

Institute of Agriculture¹, Department of Botany², Aligarh Muslim University, Aligarh-202002, India

PROPHYLACTIC AND THERAPEUTIC USE OF OILCAKES AND LEAVES OF NEEM AND CASTOR EXTRACTS FOR THE CONTROL OF ROOT-KNOT NEMATODE ON CHILLI

by
M. AKHTAR¹ and I. MAHMOOD²

Summary. Bare-root treatment of chilli (*Capsicum annuum*) seedlings with extracts of decomposed and undecomposed oil-cakes and leaves of neem (*Azadirachta indica*) and castor (*Ricinus communis*) provided protection against root-knot disease caused by *Meloidogyne incognita*. A curative effect was also noted when roots of pre-infected seedlings were given a similar treatment. Suppression of root-knot development was greater in pre-infected (therapeutic use) seedlings than in those inoculated after dip treatment (prophylactic use). Extracts of decomposed materials were more effective than those of undecomposed ones. Moreover, oilcakes and neem were more effective than leaves and castor.

Water extracts of plant derivatives have shown systemic activity against root-knot nematodes (Akhtar and Alam, 1990). Therefore, it was thought interesting to investigate the use of bare-root dips of extracts of neem (*Azadirachta indica* A. Juss.) and castor (*Ricinus communis* L.) oilcakes and leaves for the control of root-knot nematode *Meloidogyne incognita* (Kofoid et White) Chitw. on chilli (*Capsicum annuum* L.) plants.

Materials and methods

To obtain a water soluble fraction (WSF) of oilcakes of neem and castor 25 g oilcake powder was dissolved in 100 ml distilled water at 20±2 °C for 15 days and the suspension then filtered. Undecomposed WSF was similarly prepared by soaking oilcakes in water for one hour. The WSF were designated 'S' concentrations of the extract one and further dilutions with the appropriate quantity of distilled water as S/2 (two-fold) and S/10 (ten-fold). Leaf extracts were prepared by macerating 25 g of chopped leaves in 100 ml distilled water. The suspension was then filtered and dilutions of the filtrate were prepared as above.

Seedlings of chilli cv. 'Jawala' were raised in pots containing 1 kg autoclaved soil. One-week-old seedlings were transplanted singly in to 5 cm diam clay pots and inoculated with 1000 freshly hatched second-stage juveniles (J₂) of *M. incognita*. When 3 weeks old, the roots of the seedlings were dipped for 30 minutes in extracts. The seedlings were then transplanted singly in 15 cm diam clay pots and grown for 8 weeks. Seedlings that had not been previously inoculated received *M. incognita* at 1000 J₂ per plant after transplanting. Thus, seedlings received nematodes before and after bare-root dip treatment. Uninfected and untreated

seedlings served as controls. There were five replicates for each treatment, arranged in a completely randomized block design.

The experiment was discontinued two months after inoculation. Plants were uprooted, washed and plant growth (weight of shoot and root) and root-knot index on 0-5 scale (Sasser et al. 1984) determined.

Results and discussion

Bare-root dip treatments of chilli seedlings with extracts of undecomposed and decomposed oilcakes and leaves of neem (Table I) and castor (Tables II) reduced root-galling and improved plant growth.

The reduction in root galling was greater in pre-infected plants and those treated with decomposed extracts of neem and castor oilcakes compared with those inoculated with nematodes after root-dip treatment. However, the inhibition of root-knot development was relatively less in extracts of undecomposed oilcake in both pre-infected as well as post-inoculated plants. Root dips with leaf extracts were not as effective as oilcake extracts in decreasing root galling. Undecomposed extracts reduced the severity of root-knot less than decomposed extracts. The severity of infection decreased with the increase in concentration of the extracts (Tables I and II).

The growth of plants improved with increasing concentrations of the extracts and was correlated with the degree of nematode control. The greatest plant growth was recorded in the treatment with 'S' concentration of extracts of decomposed oil-cakes in post-inoculated plants of chilli. However, the enhancement of plant growth with increasing concentrations of the leaf extracts was less than that

TABLE I - Effect of bare-root dip treatment of *chilli* cv. *Jawala* seedlings with neem extracts on root-knot development and plant growth.

