

CHEMO-ORIENTED SEX ATTRACTION IN A PLANT PARASITIC NEMATODE, *HIRSCHMANNIELLA ORYZAE*

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Abstract : During the present observations on the sex attraction behaviour of *H. oryzae* it was observed that both the sexes produced attractants which resulted in a mutual response towards each other. Males of *H. oryzae* were more responsive than females. There was no attraction of males towards male attractants and females towards female attractants. The distance of nematode inoculation and the period of nematode exposure to attractants influenced the degree of attraction. Significant correlations were observed between the attraction (Mean Score) and the period of nematode exposure to attractants.

Key words : Sex attraction, behaviour, *H. oryzae*.

Many studies were made on reproductive and sex attraction behaviour of free living nematodes. Greet (1964) studied sex attraction in a free living nematode, *Panagrellus rigidus*. Later, Jones (1966) observed attraction of male *Pelodera teres* towards females. Ahmad & Jairajpuri (1980a, 1981a) observed sex attraction in *Chiloplacus symmetricus* and *Cruzema lambdiense* respectively. They have also studied the effects of various factors on the sex attraction of *C. symmetricus* (Ahmad & Jairajpuri, 1980b) and copulatory behaviour of *C. lambdiense* (Ahmad & Jairajpuri, 1981b). Fewer observations are available on the reproductive and sex attraction behaviour of plant parasitic nematodes. Green (1966, 1967) and Green & Plumb (1970) reported the presence of male attractants in *Globodera rostochiensis* and *Heterodera schachtii*. Green and Greet (1972) showed that attracting substances were secreted from the entire body of *G. rostochiensis* and *H. schachtii*. Greet *et al.* (1968) observed that males of *G. rostochiensis* were attracted more strongly towards females. Azmi & Jairajpuri (1977) reported that male at-

tracting substances also occur in active females of *Hoplolaimus indicus*.

In the present work observations were made on the sex attraction behaviour of *Hirschmanniella oryzae*.

MATERIALS AND METHODS

Adult *Hirschmanniella oryzae* were isolated from soil collected around the roots of paddy (*Oryza sativa L.*) by sieving, decantation and Baermann's funnel methods. The nematodes isolated were washed with tap water repeatedly. They were sterilized with 0.1% solution of mercuric chloride prior to experiment. For each experiment fresh specimens of *H. oryzae* were isolated.

Observations on the sex attraction of *H. oryzae* were made in 6 cm diameter Petri dishes with a 5 mm thick layer of 0.5% water agar. The Petri-dishes were marked into three zones (outer, middle and inner circles) at the bottom by drawing two concentric circles of 1 and 2 cm radii. Area (r^2) of each zone was calculated and weighting factors were obtained by dividing the area of outer zone with each of the three zones (Table -I).

TABLE 1 : Area and weighting factors of the three zones marked on the Petri-dishes.

	Inner zone (Sq. cm)	Middle zone (Sq. cm)	Outer zone (Sq. cm)
Area	3.14	9.42	16.0
Weighting Factors	5.0	2.0	1.0

Weighting factors are nearest to whole number

Scores were then obtained by summing up the products of the number of worm present in each zone with their corresponding weighting factors. Mean scores (MS) were calculated for each experiment and represented in figures I A-F. Each experiment was carried out at room temperature $28 \pm 2^\circ\text{C}$ and replicated five times.

Attraction of males was tested towards male and female secretions and of females towards female and male secretions. Sex attractants were obtained by placing 50 individuals of each in 2 ml of distilled water for 24 h in a cavity block. One drop of attractant was placed in the centre of the inner circle and ten individuals to be tested were released at various points of the periphery of the outer circle of the Petri-dish. The distribution of nematodes in each zone was noted after 4, 8, 12 and 16h. Similarly the attraction of male and female *H. oryzae* was tested by releasing them in at the periphery of the middle and inner circles. In control experiments a drop of water without male and female attractants was used.

