*Plant Pathology and Plant Nematology Laboratories, Department of Botany, Aligarh Muslim University, Aligarh-202002, India*

# EFFECT OF FLY ASH ON FEMALE MORPHOMETRICS OF *MELOIDOGYNE JAVANICA* ON PEA.

by
K. SINGH, M. W. KHAN and M. R. KHAN

**Summary**. *Meloidogyne javanica* females obtained from peas grown in 25, 50, 75 and 100% fly ash were significantly longer but rest of the morphometrics parameters decreased. Percent variation in the morphometrics was greater at 50% fly ash trements particularly in *Rhizobium leguminosarum* inoculated plants, in comparison to those of 25% or 75% fly ash levels.

Fly ash resulting from the burning of coal in thermal power plants in India tends to be dispersed on a wide area. It settles on the foliage of plants and accumulates in the soil. The accumulation of fly ash changes the physiochemical characteristics of soil (Adriano *et al.*, 1980; Elseewi *et al.*, 1981) which may be beneficial or harmful to soil microbes and to growing plants (Wong and Wong, 1989). The present study is concerned with the impact of fly ash on the development of the root-knot nematode *Meloidogyne javanica* (Treub) Chitw.

## Materials and methods

Fly ash was collected from the Kasimpur Thermal Power plant, Aligarh and mixed with field soil to obtain 25, 50, 75 and 100% fly ash volume/volume. The mixtures of field soil and fly ash were filled in 15 cm clay pots. Field soil, without fly ash was used as control. Surface sterilized seeds (dipped in 0.01% HgCl2 for 15 min.) of pea (*Pisum sativum* L.) cv. Rachna were sown in the pots.

Half of the pots in each treatment were planted with seeds that were inoculated with *Rhizobium leguminosarum* before sowing. After three weeks, each of the pots except the control were inoculated with freshly hatched second stage juveniles of *Meloidogyne javanica* (2000 J2/pot). Each treatment (Table I) was replicated five times. The experiment was terminated after 70 days from the inoculation.

For the measurement of body characters, 20 mature females were dissected from the galled roots in each of the treatments. The females were killed and fixed in FAA and stained in 0.1% acid fuchsin-lactophenol and then kept in lactophenol solution for 24 hs. The females were placed in cavity slides and examined under stereoscopic microscope. Lengths and widths of the body and neck, stylet knob width, and length and width of median bulb were measured with ocular micrometer.

Data presented in Table I were subjected to analysis of variance (ANOVA) and critical differences (C.D.) were calculated at $P = 0.05$ to identify significant effects.

## Results

Length of the body, neck, stylet and median bulb and width of the body, neck, stylet knob and median bulb of the females of *M. javanica* were significantly greater in those from nodulated peas than from non-nodulated. Body length was significantly greater at 50% fly ash, regardless of presence or absence of *R. leguminosarum* than those in nodulated or non-nodulated controls. However, the increase in body length at 25 and 75% fly ash was not significant. Rest of the parameters of morphometrics considered in the present study, were suppressed in the presence or absence of root nodule bacteria at 25, 50 and 75% fly ash levels. No females developed in roots of the plants growing in 100% fly ash (Table I).

## Discussion

Due to additional nitrogen fixation, nodulated peas would have provided suitable nutrition for the feeding of juveniles that subsequently developed into females. Amendments of soil with different fly ash levels influenced

*Table I - Effect of fly ash (% on morphometrics of females of Meloidogyne javanica on pea.*