Pre-infected with <i>M. incognita</i>										
Treatment			Oilcake extract				Leaf extract			
Infection	Condition of extracts	Conc. of extracts	Plant weight (g)			Root-gall index (0-5 scale)	Plant weight (g)			Root-gall index
			Shoot	Root	Total		Shoot	Root	Total	
Infected	Undecomposed	S	11.3	3.5	14.8	2.0	10.4	3.1	13.5	2.5
"	"	S/2	10.7	2.8	13.5	2.5	9.2	2.9	12.1	2.7
"	"	S/10	9.4	2.5	11.9	2.7	9.0	2.5	11.5	3.0
"	Decomposed	S	11.7	3.4	15.1	1.7	10.5	2.9	13.4	2.0
"	"	S/2	10.2	3.1	13.3	2.0	10.2	2.5	12.7	2.2
"	"	S/10	8.4	2.5	10.9	2.5	7.4	1.8	9.2	2.7
"	Undipped	-	4.2	1.5	5.7	4.0	4.2	1.5	5.7	4.0
Uninfected	Undipped	-	15.1	4.7	19.8	-	15.1	4.7	19.8	-
	C.D. ($P=0.05$)				1.01	0.56			0.75	0.50
	C.D. ($P=0.01$)				1.38	0.76			1.01	0.68

Post dip infected with <i>M. incognita</i>										
Treatment			Oilcake extract				Leaf extract			
Infection	Condition of extracts	Conc. of extracts	Plant weight (g)			Root-gall index (0-5 scale)	Plant weight (g)			Root-gall index (0-5 scale)
			Shoot	Root	Total		Shoot	Root	Total	
Inoculated	Undecomposed	S	10.5	2.5	13.0	2.5	10.2	2.0	12.2	2.7
"	"	S/2	8.5	2.5	11.0	2.7	8.1	2.3	10.4	3.2
"	"	S/10	7.2	1.9	9.1	3.0	6.4	1.5	8.9	3.5
"	Decomposed	S	13.2	4.1	17.3	2.2	12.4	3.5	15.9	2.5
"	"	S/2	10.7	3.0	13.7	2.5	11.2	2.8	14.0	2.7
"	"	S/10	10.2	2.8	13.0	3.0	10.0	2.2	12.2	3.2
"	Undipped	-	4.0	1.2	5.2	4.0	4.0	1.2	5.2	4.0
Uninoculated	"	-	15.1	4.7	19.8	-	15.1	4.7	19.8	-
	C.D. ($P=0.05$)				0.70	0.24			0.74	0.29
	C.D. ($P=0.01$)				0.93	0.33			1.01	0.39

with oilcakes, but decomposed extracts were more beneficial than undecomposed ones (Tables I and II).

The data indicate that bare-root dip treatment of chilli seedlings both pre- and post-inoculated with *M. incognita* with extracts of undecomposed and decomposed oilcakes and leaves of neem and castor reduced root-galling. Thus the extracts exhibited prophylactic as well as therapeutic effects against the root-knot nematodes.

Inhibition of root-galling was greater in pre-infected seedlings than in those inoculated with the nematode after root-dip treatment. This may indicate that chemicals absorbed by the roots have acted directly against the nematode already present in the roots. When the inoculation was made after the dip treatment, the chemicals may have been degraded or diluted by the time the nematodes entered the

roots. Similar results were observed by Siddiqui and Alam (1988) with a bare-root dip of tomato seedlings in undecomposed extracts of neem leaves. They suggested that some of the chemicals may have been absorbed by the roots or that there might have been some biochemical chain reaction which was triggered by an 'elicitor' / 'activator' present in the leaf extracts. The reduction in root-knot development due to root-dip treatment could also be attributed to the unfavourable conditions causing poor penetration and later retardation in biological activities such as feeding and/or reproduction of the nematode as suggested by Bunt (1975).

