

CP2527

INTERACTION OF ARBUSCULAR MYCORRHIZAL FUNGI (AMF) ISOLATED FROM HEALTHY HIGH YIELDING COCONUT PALMS WITH BURROWING NEMATODE, *RADOPHOLUS SIMILIS* ON COCONUT

V.K. SOSAMMA, P.K. KOSHY, RACHEL SAMUEL AND S.M. BINDU

Central Plantation Crops Research Institute,

Regional Station, Kayangulam, Krishnapuram-690533, Kerala

Abstract: An experiment was conducted under greenhouse conditions to find out the most effective mycorrhizal fungi suppressing *Radopholus similis* multiplication on coconut. The mycorrhizal isolates used were *Acaulospora bireticulata*, *Scutellospora coralloidea*, *Glomus macrocarpum* and *Sclerocystis rubiformis*. Among the different mycorrhizae inoculated individually, *A. bireticulata* supported maximum plant growth. The minimum growth characters and maximum multiplication of nematodes were recorded in plants that were inoculated with *R. similis* alone. On combined inoculation of mycorrhizae and *R. similis*, the maximum growth was recorded in plant inoculated with *A. bireticulata*. The mycorrhiza, *A. bireticulata* was found to multiply maximum on coconut compared to *G. macrocarpum*, *Scutellospora coralloidea* and *S. rubiformis* in nematode free as well as nematode inoculated plants. Nematode population was also lowest in plants inoculated with *A. bireticulata*.

The burrowing nematode, *Radopholus similis* (Cobb, 1993) Thorne, 1949 is an important nematode infesting coconut in India, known to cause lesions and rotting on roots, reduction in growth and yield of coconut palms (Koshy *et al.*, 1975; Koshy & Sosamma, 1994). Arbuscular mycorrhizal fungi, an obligate symbionts on most plant roots generally have a stimulatory effect on plant growth characters. In addition to this, the antagonistic effect of vesicular arbuscular mycorrhizae (VAM) to plant parasitic nematodes within the host roots is also well established (Fox & Spasoff, 1972; Hussey & Roncadori, 1978; Jain & Sethi, 1988). Lily (1975) was the first to report VAM association on coconut. Later nineteen species of arbuscular mycorrhizal fungi

(AMF) were isolated and identified from the coconut rhizosphere (Soşamma *et al.*, 1990). After a preliminary screening trial on coconut seedlings, a mixture of AMF viz. *Acaulospora bireticulata*, *Glomus macrocarpum*, *Sclerocystis rubiformis* and *Scutellospora coralloidea* were selected to find out the most effective mycorrhizal fungi suppressing *R. similis* multiplication on coconut under greenhouse conditions.

MATERIALS AND METHODS

Seednuts from healthy West Coast Tall (WCT) cocounut mother palms were selected and the nuts were dehusked leaving a tuft of fibres (mesocarp) intact above the fertile eye. These nuts were sown in steam sterilized soil in 35 cm earthen pots in the greenhouse and were watered with boiled

and cooled water (Koshy & Sosamma, 1978). After germination at three leaf stage, coconut seedlings of uniform growth were selected for the experiments and arranged in the greenhouse.

Mycorrhizal isolates of *Acaulospora breticulata* Rothw and Trappa, *Glomus macrocarpum* Tul. and Tul., *Sclerocystis rubiformis* Gerd. and Trape and *Scutellospora coralloidea* (Trappe, Gerd. & Ho.) Walker and Snaders isolated from elite coconut palms in the root (wilt) tract in Kerala were mass multiplied and maintained on coconut and sorghum nurse plants in culture pots in steam sterilized soil in open field conditions. Mycorrhizal inoculum consisted of 100 g soil and roots of sorghum nurse plants from the respective culture pots having about 200 spores was used. The nematode inoculum consisted of 100 *R. similis* (females and larvae) was axenically cultured on carrot discs. There were ten treatments with five replications each. The treatments were: T₁- *A. breticulata* alone, T₂- *S. coralloidea* alone, T₃- *G. macrocarpum* alone, T₄- *S. rubiformis* alone, T₅- *R. similis* alone, T₆- *A. breticulata* → *R. similis*, T₇- *S. coralloidea* → *R. similis*, T₈- *G. macrocarpum* → *R. similis*, T₉- *S. rubiformis* → *R. similis* and T₁₀- Control.

