

M₃. This change might be due to the changes in genetic behaviour of either host pathogen or both of them⁷. The highest percentage of resistant plants in M₃ to bunt was 2.14 per cent. Out of 22920 tested plants, 244 resistant plants were selected. These preliminary results are in agreement with many researchers⁴, in which they found approximately the same percentage of resistant plants when gamma rays or EMS were used in wheat.

¹Abdel-Hak, T. M. and A. H. Kamel. Ind. Mut. Against pl. disease IAEA and FAO, Vienna 302, (1977).

²Al-Hassan, K. K. and A. H. Alwan. *Maj. Al-Zira Al-Iraqiya*, 29 : 5, (1973).

³Al-Shukry, M. M., *Maj. Al-Zira. Iraqiya* 2 : 210, (1958).

⁴Babayan, V. O. and B. A. Orgnesian. *Dok. Akad. Nauk. Arm. SSR* 53 : 262, (1971)

⁵Dodoff, D. and V. Todorova. *Bulgriah Acid, of Science* 25 : 181, (1974)

⁶Larter, E. N. and F. C. Elliot. *Can. J. Bot.* 34 : 817, (1958).

⁷Person, C. and G. Sidhu. Proc. of Panel Vienna, IAEA and FAO 31 : (1971)

⁸Swaminathan, M. S., E. A. Siddig, N. N. Savin and G. Varughese. *Proc. Panel Vienna IAEA* 233, (1968).

Received for publication April 29, 1983.

CP0684

Efficacy of three systemic fungicides in controlling *Phytophthora* infections of black pepper*

N. RAMACHANDRAN AND Y. R. SARMA

Central Plantation Crops Research Institute, Regional Station, P. B. No. 1,
Marikunnu—P. O., Calicut 673 012

Following the introduction of systemic fungicides having specific action against Pythiaceae fungi^{1,2} reports have appeared on the use of Ridomil and Aliette in controlling Peronosporales affecting various crops. In our earlier studies³, these chemicals were found to be effective in checking the growth and sporulation of '*Phytophthora palmivora*'—MF₄, which causes the foot rot or quick wilt disease of black pepper (*Piper nigrum*). The efficacy of three systemic fungicides viz., Ridomil, Terrazole and Aliette in controlling this infection is reported in this communication.

One year old plants of pepper hybrid Panniyur-I, raised in 10" dia earthen pots, each containing seven kg of nursery mixture (Sieved field soil, river sand and cowdung in the ratio 4 : 2 : 1 by volume) were used. The fungicides (i. e., Ridomil at the rate of 500 µg/ml; Terrazole at the rate of 700 µg/ml and Aliette at the rate of 2000 µg/ml) were applied as soil drench and foliar sprays at the rate of 1000 ml per plant. Ten single plant replications were maintained for each treatment besides ten untreated but inoculated plants serving as control.

The fungus '*Phytophthora palmivora*'—MF₄ was cultured on carrot agar medium and incubated at 25°C. Discs of one cm diameter were taken from the margins of four day old cultures and kept in Petri's mineral solution⁴ for four days to induce

sporangiogenesis. The culture discs were subjected to cold shock⁵ before inoculation. Inoculation was done ten days after the fungicide treatment by loosening the soil in the pots and keeping six discs of the fungus around the collar of each plant. The discs were covered with soil and the pots were watered copiously.

The plants were assessed for infection 30 days after inoculation. Root necrosis was evaluated based on a scale having one and four as minimum and maximum grade points, respectively. For the purpose of calculation, maximum grades were given to the plants that succumbed to infection.

To compare the persistence of the fungicides in the plant tissue, a minimum of ten leaves were clipped at random from each of the treatments and control, 40 days after treatment. The leaves were inoculated on the lower side on either side of the midrib. The inoculum was a 2mm. mycelial disc taken from the advancing margin of the colony and placed on a point with a pin prick injury. The leaves were incubated in humid petriplates for 72 hrs at $25 \pm 2^\circ\text{C}$. The diameters of the lesions were recorded. The inhibition of lesion development compared to control was calculated.