The extracts of decomposed oilcakes and leaves were more effective than the undecomposed ones. This is possibly due to the release of toxic substances during the breakdown of complex substances for the production of

TABLE II - Effect of bare-root dip treatment of *chilli cv. Jawala* seedlings with castor extracts on root-knot development and plant growth.

Pre-infected with <i>M. incognita</i>										
Treatment			Oilcake extract				Leaf extract			
Infection	Condition of extracts	Conc. of extracts	Plant weight (g)			Root-gall index (0-5 scale)	Plant weight (g)			Root-gall index (0-5 scale)
			Shoot	Root	Total		Shoot	Root	Total	
Infected	Undecomposed	S	10.2	3.4	13.6	2.3	8.3	2.4	10.7	2.5
"	"	S/2	8.5	2.7	11.2	2.5	7.4	1.9	9.3	2.7
"	"	S/10	6.0	1.9	7.9	3.0	6.2	1.5	7.7	3.2
"	Decomposed	S	10.4	3.2	13.6	2.2	8.6	1.9	10.5	2.2
"	"	S/2	8.3	1.8	10.1	2.4	7.2	1.5	9.7	2.5
"	"	S/10	7.9	1.5	9.4	2.7	6.5	1.3	7.8	3.0
"	Undipped	-	4.3	1.5	5.8	4.0	4.3	1.5	5.8	4.0
Uninfected	Undipped	-	15.1	4.7	19.8	-	15.1	4.7	19.8	-
	C.D. ($P=0.05$)				1.70	0.64			1.07	0.65
	C.D. ($P=0.01$)				2.32	0.87			1.41	0.88

Post dip infected with <i>M. incognita</i>										
Treatment			Oilcake extract				Leaf extract			
Infection	Condition of extracts	Conc. of extracts	Plant weight (g)			Root-gall index (0-5 scale)	Plant weight (g)			Root-gall index (0-5 scale)
			Shoot	Root	Total		Shoot	Root	Total	
Inoculated	Undecomposed	S	9.1	2.9	12.0	2.5	8.7	2.5	11.2	2.5
"	"	S/2	8.2	2.5	10.7	2.7	7.9	2.1	10.0	3.2
"	"	S/10	5.1	2.1	7.2	3.2	5.5	2.1	7.6	3.7
"	Decomposed	S	11.2	4.1	15.3	2.2	10.5	3.9	11.4	2.5
"	"	S/2	9.5	3.7	13.2	2.5	8.2	2.1	10.4	3.0
"	"	S/10	8.1	2.5	10.6	3.0	7.4	2.0	9.4	3.2
"	Undipped	-	3.2	1.3	4.5	4.0	3.2	1.3	4.5	4.0
Uninoculated	Undipped	-	15.1	4.7	19.8	-	15.1	4.7	19.8	-
	C.D. ($P=0.05$)				1.56	0.63			1.35	0.54
	C.D. ($P=0.01$)				2.12	0.85			1.84	0.97

toxic metabolites by microorganisms associated with the decomposition process (Akhtar and Alam, 1993).

Acknowledgements. The senior author is grateful to CSIR, New Delhi, India for providing financial assistance as a position of Research Associate.

Literature cited

AKHTAR M. and ALAM M. M., 1990. Effect of bare-root dip treatment with extracts of castor on root-knot development and growth of tomato. *Nematol. medit.*, 18: 53-54.

AKHTAR M. and ALAM M. M., 1993. Utilization of waste materials in nematode control, A Review. *Bioresource Technol.*, 45: 1-7.

BUNT J. A., 1975. Effect and mode of action of some systemic nematicides. *Meded Landb. Hogesch.*, 75: 1-128.

SASSER J. N., CARTER C. C., and HARTMAN, K. M., 1984. *Standardization of Host Suitability Studies and Reporting of Resistance to Root-knot Nematodes*. Cooperative Publication Department of Plant Pathology, North Carolina State University USDA, Raleigh, North Carolina, USA 7 pp.

SIDDIQUI M. A. and ALAM M. M., 1988. Control of root-knot and reniform nematodes by bare-root dip in leaf extracts of margosa and Persian lilac. *Zeitsch. Pflanzenkbb. Pflanzensch.*, 95: 138-142.