AMF inoculation was done 40 days prior to nematode inoculation. All the pots were kept in the greenhouse and the temperature varied from 27 to 34°C.

One year after inoculation the plants were depotted without damaging the root system and washed thoroughly to remove the adhering soil particles. Plant growth

parameters such as height, girth, total number of leaves, leaf length and breadth, root lesion index, fresh root and shoot weight were recorded. The soil in each pot was mixed well and three aliquotes of 250 g soil were processed using Cobb's sieving and decantation technique and the average of three was used for estimating the soil nematode population. Another three, 50 g soil samples were processed for the recovery of resting spores/sporocarps of AMF by wet sieving and decanting technique (Gerdemann & Nicolson, 1963). The average of three samples was used for estimating the total spores.

R. similis population in 50 g tender fresh main roots was estimated as per method of Koshy *et al.* (1975).

Five gram coconut root was cut into one cm bits. Thick primary roots were then cut longitudinally into four pieces and processed alongwith the tertiary roots. The root bits were processed by a slight modification of the methods of Philips & Hayman (1970) and Koske & Jemma (1989). The root bits were put overnight in 2.5% KOH solution. The roots were then washed in water, bleached in alkaline hydrogen peroxide, rinsed again in water and acidified by soaking in 1% HCL (20-25 vol.) for 1.24 h depending upon the hardness of the roots. Then the roots were stained using trypan blue in acidic glycerol. The stained root bits were processed between microscopic slides and the percentage root infection was assessed.

RESULTS AND DISCUSSION

The maximum growth characters were recorded in plants inoculated with the

TABLE 1. Interactive effect of burrowing nematode and different AMF on shoot and root growth characters of coconut seedlings (av. of 5 seedlings).

| Treatments | Height (cm) | Girth (cm) | No. of leaves | Total leaf area (cm ²) | Fresh shoot wt. (g) | Fresh root wt. (g) | Lesion index |
|----------------------------------|-------------|------------|---------------|------------------------------------|---------------------|--------------------|--------------|
| <i>A. bireticulata</i> | 298 | 15 | 7 | 8863.10 | 770 | 178 | . |
| <i>S. coralloidea</i> | 264 | 16 | 8 | 8313.26 | 716 | 166 | - |
| <i>G. macrocarpum</i> | 256 | 16 | 7 | 8526.40 | 816 | 156 | - |
| <i>S. rubiformis</i> | 242 | 15 | 7 | 8325.17 | 772 | 135 | - |
| <i>R. similis</i> | 172 | 15 | 7 | 7369.90 | 440 | 102 | 4 |
| A. b.→ <i>R. similis</i> | 202 | 15 | 8 | 7927.60 | 698 | 158 | 2 |
| <i>S. c.</i> → <i>R. similis</i> | 210 | 16 | 7 | 7655.41 | 508 | 148 | 2 |
| <i>G. m.</i> → <i>R. similis</i> | 238 | 15 | 7 | 7632.18 | 684 | 154 | 2 |
| <i>S. r.</i> → <i>R. similis</i> | 220 | 16 | 7 | 7520.40 | 620 | 151 | 2 |
| Control | 240 | 15 | 7 | 8124.76 | 688 | 140 | - |

mycorrhizae compared to plants without mycorrhizae. The minimum growth characters and maximum multiplication of nematodes was recorded in plants that were inoculated with *R. similis* alone. On combined inoculation of mycorrhizae and *R. similis*, the maximum growth was recorded in plants inoculated with *A. bireticulata* (Table 1 and 2). Among the mycorrhizae tried, *A. bireticulata* was found to multiply maximum on coconut compared to *G. macrocarpum*, *S. coralloidea* and *S. rubiformis* in nematode free as well as nematode inoculated plants. Maximum growth in terms of total plant height, girth, leaf area, fresh root and shoot weight was also recorded in plants inoculated with *A. bireticulata* alone. O'Bannon & Nemeč (1979) reported significantly greater growth in mycorrhizal lemon seedlings than that of non-mycorrhizal or seedlings inoculated with

