STUDIES ON ROTYLENCHULUS RENIFORMIS - A REVIEW

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ABSTRACT

Rotylenchulus reniformis is a semiendoparasite attacking the roots of pulse and vegetable crops. It feeds on pericycle and completes its life cycle within 22-32 days. The embryonic development lasts for 5-6 days, post embryonic development in water without feeding with 4 juvenile stage and young female. The young female is only infective stage which attains reniform shape within 8-10 days. It causes reduction in plant height, nodulation and yield coupled with lower protein content of the seed. The four weed plants viz: Ammi baccifera, Ludwigia, Corchorus acutunglutis and Aeschynomene indica are considered to be non host plants. The races are identified as A and B. It interacts with Fusarium solani Macrophomina phaseolina and causes considerable losses. It can be effectively managed by using pesticides.

Embryonic Development: Vadhera (1993) observed that the nematode laid single or rarely two celled stage egg with prominent nucleus in the centre. After 1 or 2 hr., first division occurred transversely giving rise to two blastomeres. In a span of 3-4 hours, the third division occurred in anterior cell resulting in three blastomeres. Third division also occurred transversely, splitting the posterior cell into two, giving rise to four blastomeres in 6-7 hr. Further, division was longitudinal up to eight cell stage which reached in 18-24 hr. Thereafter it was difficult to distinguish the sequence due to rapid cells division. Many celled stage reached after 36 hrs followed by tadpole stage in 72-76 hr. The first moult occurred inside the egg shell on the fifth day. Similar division of cleavages were noticed by Khan and Khan (1969). Sivakumar and Seshadri on Okra (1971) and Oteifa and Salem on cotton (1972).

Post Embryonic Development: The nematode was able to complete its post embryonic development in water and developed into adult females or adult males without feeding thus completing the preparasitic or free living phase. The post embryonic development consisted of four juvenile stages and the female with four molts, the first being inside the egg (Dasgupta and Raski, 1968; Sivakumar and Seshadri 1971 and Vadhera 1993). Individuals of different stages were differentiated on the basis of body, stylet and gonad development. The third and fourth stage juveniles were devoid of stylet, but not the second stage and adult. (Swarup et al., 1967; Sivakumar and Seshadri 1971; Oteifa and Salem 1972; Vadhera 1993). Differentiation of sex was discernible from third juvenile stage (Linford and Oliveira, 1940).

Post Infection Development: Vadhera (1993) inoculated young female (which is only the infective stage) on french bean seed-
lings and found that after 72 hr. of infection the changes in its morphology become apparent as bulging of vulval region. The region continues to enlarge and increase in girth and body remains prominent outside the host. Finally, the female attains the typical reniform shape within 8-10 days, while the terminal region of tail retains the typical acute shape (oteifa and salem on cotton 1972; Midha and Trivedi (1990) on black gram observed fully formed adult in 7 days. The result further showed that the female secretes a gelatinous matrix in which gravid female starts laying egg within 11-12th days and continues up to 15th day forming a complete eggmass whereas, Brathwite and Duncan (1974) on Sweet Potato reported that eggs were laid within 15-18 days of inoculation.

Life Cycle Span : Vadhera (1993) observed that life cycle of *R. reniformis* from egg to egg took 22 to 28 days on french bean while earlier reports indicate that it requires 29 days on castor (Nath *et al.*, 1969), 24-29 day on okra (Sivakumar and Seshadri 1971) and 32 days on cotton (Oteifa and Salem 1972). These differences in duration of life cycle appear to be due to host preference, temperature and environmental factors interacting in a complex way.

