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DEVELOPMENT AND PATHOGENESIS OF *MELOIDOGYNE JAVANICA* IN COTTON ROOTS

by

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Root-knot nematodes (*Meloidogyne* spp.) have long been known to cause serious damage to cotton (*Gossypium hirsutum* L.). Brodie and Cooper (1964) in an experiment with five single egg-mass isolates of *Meloidogyne* spp., representing four species found that the roots of cotton seedlings were penetrated in equal numbers and growth was significantly reduced. One isolate of *M. incognita* reached the egg-laying stage, while isolates of *M. arenaria, M. javanica, M. hapla* and a second isolate of *M. incognita* did not develop beyond the second larval stage. McClure *et al.* (1974) stated that larvae of *M. incognita* penetrated susceptible cotton roots and matured within 14 days following inoculation, whereas nematode development in resistant roots was greatly retarded and many galls contained no nematodes. Minton (1961) showed that a highly resistant wild selection of *G. barbadense* L. was more hypersensitive to *M. incognita acrita* than the *G. hirsutum* cultivars Auburn 56 and Rowden. He noted that hypersensitivity resulted in tissue necrosis and consequently the nematode was unable to complete its life cycle. Previous studies by Khalil (1977) showed that *G. barbadense* cv. Giza 69 was highly susceptible to *M. javanica*, while *G. hirsutum* cv. Acala 4-42 was resistant.

The present work describes the development of *M. javanica* (Treub) Chitw. in cvs Giza 69 and Acala 4-42 and the related histopathology of the infected roots.

Materials and Methods

The nematode inoculum used in this study was originally obtained from cotton roots infested with *M. javanica* collected from Abees, Alexandria. A single egg mass of an identified female was isolated and the hatched larvae were then reared on cotton plants cv. Giza 69.

Cotton seeds of cvs Giza 69 and Acala 4-42 were planted in steamed sandy clay soil in 20 cm clay pots. Seven days after emergence, the seedlings were thinned to two per pot and each pot was inoculated with 3,000 second stage larvae. Root samples of both cultivars were collected at 12, 24, 48 hrs and then at intervals of 2 days until 40 days after nematode inoculation; root samples of Acala 4-42 were then collected at 4 day intervals up to 76 days after inoculation.

Galled parts of infected root samples were fixed in FAA solution and processed as described previously by Ibrahim and Massoud (1974) for studying nematode development and the related histopathology.

Results

The development of *M. javanica* in the roots of Giza 69 (susceptible) and Acala 4-42 (resistant) proceeded normally to the developing female stage with slight periodical variations. Infective second stage larvae penetrated the roots of both cultivars 12 hrs after inoculation, and subsequently were oriented in the cortex parallel to the longitudinal axis of the root. In Giza 69 the third and fourth larval stages and young females were detected in the root tissues 12, 16 and 20 days, respectively, after inoculation while in Acala 4-42, these stages appeared at 8, 12 and 20 days, respectively. The egg-laying females and second generation larvae were observed in Giza 69 within 32 and 34 days, respectively, after inoculation. Conversely, egg-laying females were not detected in Acala 4-42 up to 76 days after inoculation. Root galls on Giza 69 were large but comparatively small on Acala 4-42.

Microscopic observations of infected roots of Giza 69 revealed that hypertrophy, hyperplasia and giant cells were primarily initiated in the stelar tissue at the nematode feeding sites, 16 days after inoculation. The number of induced giant cells ranged from 3-9 around the nematode head (Fig. 1 a). Giant cells stained deeply, and had gran-

ulated protoplasm and enlarged nuclei. In Acala 4-42, hyperthophy and hyperplasia of the stelar tissue were noted at the feeding sites of the fourth stage larvae 12 days after inoculation, but giant cells were not observed up to 34 days when the enlarged females appeared (Fig. 1 b).

The vascular system of infected roots of Giza 69 was greatly distorted due to the pressure exerted by the developing nematodes and the formation of giant and hypertrophied cells. Generally, secondary growth in infected roots was greatly reduced and the periderm and lateral roots were little developed.

