Hatching response of *Rotylenchulus reniformis* to root leachates of certain hosts and nonhosts

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SUMMARY

Root leachates of favourable hosts such as okra, tomato, castor, egg-plant and cowpea stimulated the hatching of *R. reniformis* larvae, while those of nonhosts such as onion and chilli suppressed it. Optimal hatch was achieved within nine hours and further increase in duration of leach decreased it. Leachates obtained from five seedlings showed optimal hatching activity which decreased with further increase in seedling concentration. This was further confirmed by tests made by diluting the leachates obtained from the roots of fifteen seedlings.

RÉSUMÉ

Eclosion de Rotylenchulus reniformis *en réponse aux exsudats radiculaires de plantes hôtes et non hôtes*

Les exsudats radiculaires provenant d'une part de dix plantes hôtes (gombo, tomate, ricin, aubergine, haricot, chou, concombre, pois d'Angole, calebassier et blé) et d'autre part de cinq plantes non hôtes (oignon, fenouil, navet, piment, épinard) ont été testés pour leur effet sur l'éclosion des larves de *R. reniformis*. Il a été constaté que l'éclosion était stimulée, à des degrés divers, par les exsudats du gombo, de la tomate, du ricin, de l'aubergine et du haricot et était inhibée par ceux provenant du piment et de l'oignon. L'éclosion optimale a été obtenue avec des exsudats provenant de racines immergées pendant neuf heures; cette éclosion est diminuée si la durée d'immersion augmente. Les exsudats provenant de cinq jeunes plants de tomate ont montré une action optimale sur l'éclosion; cette action diminue si le nombre de ces plants est augmenté. Ce phénomène a été confirmé par des tests de dilution d'exsudats radiculaires provenant de quinze jeunes plants de tomate.

Larval hatching in plant parasitic nematodes is affected by various physical, chemical and seasonal factors. Among the chemical factors, root exudates from the host plants have been found to influence hatching in various species of *Heterodera* (Baunacke, 1922; Fenwick, 1949; Winslow, 1955; Winslow & Ludwig, 1957; Doncaster, 1957) and *Meloidogyne* (Loewenberg *et al.*, 1960; Jones & Nirula, 1963; Ahmad & Khan, 1964; Hamlen & Bloom, 1968; Webber & Barker, 1968). However, there are no such reports outside the family Heteroderidae. Attempts were, therefore, made to study the effect of : *(i)* root leachates from certain host and nonhost plants, *(ii)* duration of leach, and *(iii)* seedling concentration on larval hatching in the reniform nematode, *Rotylenchulus reniformis* Linford & Oliveira, 1940.

Materials and methods

Ten host plants viz., okra (*Abelmoschus esculentus* Moench), tomato (*Lycopersicon lycopersicum* (L.) Karst.), castor (*Ricinus communis* L.), egg-plant (*Solanum melongena* L.), cowpea (*Vigna unguiculata* L.), cabbage (*Brassica oleracea* L. var. *capitata*), cucumber *cucumis sativus* L.), Bonavist bean (*Dolichos lablab* L.), bottle gourd (*Lagenaria leucantha* (Duch.) Rusby) and wheat (*Triticum aestivum* L.) and five nonhost plants viz., onion (*Allium cepa* L.), dill (*Anethum graveolens* L.), turnip (*Brassica rapa* L.), chilli (*Capsicum frutescens* L.) and spinach (*Spinacia oleracea* L.) were selected for these studies. Root leachates were prepared by immersing the excised roots of five, six day-old seedlings, grown in sterilized quartz sand in Petri plates in 10 ml of distilled water for six hours. For studying the effect of duration of leach on its potency, thoroughly washed excised roots of 50 six day-old tomato seedlings were immersed in 100 ml of distilled water and samples of leachates were taken at 1, 3, 6, 9, 12, 15 and 18 hours intervals. Effect of seedling concentration on leachate potency was studied by immersing 1, 3, 5, 7, 9, 11, 13 and 15 excised roots of tomato seedlings of the same age in 10 ml of distilled water respectively. The leachate obtained from fifteen excised roots of tomato was termed " x " and different dilutions viz., x/2, x/3, x/5, x/10 and x/50 were prepared from it to study their effect on leachate potency. Throughout the studies five surface sterilized egg masses of *R. reniformis*, obtained from pure culture, were transferred to 10 ml of aliquot contained in 5 cm Petri plates. An equal amount of distilled water with an equal number of egg masses transferred to it served as control. Replication in each test was five fold. The plates were incubated for a week

Table 1

Larval hatching in root leachates of certain host and nonhost plants after one week exposure.