| Treatments | Body length (µm) | Body width (µm) | Neck length (µm) | Neck width (µm) | Stylet length (µm) | Stylet knob width (µm) | Median bulb length (µm) | Median bulb width (µm) |
|---|---|---|---|---|---|---|---|---|
| P+N | 729.76±54.86 (7.52) | 353.45±22.29 (6.31) | 215.09±18.54 (8.62) | 68.42±0.669 (0.978) | 18.58±0.478 (2.57) | 3.48±0.027 (0.776) | 45.32±0.455 (1.00) | 34.13±0.664 (1.95) |
| P+R+N | 735.39±42.96 (5.84) | 394.37±21.57 (7.24) | 245.86±27.37 (11.11) | 81.36±0.950 (1.17) | 19.84±0.427 (2.15) | 3.56±0.016 (0.449) | 47.75±0.854 (1.79) | 35.51±0.226 (0.636) |
| P+N+ 25% | 731.15±54.25 (7.42) | 347.91±29.91 (8.60) | 220.48±23.53 (10.72) | 64.56±0.625 (0.968) | 18.17±0.090 (0.495) | 3.44±0.013 (0.378) | 34.00±1.30 (3.82) | 33.14±0.212 (0.640) |
| P+R+N +25% | 762.52±36.17 (4.74) | 388.46±20.89 (5.38) | 229.85±14.64 (6.37) | 72.69±0.499 (0.686) | 18.56±0.136 (0.733) | 3.50±0.045 (1.86) | 35.25±0.180 (0.511) | 34.18±0.410 (1.20) |
| P+N+ 50% | 809.05±27.75 (3.43) | 324.89±17.02 (5.24) | 232.75±16.85 (7.24) | 59.38±0.801 (1.35) | 17.84±0.097 (0.544) | 3.27±0.018 (0.550) | 32.17±0.241 (0.749) | 32.75±0.125 (0.382) |
| P+R+N +50% | 941.92±28.21 (2.99) | 345.60±30.50 (8.83) | 243.61±19.42 (7.98) | 66.71±0.396 (0.594) | 18.25±0.105 (0.575) | 3.42±0.020 (0.585) | 34.15±0.175 (0.512) | 33.00±0.215 (0.652) |
| P+N+ 75% | 751.48±28.89 (3.84) | 305.45±29.96 (9.81) | 252.46±13.74 (5.44) | 43.30±0.810 (1.87) | 16.08±0.123 (0.765) | 3.20±0.022 (0.688) | 28.60±0.263 (0.920) | 31.50±0.178 (0.565) |
| P+R+N +75% | 908.00±27.30 (3.01) | 322.51±28.59 (8.86) | 218.28±16.22 (6.65) | 51.59±0.505 (0.979) | 16.69±0.089 (0.533) | 3.29±0.021 (0.638) | 31.41±0.296 (0.942) | 30.83±0.185 (0.600) |
| P+N+ 100% | - | - | - | - | - | - | - | - |
| P+R+N +100% | - | - | - | - | - | - | - | - |
| C.D. at P=0.05 | 29.30 | 18.76 | 9.47 | 1.63 | 0.18 | 0.02 | 0.45 | 0.24 |

P = Plant, R = *Rhizobium leguminosarum*, N = Nematode (= *Meloidogyne javanica*); values in the table are mean of 20 mature females; figures in parentheses are coefficient of variation (CV); ± shows standard deviation (SD); - shows no females formed.

the morphometrics of the females of *M. javanica*; body length increased in fly ash amended soils and rest of the parameters were suppressed. Thus, a change in the plant physiology can influence nematode development (Wallace, 1969). Due to fly ash addition, physiological and/or biochemical activities of the plants may have been affected producing an indirect effect on the nematode development through the altered supply of nutrients.

The study demonstrated that fly ash addition to soil at 100% completely checked the development of the nematode and was injurious for peas as well. Lower levels of fly ash may be beneficial for crop cultivation in fields infested with root-knot nematodes as fly ash at 25 and 50% levels apparently caused hinderance in nematode development and at the same time provided utilizable nutrients for the plants.

Nitrogen was almost absent in the fly ash, which can cause severe deficiency in soil, but this deficiency can be supplemented by the application of nitrogen fixing bacteria. Hence, cultivation of leguminous crops seems feasible in the field contaminated with fly ash.

## Literature cited


ADRIANO D. C., PAGE A. L., ELSEEWI A. A., CHANG A. C. and STRAUGHAN I. A., 1980. Utilization and disposal of fly ash and other coal residues in terrestrial ecosystems. A review. *J. Environ. Quality, 9*: 333-344.

ELSEEWI A. A., GRIMM S. R., PAGE A. L. and STRAUGHAN I. R., 1981. Boron enrichment of plants and soils treated with coal ash. *J. Plant Nutrit., 3*: 409-427.

Wallace H. R., 1969. The influence of nematode numbers and of soil particle size, nutrients and temperature on the reproduction of *Meloidogyne javanica*. *Nematologica, 15*: 55-64.

WONG M. H. and WONG J. W. C., 1989. Germination and seedling growth of vegetable crops in fly ash amended soils. *Agricult. Ecosyst. Environ., 26*: 23-35.


Accepted for publication on 3 January 1994.