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Influence of Photoperiod and Temperature on Migrations of Meloidogyne Juveniles

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Abstract: Photoperiod influences the migration of *M. incognita* juveniles toward tomato roots. Approximately 33% migrated vertically 20 cm in 7 days to roots when 12 h dark were alternated with 12 h light. Only 7% migrated when light was constant for 24 h. Vertical migration of *M. incognita* juveniles was studied at 14, 16, 18, 20, and 22 C. The migration of *M. incognita* juveniles begins at about 18 C and reaches its maximum at 22 C. The migration of *M. hapla* and *M. incognita* juveniles were compared at 14, 18, and 22 C. Juveniles of *M. hapla* were able to migrate at a lower temperature than those of *M. incognita*. With *M. hapla,* there was no significant difference in migration between 18 and 22 C. *Key words: Meloidogyne incognita, Meloidogyne hapla,* attraction, photoperiod.

Direct sun or artificial light is known to influence nematodes living above ground, such as *Aphelenchoides* (1,6). There are some suggestions that light can affect plant-parasitic nematodes living in the soil indirectly through the plant. Darkness influenced penetration and the development of *Heterodera oryzae* (Luc and Berdon Brizuela) and *Heterodera sacchari* (Luc and Merny) (2), and the length of the light period affected cyst production by *Globodera rostochiensis* (Wollenweber) Stone (3,4) and egg mass production by *Meloidogyne incognita* (Kofoid and White) Chitwood (9). Temperature is known to influence such nematode activities as hatching, mobility, invasion, reproduction, development, and moulting (10).

The influence of photoperiod on migration of *M. incognita* juveniles was studied using tomato root systems grown under two different light periods, 12 and 24 h. The effect of temperature on migration was studied as a function of the time at five different temperatures—14, 16, 18, 20, and

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22 C—and the migration of second-stage juveniles of *Meloidogyne hapla* Chitwood and *M. incognita* was compared at 14, 18, and 22 C.

MATERIALS AND METHODS

Juveniles of *M. incognita* and *M. hapla* used in these experiments were derived from cultures maintained on tomato (*Lycopersicon esculentum* cv. Tropic) in the greenhouse. Only second-stage juveniles hatched

perature tanks in the greenhouse. The experiments were terminated after 5, 10, 15, and 20 d. The root systems were then stained and the number of juveniles that infected the roots were counted. There were 10 replications for each temperature and time.

Vertical migrations of *M. incognita* and *M. hapla* juveniles were compared at 14, 18, and 22 C. Tomato roots were harvested 10 d after introduction of juveniles at the

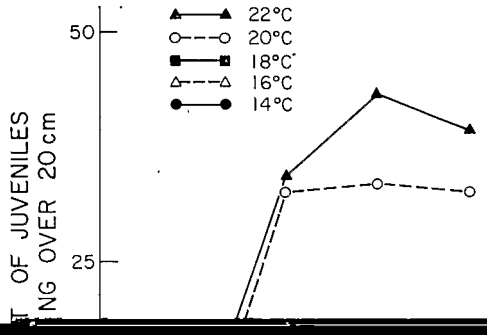
Table 2. Penetration of tomato roots by *Meloidogyne incognita* juveniles in a soil containing 86% sand, 5.2% silt, and 8.8% clay under two different light periods.

Experiment	% penetration after 7 d: 12 h light and 12 h dark	% penetration after 7 d: 24 h light
1	51*	64
2	71	66
3	76	75
3	67	73

*Each number represents the mean of five replications.

niles (Table 2) when placed in close proximity to the roots. There were no significant differences between penetration of juveniles into roots of tomato plants lighted continuously and penetration into roots of plants exposed to 12 h alternating photoperiod.

Like all the nematodes' activities, the migration of *Meloidogyne* juveniles is affected by temperature. Figure 1 shows the percentage of *M. incognita* juveniles migrating 20 cm and penetrating a tomato plant as a function of the time. At the lowest soil temperature, 14 C, only about 2% of the juveniles accomplished this. At 18 C the



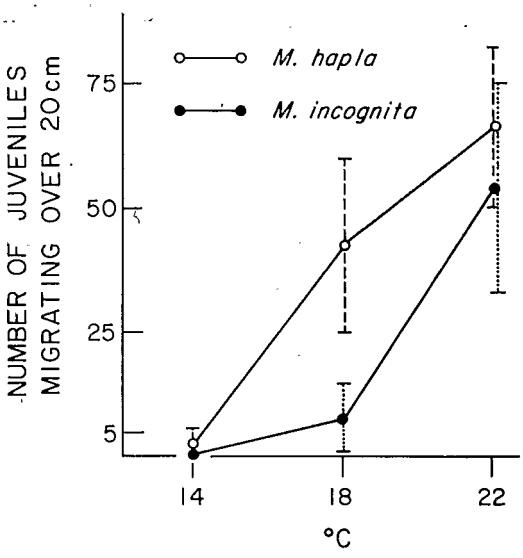


Fig. 2. Migration of *Meloidogyne incognita* and *M. hapla* juveniles toward tomato roots as a function of temperature.

percentage increased to 6–8% and at 20 and 22 C to 30%.

No significant differences were observed between migrations of *M. incognita* and *M. hapla* at 14 and 22 C (Fig. 2). At 18 C 17% of the *M. hapla* were able to migrate 20 cm in 10 d. This was significantly greater than the 3% of *M. incognita* capable of migration at that temperature.

DISCUSSION

Approximately 30% of the second-stage juveniles of *M. incognita* and *M. hapla* were able to migrate 20 cm vertically and penetrate a tomato root system. These observations and those of Prot (8) in West Africa suggest that *Meloidogyne* species commonly have the capacity to migrate large distances vertically.

The fact that migration to plants was significantly reduced but penetration not

temperatures the percentage of migration was no greater after 20 d than after 10 d. The migration of *M. incognita* began at about 18 C and reached a maximum at 20 C.

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