RESULTS

The present observations on the sex attraction behaviour of *Hirschmanniella oryzae* show that there is a positive response of male individuals to female attractants and female individuals to male attractants. The males were more responsive than females. Maximum attraction was observed after 16

h and there was a significant influence of the period of exposure of nematodes on their responses. Males towards male and females towards female attractants were rarely attracted. The distance of the inoculation of male and females also influenced the degree of attraction.

Attraction of males towards female attractants (Fig. 1,B).

When male individuals of *H. Oryzae* were released at the periphery of the outer circle they showed a gradual increase in the attraction from 4h (MS = 3.86) to 16h (MS=10.46, $P < 0.05$). When tested from the middle circle nematodes exhibited stronger response towards female attractants ($P < 0.05$). Attraction was minimum after 4h (MS = 7.46) while it was maximum after 16 h (MS = 10.43) ($P < 0.05$). The attraction of male individuals was more than the control ($P < 0.05$) when tested from the inner circle. Maximum attraction was recorded after 16 h (MS = 15.40; $P < 0.05$) while minimum after 8 h (MS = 15.26). There was a significant correlation between the attraction and period of exposure when the nematodes were inoculated in the outer ($r = + 0.65, P < 0.05$), middle ($r = + 0.90, P < 0.05$) and inner circles ($r = + 0.93, P < 0.05$).

Attraction of males towards male attractants (Fig. 1, C)