TABLE 2. Interactive effect of burrowing nematode and different AMF on the population build up of *R. similis* and AMF on coconut seedlings.

| Treatments | Root (50g) | soil (250g) | Resting spore (50g soil) | Root infection |
|----------------------------------|------------|-------------|--------------------------|----------------|
| <i>A. bireticulata</i> | - | - | 140 | 84 |
| <i>S. coralloidea</i> | - | - | 83 | 72 |
| <i>G. macrocarpum</i> | - | - | 84 | 78 |
| <i>S. rubiformis</i> | - | - | 80 | 74 |
| <i>R. similis</i> | 186 | 23 | - | - |
| A. b.→ <i>R. similis</i> | 66 | 32 | 16 | 60 |
| <i>S. c.</i> → <i>R. similis</i> | 104 | 20 | 14 | 60 |
| <i>G. m.</i> → <i>R. similis</i> | 153 | 12 | 32 | 50 |
| <i>S. r.</i> → <i>R. similis</i> | 123 | 14 | 14 | 10 |
| Control | - | - | - | - |

R. similis. Nematode population in the root was highest in the seedlings inoculated with *R. similis* alone. Reduction in growth, shoot and root weights was also maximum in these plants which again proved the pathogenic effect of *R. similis* on coconut seedlings. Nematode population in soil and root was less in seedlings that were protected with AMF prior to nematode inoculation. This supports the fact that prior colonization of AMF in plant roots can reduce nematode multiplication. This is in agreement with the reports of Umesh *et al.* (1988) and Smith & Kalpan (1988). Root colonization of mycorrhizae was reduced in plants inoculated with nematodes, but in turn *R. similis* population in roots was also significantly reduced as a result of mycorrhization which shows both burrowing nematode and AMF are mutually inhibiting to each other in coconut roots.

REFERENCES

- Fox, J.H. & Spasoff, L. (1972). *J. Nematol.* 4: 224-225.
- Hussey, R.S. & Roncadori, R.W. (1978). *J. Nematol.* 10: 16-20.
- Jain, R.K. & Sethi, C.L. (1988). *Indian J. Nematol.* 18: 89-93.
- Koshy, P.K. & Sosamma, V.K. (1978). *Indian Coconut J.* 9: 4-5.
- Koshy, P.K. & Sosamma, V.K. (1994). International symposium on Plantation crops. (PLACROSYM. XI), 30th Nov.-3rd Dec. 1994, Calicut, Kerala.
- Koshy, P.K., Sosamma, V.K. & Radhakrishnan Nair, C.P. (1975). *Indian J. Nematol.* 5: 26-35.
- Koske, R.E. & Gemma, J.N. (1989). *Mycol. Res.* 92:486-505.
- Lily, V.G. (1975). *Curr. Sci.* 44: 201-202.
- O'Bannon, J.H. & Nemeč, S. (1979). *J. Nematol.* 11: 270-275.
- Philips, J.M. & Hayman, D.S. (1970). *Trans. Br. Mycol. Soc.* 55: 158-161.
- Smith, G.S. & Kalpan, D.T. (1988). *J. Nematol.* 20: 539-544.
- Sosamma, V.K., Sobha, A.T., Rachel Samuel & Rohini Iyer (1990). Proceedings of the seminar on Bioagents in Nematodes Management, July 13, 1990. IARI, New Delhi, 43 p.
- Umesh, K.C., Krishnappa, K. & Bagyaraj, D.J. (1988). *Indian J. Nematol.* 18: 6-11.