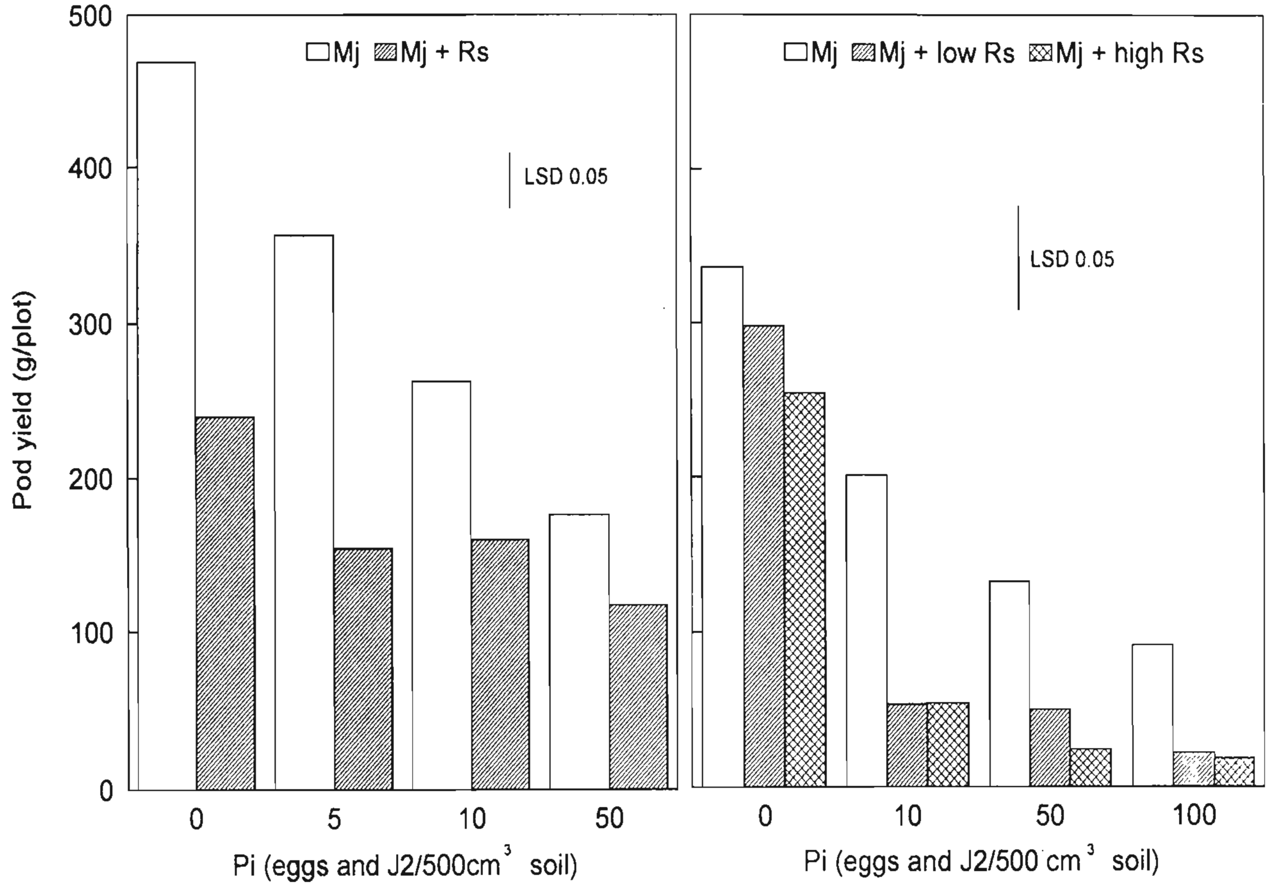

Fig. 5. *Combined effects of* Meloidogyne javanica *(Mj) and* Rhizoctonia solani *(Rs) on pod yield of peanut in field microplots (Left: 1995. Right: 1996. Low Rs and High Rs = 0.01 g and 0.02 g of inoculum per 500 cm^3 soil, respectively).*

wilt/root-knot nematode complex of cotton (Starr *et al.*, 1989).

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