Male *H. oryzae* when tested towards male attractants there was no significant

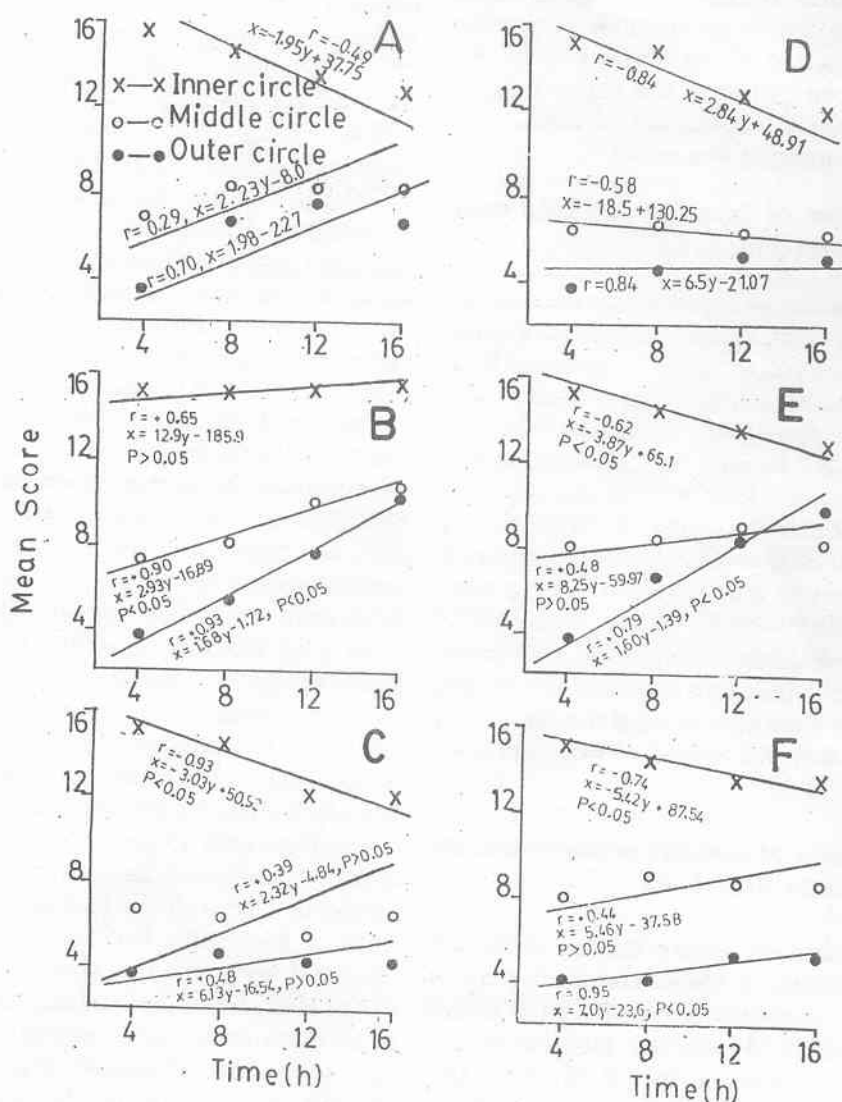


Fig. 1. A - Attraction of males in absence of females (Control)
 B - Attraction of males towards female attractants
 C - Attraction of males towards male attractants
 D - Attraction of females in absence of males (Control)
 E - Attraction of females towards male attractants
 F - Attraction of females towards female attractants.

difference in their response ($P > 0.05$). Inoculation of males at the periphery of either outer, middle or inner circle did not evoke any positive response. However, males showed a significant negative correlation with the period of exposure ($r = -0.93$, $P < 0.05$) when placed at the inner circle. In other cases the coefficient of correlations were insignificant ($P > 0.05$).

Attraction of females towards male attractants (Fig. 1, E)

Attraction of females towards male attractants declined with the period of exposure ($r = -0.62$, $P < 0.05$) when tested from the inner zone. Maximum attraction was recorded after 4 h (MS = 15.2) while the least after 16 h (MS = 13.9). The inoculation of females in the middle circle evoked more response than the control ($P < 0.05$) but the period of exposure did not have any significant effect on their response to attractants ($r = +0.48$, $P > 0.05$). Though, there was no positive response of females to male secretions ($P > 0.05$) when they were tested from the outer circle but a positive correlation was evident with the period of exposure ($r = +0.79$, $P < 0.05$).

Attraction of females towards female attractants (Fig. 1, F)

Female *H. oryzae* did not show any positive response towards female hormones in either of the conditions ($P > 0.05$). Mean Score declined with the increase in the period of exposure ($r = -0.74$, $P < 0.05$) when tested from the inner zone. It increased with the increase in the period of exposure ($r = +0.95$, $P < 0.05$) when females were released at the periphery of the outer circle. Inoculation of females at the middle circle did not set any pattern ($r = 0.44$, $P > 0.05$).

DISCUSSION

During present observations on the sex attraction behaviour both the sexes on *H. oryzae* produced sex attractants which resulted in a mutual response towards each other. A similar behaviour has also been observed in *Panagrolaimus rigidus* (Greet, 1964), *Panagrellus silusiae* (Cheng & Samoiloff, 1971), *P. redivivus* (Duggal, 1978) and *Cruznama lambdiense* (Ahmad & Jairajpuri, 1981a). Males of *H. oryzae* appeared more responsive than their females as was also observed by Ahmad & Jairajpuri (1980a) in *Chiloplacus symmetricus* and Greet *et al.* (1968) in *G. rostochiensis*. No response of males and females to their own attractants suggests that these individuals perceive attractants of opposite sex more than their own body secretions and that they are specific in their attraction responses. Theoretically, the attraction should be more when the nematodes were released at the periphery of the inner circle. However, in all such the experiments except Fig. 1 B (attraction of males to female attractants) the degree of attraction (Mean Score) decreased after every 4 h. The reason could either be the attractants had a little effect on the nematodes to change their course from such a short distance or nematodes were repelled due to high attraction gradients. Due to these factors the movement of nematodes from the inner circle appeared more random similar to control where Mean Score declined after every 4 h. In all these experiments negative correlations were obtained between the attraction and the period of nematode exposure to attractants. In rest of the cases where the nematodes were inoculated either at the periphery of the middle or outer circle the relationships were positive and there was an increasing trend in the attraction of nematodes.

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