

Influence of host nutrition on the population and sex ratio of the reniform nematode, *Rotylenchulus reniformis*

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SUMMARY

The sex ratio and rate of multiplication of *R. reniformis* were affected by the nutritional status of castor plants (*Ricinus communis* L.). Of the three elements tested, potassium and nitrogen profoundly influenced the sex ratio and reproduction of this nematode. The percentage of males significantly increased in deficient and subnormal treatments, while that of females increased in supernormal treatments of both elements. Phosphorus, on the other hand, had little or no effect either on the sex ratio or on reproduction.

RÉSUMÉ

Influence de la nutrition de l'hôte sur la population et le quotient sexuel du nématode réniforme, Rotylenchulus reniformis

Le quotient sexuel et le taux de reproduction de *Rotylenchulus reniformis* sont modifiés par le régime nutritionnel de la plante-hôte, le ricin (*Ricinus communis* L.). Des trois éléments testés, potassium, azote et phosphore, seuls les deux premiers influencent profondément le quotient sexuel et la reproduction du nématode : le pourcentage de mâles augmente de façon notable au cours de traitements déficients ou à des taux au-dessous de la normale, tandis que celui des femelles augmente pour des taux supérieurs à la normale. En revanche le phosphore a peu ou pas d'effet sur les deux données étudiées.

The reniform nematode, *Rotylenchulus reniformis* Linford & Oliveira, 1940, is a serious pest of a variety of crops and is distributed worldwide. Considerable work has been done on its morphology, life history, pathogenicity, bio-ecology and control. However, there are very few reports on the effect of host nutrition on its development (Sivakumar & Meerzainuddeen, 1974; Haque & Mukhopadhyaya, 1983). The present studies were, therefore, undertaken to study the effect of deficient (—), subnormal (1/2), normal (NPK) and supernormal (2 ×) levels of nitrogen (N), phosphorus (P) and potassium (K) on the population and sex ratio of *R. reniformis* on castor, *Ricinus communis* L., var. local.

Materials and methods

Glazed crocks filled with sterilized fine quartz sand were used for these studies. The plants were supplied with either complete Long Ashton nutrient solution (Table 1), or with nutrient solutions adjusted for different deficient, subnormal or supernormal levels of N, P or K (Tables 2 & 3). Six day old castor seedlings were

inoculated each with 1000 newly hatched juveniles of *R. reniformis*, obtained from surface sterilized egg masses. Final nematode population was estimated 60 days after inoculation and separate counts were made for sexually undifferentiated juveniles, immature females, adult females, immature males and adult males.

Results

Results presented in table 4 show that the number of nematodes recovered from castor plants treated with the supernormal dose of nitrogen (2 N) or potassium (2 K) was higher than from those with normal nutrients (NPK). It was not so in plants treated with supernormal dose of phosphorus (2 P). Deficient or subnormal doses of all nutrients reduced the recovery of nematodes as compared with normal (NPK), though recovery was greater with subnormal dose of phosphorus (1/2 P) than with 1/2 N or 1/2 K.

In plants receiving normal nutrients, the ratio between males (44.26 %) and females (42.76 %) was almost 1 : 1. When the plants were subjected to a deficiency of

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Table 1
Composition of complete nutrient solution

<i>Nutrients</i>	<i>ppm</i>			
Macroelements :				
KNO ₃	K	156	N	57
Ca (NO ₃) ₂ Anhyd.	Ca	160	N	113
MgSO ₄ 7 H ₂ O	Mg	36	S	48
NaH ₂ PO ₄	N	31	P	41
Microelements :				
Fe-citrate 3 H ₂ O	Fe	5.6		
MnSO ₄ 4 H ₂ O	Mn	0.55		
CuSO ₄ 5 H ₂ O	Cu	0.064		
ZnSO ₄ 7 H ₂ O	Zn	0.065		
NaCl	Cl	3.5	Na	2.3
H ₃ BO ₃	B	0.54		
(NH ₄) ₆ MO ₇ O ₂₄ 4 H ₂ O	Mo	0.048		

Table 2

Compensation made for element deficiencies in the nutrient solution so as to maintain nutrient balance

<i>Deficiencies</i>	<i>Compensation made</i>	<i>Nutrient solution designated as</i>
Complete nutrient	None	NPK
Nitrogen	Ca (NO ₃) ₂ and KNO ₃ replaced by CaCl ₂ and K ₂ SO ₄	— N
1/2 Nitrogen	Ca (NO ₃) ₂ and KNO ₃ replaced proportionately by CaCl ₂ and K ₂ SO ₄	1/2 N
Phosphorus	NaH ₂ PO ₄ replaced by NaNO ₃	— P
1/2 Phosphorus	NaH ₂ PO ₄ replaced proportionately by NaNO ₃	1/2 P
Potassium	KNO ₃ replaced by NaNO ₃	— K
1/2 Potassium	KNO ₃ replaced proportionately by NaNO ₃	1/2 K

Table 3

Additions made so as to maintain an excess of elements in the nutrient solution

<i>Element</i>	<i>Addition made</i>	<i>Nutrient solution designated as</i>
Nitrogen	Proportionate amounts of Ca(NO ₃) ₂ , 2 KNO ₃ and NaNO ₃	2 N
Phosphorus	Proportionate amount of NaH ₂ PO ₄	2 P
Potassium	Proportionate amounts of KNO ₃ and K ₂ SO ₄	2 K

Table 4

Population and sex ratio of *R. reniformis* on castor var. local 60 days after inoculation with 1000 juveniles, when plants were grown in deficient, subnormal, normal and supernormal doses each of N, P and K

Nutrient level	Total number of nematodes recovered	Sexually differentiated nematodes (%)	
		Females (adults + juveniles)	Males (adults + juveniles)
— N	2 270	31.80	45.72
1/2 N	2 865	32.56	44.16
2 N	4 480	46.49	39.66
— P	3 754	42.54	44.93
1/2 P	3 940	44.03	41.95
2 P	3 375	39.11	39.29
— K	1 745	12.03	75.93
1/2 K	3 156	16.28	63.62
2 K	5 860	59.28	22.35
NPK (Normal)	4 130	42.76	44.26
S.D. at 5 %	954.0496		

Data represent the mean of five replicates.

nitrogen, the number of females decreased by about 11 % while that of males remained almost unchanged. Almost the same percentage of females (32.56) and males (44.16) was recovered from plants receiving subnormal dose. More females than males were recovered in supernormal dose.

Deficiency or excess of phosphorus in the nutrient solution was found to have no effect on the sex ratio of this nematode as it remained more or less 1 : 1 in all the treatments where other nutrient doses were normal. Moreover, there was no correlation between the treatments and the number of nematodes.

Potassium significantly affected the sex ratio and the rate multiplication of *R. reniformis* on castor. There were more males than females in plants grown in deficient (— K) or subnormal (1/2 K) nutrient. Deficiency of potassium not only influenced the sex ratio but also significantly affected the multiplication as only 1,745 and 3,156 nematodes were recovered in potassium deficient and subnormal treatments respectively.

Discussion

The present studies indicate that the sex ratio and the rate multiplication of *R. reniformis* were affected by the nutritional status of castor plants. These findings are generally in agreement with those of Oteifa (1953) and Davide and Triantaphyllou (1967) with root-knot nematodes.

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