Host Physiology : The initial greening effect of inoculated plants as observed by Vadhera (1993) reflected the apparent changes in physiology of host to sustain the parasitic burden and its demand for nutrition from the host. The leaves become upright and progressive increase in yellowing during noon thereby suggested the tendency amongst the inoculated plant to show signs of water stress. The cotyledonary leaves appeared reduced in size and emergence of trifoliate leaves was delayed by 5 days. The flower setting delayed followed by 50 per cent obscission at higher inoculum level. Similarly, Nath *et al.* (1976) on *Trichosanthes dioica* reported that at higher inoculum level, leaf size was reduced and flowering was delayed by 10 to 15 days, but these observation differed from Sivakumar and Seshadri (1971). They found early flowering in castor. Further, Padhi and Mishra on french bean (1987), Patel and Thakur on mungbean (1988) and Vadhera on french bean (1995).

**Influence of inoculum level on plant growth:** Siddique (1961) on roots of mangifera indica, Chandrasakharan on castor (1964) and Padhi and Mishra on french bean (1987), Tiyagi and Alam on chickpea and Gaur (1981) reflected the apparent changes Alam (1987) on chickpea, Khani and Husain on cowpea (1989) and Vadhera *et al.* on french bean (1995) noticed that a week's old seedlings were highly susceptible to 10³ levels of *R. reniformis* but higher levels did not differ significantly in as much as three fold of damage is concerned. At lower level of inocula, the effect however was not pronounced but stimulatory effect on plant growth was noticed. The appraisel of fresh shoot and root weights and their ratio on french bean did not indicated significant difference in lower levels of inocula. Vadhera *et al.* (1995). But significant reduction in shoot and root weight was noticed at 1000 N and above level Padhi and Mishra (1987) on french bean similar reduction of fresh shoot and root weight has been also recorded by Singh *et al.* (1975) on soybean, Gupta and Yadav (1979) on urad, Mishra and Gaur (1981) on moth bean, Gupta and Yadav (1982) on *Vigna radiata* and Tiyagi and Alam (1987) on chickpea.

**Influence of inoculum on nematode population:** There was ten fold increase in population at 100 N and 1000 N levels which was further decreased at 10000 N levels to 1.2 fold and 4 fold at 10 N levels Gupta and Yadav, (1982) on urad, Tiyagi and Alam (1987) on chickpea, Khan and Husain, (1989) on cowpea, Vadhera *et al.* (1995) on french bean.

**Influence of inoculum on protein content:** Rebios *et al.* (1973) on soybean, Vadhera (1993) and Vadhera and Dave (2000)
Host Parasite Relationship: Vadhera (1993) observed that reniform nematode gained entry in French bean through epidermis, initially feeding on cortex which was envinced by increased in size of cortical cells, the nematode further penetrate and feed on pericycle. Similar finding was reported by Birchfield (1962) in cotton, Sivakumar and Seshadri (1972) in castor, Papaya and Tomato, Oteifa and Salem (1972) and Cohn (1973) on cotton, Heald (1975) on Cataloup and Patel (1986) in Tobacco.

Identification of Races: As early Brichfield and Brister (1962) reported the possibility of existence of races/biotypes in R. reniformis and later. Ayala (1962) suspected the races/biotypes in this nematodes. Dasgupta and Seshadri (1971) have reported races A and B Races, 'A' multiplied on castor, cowpea and cotton while Races B on cowpea only. Vadhera et al. (1995) noticed entirely different races of R. reniformis which failed to reproduce on castor.

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Inter relationship between Rotylenchulus reniformis and fungal pathogen: Vadhera et al. (1995) found that the incidence of foliage of shoot and root symptoms were maximum in simultaneous inoculation of R. reniformis and F. solani. The parasitism by R. reniformis not only increased the severity of disease but also induced vulnerability of plant to infection observed as reduction in incubation period for disease expression.

Vadhera et al. (1995) reported that when nematode and fungus cohabit the result-

Source of resistance: Vadhera (1993) tested agronomically accepted varieties of french bean for their relative susceptibility/resistance to R. reniformis revealed that Mahycon I and Mahycon II did not favour, the development of the nematode as no infective female was recorded on their root system. Except this information is not available on varieties resistance in french bean against R. reniformis.