In this pot culture study, Ridomil treated plants showed the least root necrosis and death of the plants was not noticed (Table 1). Plants treated with Terrazole and Aliette had 10 per cent and 20 per cent deaths compared to 60 per cent in control. Root necrosis was comparatively higher in plants treated with these two chemicals. On statistical analysis, the means of the scores for root necrosis were found to be highly significant among the treatments. As an adjunct to the pot culture study pepper vines in the field were treated with Ridomil 5G at the rate of one g a.i./plant applied to the soil during July (South-west monsoon period). Eleven fungicide treated and eight control plants were artificially inoculated with 20 sporulating discs of '*P. palmivora*' ten days after treatment. Three treated (27 per cent) and five control (62 per cent) plants were infected. The persistent activity of Ridomil was present in the leaves even 40 days after treatment, Ridomil completely inhibited the lesion development, whereas Terrazole and Aliette inhibited the lesion formation to the extent of 55.7 per cent and 23.9 per cent respectively. It is reported that Ridomil at a concentration of more than one $\mu\text{g/g}$ of air dried soil is required to prevent the activity of *Phytophthora syringae*.⁶ The persistence of this concentration was obtained in the field for two, three and over four months by applying 0.5, 1.5 and 4 kg a. i./ha respectively. In the present study the concentration of the fungicide applied to the soil works out to 71.4 $\mu\text{g/g}$ of soil. Phytotoxicity of Ridomil is reported in potted citrus plants at 200 $\mu\text{g/ml}$.⁷ However no phytotoxicity was noticed in the present

TABLE 1 : Effect of fungicides on *Phytophthora* infection in black pepper.

Treatments	No. of plants infected*	Root necrosis** (grade average)
Ridomil	0	0.3
Terrazole	1	2.0
Aliette	2	1.9
Control	6	3.2

*Number of plants inoculated = 10; **Scale for root necrosis : Root necrosis 1-25 per cent = 1; 26-50 = 2; 51-75% = 3; 76% and above = 4. CD at 5 per cent = 0.89.

investigation. The poor protective effect of Aliette might be due to the low concentration used. Higher concentrations are to be tried in order to test its efficacy. In general all the three systemic fungicides are effective in checking the '*P. palmivora*' infection when compared to control.

The authors are thankful to Dr. M. K. Nair, Joint Director, Central Plantation Crops Research Institute, Regional Station, Calicut for going through the manuscript and suggesting improvements.

¹Schwinn, F., T. V. Staub and P. A. Urech. *Meded. Fac. Landbouwet. Rijksunvi Gent.* 42 : 1181-1188, (1977).

²William, D. J., B. G. W. Beach, D. Horriere and G. Marecha. *Proceedings, British Crop Protection Conference, Pests and diseases 2* : 565-573, (1977).

³Ramchaandran, N., Y. R. Sarma and K. K. N. Nambiar. In : *Phytophthora diseases of tropical cultivated plants*, pp. 248-251 Ed. K. K. N. Nambiar, Central Plantation Crops Research Institute, Kasaragod, pp. 284, (1982).

⁴In : *Plant Pathologist's pocket book*. Commonwealth Mycological Institute, London. pp. 267, (1968).

⁵Ribeiro, O. K. In : '*A source book of the genus Phytophthora*'. J. Cramer. Inder A. R. Gantner Verlag K. G., FL-9490 Vaduz. Germany, (1978)

⁶Austin, D. J., P. Alford and D. C. Harris. *Crop Protection Division, East Malling Research Stn. Report for 1980*. p. 94., (1980)

⁷Davis R. M. *Pl. Disease* 66 : 218-220, (1982).

Received for publication June 13, 1983.

Seed borne nature of *Alternaria alternata* in linseed and its detection

KUMUD KUMAR, S. K. GARG AND H. K. SAKSENA

Department of Plant Pathology, C. S. Azad University of Agriculture and Technology, Kanpur 208002

Amongst seed borne fungi⁵, *Alternaria alternata* (Fries) Keissler is an important and common pathogen, causing seed rot, seedling blight, leaf spot, black bud on many improved cultures of linseed like Heera, Neelam and Mukta in U. P.¹ The present paper deals with the comparison of different seed health testing methods for finding out the best method for the detection of *A. alternata* from linseed seeds. Five seed health testing methods were compared.

The fungus was identified by the presence of olivaceous black or black colonies containing simple or branched, long conidial chains on seed surface under stereoscopic binocular microscope. Conidia were obovoid or obclavate, muriform with or without beak. In pathogenicity tests the fungus produced typical disease symptoms on leaves, stem twigs and buds.

Eight seed samples, each consisting of two hundred seeds were used for comparing different seed health testing methods viz. standard blotter method with or without pretreatment with chlorine, agar plate method with PDA, 2,4-D blotter², deep