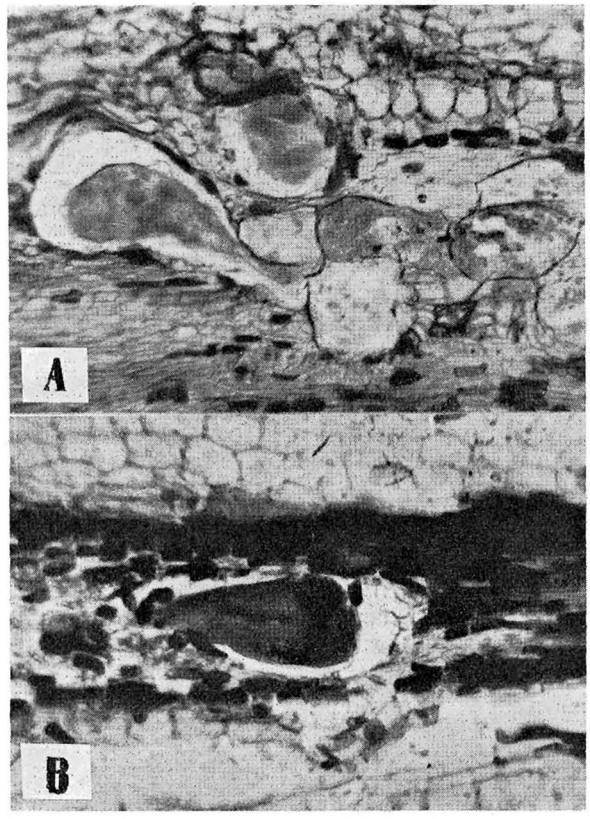

Fig. 1 - *Meloidogyne javanica* in roots of cotton: A, young female and giant cells in a root of the susceptible cv. Giza 69, 20 days after inoculation; B, adult female in the root of the resistant cv. Acala 4-42, 34 days after inoculation.

Conclusion

This is the first record of reproduction and pathogenicity of *M. javanica* on a cv. of *G. barbadense* which can be considered susceptible to the nematode. Failure of this species to complete its life cycle and to induce formation of giant cells in the cv. Acala 4-42 indicates, as shown by other authors (Brodie and Cooper, 1964), that *G. hirsutum* is resistant to *M. javanica* although nematode penetration can cause some damage to the roots.

SUMMARY

Development of *Meloidogyne javanica* (Treub) Chitw. and the related histopathology of infected cotton roots were studied in the cultivars Giza 69 (*Gossypium barbadense* L.) and Acala 4-42 (*G. hirsutum* L.). Giza 69 is a favourable host for *M. javanica* as large numbers of root galls and egg masses developed in infected plants, and the nematode life cycle was completed within 34 days after inoculation. On Acala 4-42, the nematode females were detected after 34 days but they did not deposit any egg up to 76 days following inoculation. Hypertrophy and hyperplasia were observed in infected root tissues of both cultivars but giant cells were found only in Giza 69.

RIASSUNTO

Sviluppo e patogenesi di Meloidogyne javanica *in radici di cotone.*

Sono stati studiati lo sviluppo e la relativa istopatologia di *Meloidogyne javanica* (Treub) Chitw. in radici di due cultivar di cotone: Giza 69 (*Gossypium barbadense* L.) e Acala 4-42 (*G. hirsutum* L.). Giza 69 è risultato essere un ospite favorevole per il nematode che ha indotto sulle radici la formazione di numerose galle ed ha compiuto il ciclo in 34 giorni producendo masse d'uova. Su Acala 4-42 le femmine di *M. javanica* sono state osservate dopo 34 giorni, ma esse non hanno depositato uova per i successivi 42 giorni. Fenomeni ipertrofici ed iperplastici sono stati osservati nelle radici di ambedue le cultivar, ma cellule giganti erano presenti solo in radici di Giza 69.

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