Plants	Okra	Tomato	Castor	Egg-plant	Cowpea	Cabbage	Cucumber	Bonavist bean	Bottle gourd	Wheat	Onion	Dill	Turnip	Chilli	Spinach	Water
Cumulative larval hatch	113	145	162	116	103	70	59	65	72	73	19	64	62	28	67	68
F	4.000*	10.240*	17.454*	4.551*	2.420*	0.008	0.160	0.178	0.032	0.050	4.743*	0.032	0.071	3.160*	0.002	—
S.D.	2.702	3.535	1.140	0.837	0.894	1.414	1.304	1.871	0.894	1.517	2.608	1.924	2.074	1.817	1.140	0.894

* Significant at 0.01 level ($P < 0.01$)

at room temperature (30° ± 1°) after which the larval hatch was counted.

Results and discussion

Results presented in Table 1 show that root leachates of five out of the ten host plants tested, tended to stimulate the hatching of *R. reniformis* larvae in varying degrees. Cumulative larval hatch in root leachates of okra, tomato, castor, egg-plant and cowpea, one week after introduction, was 113, 145, 162, 116 and 103 respectively as against 68 in water. Leachates from the roots of remaining host plants viz., cabbage, cucumber, Bonavist bean, bottle gourd and wheat had no obvious effect. Leachates from the roots of three out of the five nonhost plants viz., dill, turnip and spinach had no significant effect on the larval hatch, while onion and chilli evidently suppressed hatching activity.

Duration of leach significantly affected the leachate potency (Tab. 2). The hatching activity increased with the increase in duration of leach up to nine hours, where optimal hatching occurred. Further increase in duration brought about decrease in hatching. The number of larvae that hatched in leachates collected after fifteen and eighteen hours was lower than the hatch in water.

The hatching activity increased with the increase in seedling concentration (Tab. 3). The highest hatch occurred when roots of five seedlings were used for production of leachates. Further increase in the number of seedlings resulted in decline of hatch till it reached its lowest in leachates prepared from the roots of fifteen seedlings. Cumulative larval hatch in such leachates was lower than in water.

Similar results were obtained with six different concentrations of leachates prepared from the roots of fifteen tomato seedlings (hereafter termed as " x ") (Tab. 4). Evidently, the hatching activity increased with the increasing concentration reaching its highest in x/3 and dropping to lower than in water at x concentration. The concentration of x/3 corresponds to leachates prepared from the roots of five seedlings (x = 15; x/3 = 5).

Table 2

Larval hatching in root leachates of tomato, collected after different durations of leach.

Duration	*Cumulative larval hatch*	*F*	*S.D.*
1 hr	94	9.984*	0.56
3 hr	117	30.296*	1.04
6 hr	146	71.574*	0.96
9 hr	167	112.374*	1.04
12 hr	76	1.756	0.16
15 hr	57	0.374	1.04
18 hr	49	2.036	0.56
Water	63	—	3.44

* Significant at 0.01 level ($P < 0.01$)

Table 3

Larval hatching in root leachates obtained from Different concentrations of tomato seedlings.

Seedling concentration	*Cumulative larval hatch*	*F*	*S.D.*
1	53	0.003	1.44
3	88	11.325*	1.84
5	142	68.510*	0.64
7	107	25.943*	0.64
9	78	6.031*	1.04
11	72	3.648*	1.04
13	63	1.191	3.44
15	43	0.529	0.24
Water	51	—	0.56

* Significant at 0.01 level ($P < 0.01$)

The results show that hatching in the reniform nematode, *R. reniformis*, was stimulated by root diffusates produced by certain host plants and suppressed by those produced by certain nonhost plants. Apparently the

Table 4
Larval hatching in different concentrations of root leachates obtained from fifteen tomato seedlings.

Concentration of leachate	*Cumulative larval hatch*	*F*	*S.D.*
x/50	37	0.028	1.04
x/10	41	0.711	0.56
x/5	54	9.215*	0.56
x/3	61	17.776*	0.16
x/2	46	2.844	0.16
x	27	2.304	0.24
Water	36	—	0.56

* Significant at 0.01 level ($P < 0.01$)

hatching stimulants were certain water soluble chemical substances. Leachates with highest potency were produced by castor roots followed by tomato, egg-plant, okra and cowpea in that order. Duration of leach also had a marked effect on the leachate potency. The decrease in rate of hatching after nine hours might have been the result of a fall in leaching due to diminished reserves of these chemical substances within the roots. It could also be due to a degradation of the leachate or a reabsorption by the roots. The leachate potency was found to be directly proportional to seedling concentration up to an optimum above which hatching was depressed. It is possible that the inhibitory effects observed at higher concentrations were due to an osmotic pressure effect exerted by dissolved salts. It is also likely that the hatching factors, if present beyond a certain threshold, bring about a reduction in hatching. These findings are generally in agreement with those of Winslow and Ludwig (1957) for beet leachings and Hague (1958) for potato root diffusates.

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