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EFFECT OF BRASS INDUSTRIAL EFFLUENTS ON EGG MASS NUMBER OF *Meloidogyne incognita* AND ON NODULES PER PLANT OF SOYBEAN

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ABSTRACT

This paper deals with the effect ofbrass industry effluents on egg mass number and root nodules of soybean plants infected by *Meloidogyne incognita*. It is found that as the level of effluent in soil increases gradually, the growth of plants is decreased. It is because of heavy metals present in the soil of Moradabad city.

KEYWORDS : Brass Industrial Effluents, Egg Mass Number, *Meladogyne incognita*, Nodule, Soybean

Root-knot nematodes (*Meloidogyne* species) attack several kinds of crops all over the world and cause enormous crop damages (Sasser, 1980). Out of these species *Meloidogyne incognita* (Kofoid and White) was one of the common species with effect soyabean plants. The average crop yield losses are estimated to be about 25% with damage in the individual fields ranging as high as 60% (Sasser, 1980; Sasser and Carter, 1982). The infected plants develop galls on the roots due to hypertrophic and hyperplastic activities in the root tissues under the influence of the endoparasitic sedentary female nematodes. A number of giant cells develop around the female neck and head. Giant cells are multinucleated with irregularly thickened wall and remain in high state of metabolic activities. They function as transfer cells and the sedentary female nematodes in the root obtain their nutrition from them (Jones and Northcote, 1972b). Root-knot nematode brings about extensive alterations in the vascular tissue of the plants and absorption and supply of water and nutrients become greatly impaired.

Moradabad is one of the districts of Uttar Pradesh state of India. It is situated on the bank of river Ramganga (a tributary to the great Ganges). Moradabad is renowned for brass work and has carved a niche for itself in the handicraft industry throughout the world and is also called "Brass City" or PeetalNagri (in the local language). The modern, attractive and artistic brass wares, jewellary and trophies made by skilled artisans are the main crafts. The attractive brass wares are exported to countries like USA, Britain, Canada, Germany and Middle-East Asia. There are about 600 export units and 5000 industries in the district. Moradabad exports goods worth Rs. 2200 crore every year.These brass industries are producing a number of effluents which are reaching in water and soil and ultimately entering in to food chain.

The effluents emited from the brass industries contains P, K, Ca, Mg, Mn, Cu, Zn, Cd carbonates, bicarbonates, sulphate and chloride. Porosity, water holding capacity, pH, conductivity and cation exchange capacity are also increased in fly ash amended soil (Singh et al., 2011; Adriano, et al., 1980 and Khan et al., 1997).Thus like fly ash, brass ash has a vast potential for use in agriculture as a soil amendment.But according to recent study it is shown that inhibitory effects on root-knot nematodes (Khan, et al., 1997; Tarannum, et al., 2001 and Rizvi and Khan, 2009b).

The objective of present work is to study the effects of brass industries effluents on egg mass number and nodules ofsoyabean.

MATERIALS AND METHODS

For the present work study area is divided into three sites and effluents from brass and electroplating industries were collected and their effects were studied on soyabean by following method.

Meloidogyne incognita (Kofoid and White) one of the important root-knot nematode species in the area, was used. Field population of *M. incognita* were first raised on tomato, *Lycopersico mesculentum* Mill. (cv. Pusa Ruby)Roots of tomato infected with root-knot nematode were collected from the field and the species present in the samples were tentatively identified on the basis of the characteristics of perennial patterns of the females. (Eisenback et al., 1981)

Second- stage juveniles (J2) of the nematode were used as inoculum in the study. Second- stage juveniles were

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obtained by incubating egg masses collected from the roots of tomato or eggplant maintaining single egg mass culture of M. incognita. Egg masses were incubated in coarse sieve fitted with double layered tissue paper and placed on Baermann funnel containing water. The sieves were then placed in an incubator (temp. 25^0C). After 72h, number of hatched juveniles (J2) were collected in a beaker and a number of juveniles per ml was standardized by counting the juveniles from ten, 1 ml samples. Average number of juveniles was then calculated to represent the number of juveniles per ml of the suspension.

Seedlings of soybean (*Glycine max* (L.) Merr. cv. were grow in clay pots (30 cm diam.) from surface sterilized seeds. Prior to seeding, seeds were soaked in water for 24 h and then surface sterilized with 0.01% mercuric chloride for 15 min. The surface-sterilized seeds were sown in the pots filled with autoclaved sandy loam field soil.