Management: While studying the bioefficacy of carbendazim and Dithane Z-78 against F. solani and R. reniformis complex in french bean, Vadhera et al. (1997) noticed that fungicide were inhibitory to both the nematode and the fungus. Carbendazim @ 500 ppm resulted hundred per cent mortality of R. reniformis were as Dithane Z-78 @ 2000 ppm had only 25 per cent which is in confirmation to Shukla and Gopal Swarup (1974). They reported that Dithane Z-78, Thiram, phytolon significantly or completely inhibited the larval hatch of M. incognita in vitro but on the contrary, Sakhija et al. (1981) reported that carbendazim did not have any inhibitory effect on the emergence of Heterodera avenae, Vadhera et al. (1997) further observed that soil drenching with carbendazim and Dithane Z-78 in nematode fungus infested soil significantly increased the height and fresh and dry shoot root weight. Carbendazim inhibited the fungus and the nematode population completely but Dithane Z-78 had very little effect on nematode population in soil also. Khan and Husain (1988) and Iresholn (1988) reported that naturally infested soil of H. avenae treated with different dosages of benomyl had negative influence of multiplication. Rajendran & Naganathan (1981) reported that carbofuran at 2 kg.ai per ha. gave significant reduction in soil population of nematode and increased the papaya fruit yield by 38 per cent. Thionazin 4 kg/ ha. was found to be effective against R. reniformis (Reddy and Seshadri 1972).

CONCLUSION
The perusal of the literature on different aspects of R. reniformis revealed the following picture. The embryonic development completes its eight cell stage in 18-24 hr. beyond which the sequence of rapid cell division is not distinguishable. Many celled stage reaches after 36 hr followed by tadepole stage in 72-76 hr. The first moult occurs inside the egg shell on the 5th day. The nematode is capable of completing its post embryonic development in water and develops into female or adult males without feeding thus completes the preparasitic or free living phase. This stage consists of four juvenile stage and the young female with four moults. The third and fourth stage juvenile are devoid of stylet whereas, second stage and adult have stylet. Differentiation of sex is discernible from third juvenile stage.

Post infection development studies showed that young females are the only infective stage and attain typical reniform shape within 8-10 days. The female, thereafter secretes a gelatinous matrix and lays eggs within 11 to 15 days forming a complete egg mass. The nematode completes its life cycle from egg to egg in 22 to 32 days. Post infection changes
in the physiology of host brought about by *R. reniformis* were signs of water stress viz. reduced size of cotyledonary leaves, length of main and lateral roots, delayed emergence of trifoliate leaves and flower setting followed by occurrence of abscession.

In general, there was no impact of lower inoculum levels on root system but the dry weight of shoot and root was significantly decreased at 10,000 N level. Lower inoculum levels viz; 100 N and 1000 N increased the nematode population by ten fold where as, 1000 N had inhibitory effect. There was progressive decrease in number of *Rhizobium* nodules as the inoculum levels increase in logarithmic series. Influence of higher inoculum levels had inhibitory effect on protein content of the seeds. So far race A, B, and a new different race of *R. reniformis* has been identified in India. *R. reniformis* enters through root epidermis feeding on cortex and finally reaches to pericycle. Studies on interrelationship between *R. reniformis* and *Fusarium solani* in French bean revealed that simultaneous inoculation of these agents increase the severity of root rot. The nematode induce the vulnerability of plants to infection by *F. solani* and plays a dominant role in nematode fungal complex. Fifteen plant species are host of *R. reniformis* and Mahcon I and Mahycon II are only known resistance varieties of French bean. Although there are contradictory finding on the fungicidal control of the nematode and nematode fungal complex, however, most of authors have confirmed the inhibitory effect of carbendazim and Dithane Z-78.

REFERENCES

Swarup, Gopal, et al. (1967). *Indian Phytopath.* 22 (2) : 118-123.