For the treatments, fresh effluent was brought directly from selected polluted sites of Moradabad in sterilized glass containers and was analyzed for its chemical parameters following APHA (1995). According to chemical analysis effluent of brass and electroplating industries contained chloride, sulphate, carbonate, bicarbonate and heavy metals (i.e. Pb, As, Ni, Co & cd). Three-week-old seedlings were exposed treated with effluents at every alternate day for three hours. Treatment started at the time of inoculation (i.e. simultaneous) inoculation treatment. This procedure was continued for 55 days. The concentrations of effluent used were 50% and 100%. Each treatment was replicated five times and pots were arranged randomly in block design in glasshouse. At termination of the experiment after 75 days of sowing, length and fresh and dry weights of shoots and roots were determined. Roots were examined to count total nodules per plant and root of nematode inoculated plants were treated with Phloxine B (0.15g/l)to facilitate the counting of egg mass number. Statistical analysis of the data was done according to the (Fisher, 1950) factorial method.

RESULTS AND DISCUSSION

It has been shown that soyabean treated with *Meloidogyne incognita* supresses the growth of plants in all respect.

Root nodule number was also suppressed after treating the plant with effluents from brass and electroplating industries. It has been observed that as the percentage of effluents increases in the soil the production of nodules gets lesser and lesser. Table 1

Treatment of soybean plants, inoculated with *M. incognita* alone or together with B. japonicum suppressed the root-knot disease. Number of Egg masses were decreased after treating it with brass and steel industrial effluents, Table 2(a&b).

Table1: Effect of Brass and Electroplating Industrial Effluents on Egg Mass Number of *Meloidogyne incognita* on Soyabean

Treatments	Number of Egg Mass (site1)				Number of Egg Mass(site 2)			
	Effluents %				Effluents %			
	0	5 0	10 0	M M	0	5 0	10 0	M M
P	-	-	-	-	-	-	-	-
P +B	-	-	-	-	-	-	-	-
P + M i	33.6 0	23.8 0	16.2 0	24.5 3	33.6 0	14.4 0	10.0 0	19.3 3
P+B+M i	30.0 0	22.2 0	14.4 0	22.0 0	30.0 0	12.0 0	8.6 0	16.8 7
M M	31.8 0	23.0 0	15.3 0	-	31.8 0	13.2 0	9.3 0	-

CD at P = 0.05 Treatments = 1.91 Treatment = NS Effluent = 2.34 Effluent = 16.30
Treatments X Effluent = NS Treatments X Effluent = NS
MM = Means of mean B = Bradyrhizobium Mi = *Meloidogyne incognita*

Table 2 a : Effect of Brass and Electroplating Industrial Effluents on Bacterial Nodules Per Soyabean Plant Inoculated With *Meloidogyne incognita* (Site 1)

Treatments	No. of functional nodule				No. of total nodule			
	Effluents %				Effluents %			
	0	5 0	10 0	M M	0	5 0	10 0	M M
P	-	-	-	-	-	-	-	-
P + B	199.6 0	115.3 0	91.2 0	135.5 3	222.4 0	151.8 0	119.8 0	164.6 7
P + Mi -	-	-	-	-	-	-	-	-
P+B+M i	155.0 0	105.2 0	80.2 0	113.4 7	187.2 0	145.8 0	110.8 0	-
M M	117.3 0	110.5 0	58.7 0	-	204.8 0	148.8 0	115.3 0	-

Table 2 b : Effect of Brass and Electroplating Industrial Effluents on Bacterial Nodules Per Soyabean Plant Inoculated With *Meloidogyne incognita* (Site 2)

Treatments	No. of functional nodule				No. of total nodule			
	Effluents %				Effluents %			
	0	5 0	10 0	M M	0	5 0	10 0	M M
P	-	-	-	-	-	-	-	-
P + B	199.6 0	77.0 0	63.6 0	113.4 0	222.4 0	111.2 0	97.4 0	143.6 7
P + M i	-	-	-	-	-	-	-	-
P+B+M i	155.0 0	69.8 0	52.8 0	92.5 3	187.2 0	106.2 0	83.0 0	125.4 7
M M	117.3 0	73.4 0	52.8 0	-	204.8 0	108.7 0	90.2 0	-

CD at P = 0.05 Treatments = 1.91 Treatment = NS Effluent=2.34 Effluent = 16.30

Treatments X Effluent = NS Treatments X Effluent = NS

. = Means of mean B = Bradyrhizobium Mi = *Meloidogyne incognita*

Plant growth decreased in presence of *M. incognita* reduction in plant growth due to root knot nematode infection is caused by dis-functioning of the absorption and supply of water and minerals which help to alter the biochemistry of nematode.

Husaini and Seshadri (1975) and Bopaiah et al (1976) observed reduced disease intensity due to poor penetration of the nematode juveniles. Root galling showed an increase at 25 and 50%, but decreased at 75% and 100% brass ash. Gradual suppression in egg masses however, found at all the levels of brass ash. This happened due to presence of heavy metals in the effluents of brass and electroplating industries.

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