Pakistan J. Sci. Ind. Res., Vol. 29, No. 6, December 1986

LABORATORY EVALUATION OF SYSTEMIC FUNGICIDES FOR THE CONTROL OF ROOT-ROT FUNGI IN *PIPER BETLE* L. (PAN)

Naheed Anwar, S. Iftikhar Ahmed and Nigar Sultana

PCSIR Laboratories, Karachi-39

(Received December 2, 1985; revised September 4, 1986)

Comparative efficacy of five systemic fungicides, namely, Afugan, Benlate, Morocide, Saprol and Topsin has been examined under laboratory conditions against the fungi causing root-rot of *Piper betle* L. These include *Alternaria* sp.,*Botryodiplodia theobromae* Pat., *Cephalosporium curtipes* Sacc., *Colletotrichum capsici* (Syd.) Butl. & Bis. and *Fusarium vasinfectum* Atkin. Histograms have been provided, showing the percentage of inhibition caused by different concentrations of the above fungicides for each of the species involved.

Key words: Fungicide; Root-rot and *Piper betle.*

INTRODUCTION

Piper betle L. (Pan) leaves are widely used for chewing purposes in Pakistan. Since 1971 Pakistan has been importing these leaves in large quantities involving nearly Rs. 100 million annually. Since the demand is high, it sells for about Rs. 350/kg (approximately 20/- U.S. dollars). Keeping in view the regular demand and high price, efforts were made to cultivate these plants at different places, like Mirpur Sakro (Thattá), Nabi Sarwar, Mirpur Khas (Tharparkar), Manora, Karachi and Malir areas [1, 2].

These initial attempts indicated that the coastal areas of Karachi in the Indus delta are comparatively more suitable for its cultivation. A gradual increase in the number of pan farms has been noticed by us in the adjoining areas of Karachi, but uptil now the local production, unfortunately, has neither shown any impact on the local market nor on the overall import situation. It is therefore felt that expertise for its cultivation should be generated and more and more areas brought under the cultivation of *Piper betle.*

Surveys, interviews and observations revealed that the farmers in the outskirts of Karachi are faced with (I) root-rot complex, usually prevalent during rains and resulting in heavy losses of plants; and (ii) lack of proper management and knowledge about irrigation, light, humidity and nutritional requirements of this plant.

Keeping in view the losses incurred due to root-rot complex prevalent in the area, it was considered necessary that some experiments should be conducted regarding its control. The present paper deals with the comparative efficacy of five different systemic fungicides used against the casual fungi.

MATERIALS AND METHODS

The infected material used for the isolation of fungal organisms was obtained from the PCSIR experimental farms as well as pan farms around Malir.

Lesions and discoloured portions were examined under the dissecting microscope. Identifications were based on microscopic studies of the fruiting bodies of fungi present on the plant material as well as studies made on the fungal cultures grown on Czepek's Dox Agar medium. Pathogenicity tests were conducted. Specimens of the infected plants were preserved in dried form for ready reference. As a result of microscopic studies the fungi were identified as: *Alternaria* sp. [3, 4] (leaf, stem and root), *Botryodiplodia theobromae* Pat. [3, 4] (stem and root), *Cephalosporium curtipes* Sacc. [5, 6] (stem and root), *Colletotrichum capsici* (Syd.) Butl. & Bis [6, 7] (leaf, stem and root), and *Fusarium vasinfectum* Atkin [3, 7, 8] (leaf, stem, and root).

Since the above fungi were found responsible for causing root-rot and considerable plant loss, especially during the rainy season, it was considered appropriate to examine the comparative efficacy of some of the available fungicides against each fungus involved. Poison food technique was used [9]. Five of the systemic fungicides, i.e., Afugan, Benlate, Morocide, Saprol and Topsin were tested against the causal agents of root-rot. The concentrations of the commercial fungicides used were 10, 20, 30, 40, and 50 ppm. Two petri-plates of each concentra-

tion along with control were used for each of the five fungi involved in root-rot. In all experiments the plates were inoculated with 4 mm discs of the fungal mycelium obtained from the growing edges of four-day-old cultures. Incubation was carried out at 28-29°. All experiments were repeated thrice. Measurements of the diameter of fungal growth in different concentrations of fungicides and the control were taken, percentages of inhibition calculated and histograms prepared. Cases where the percentage of inhibition was not available owing to contaminations are represented by a dash. Histograms indicate the comparative efficacy of different fungicides against each of the fungus involved.

RESULTS AND DISCUSSION

The efficacy of different fungicides may differ with respect to different genera of fungi and even with respect to different species of the same genus [10, 11]. Considerable variation has been noticed in the effectiveness of different fungicides used (Afugan, Benlate, Morocide, Saprol and Topsin) in the present work, as indicated by histograms.

In the case of *Alternaria* sp. (Fig. 1) the maximum efficacy indicated by Morocide. was 58% inhibition at 50 ppm concentration, whereas Saprol stood second at the same concentration and showed 54% inhibition. The minimum effectiveness of 15% inhibition was shown by Topsin at 50 ppm concentration.

Maximum efficacy was indicated by Benlate against *Botryodiplodia theobromae* and 71% inhibition was noticed at 50 ppm concentration (Fig. 2). The second best was Topsin where 59% inhibition was recorded at 50 ppm concentration. Afugan was found least effective and the inhibition was 37% at 50 ppm concentration.

Benlate was again found most effective against *Cephalosporium curtipes*. Fungal growth was not observed in any concentration (Fig. 3), whereas Topsin was the second in line and there was no growth observed from 30 ppm onwards. It seems that the least effective against *Cephalosoporium curtipes* is Morocide, which causes 25% inhibition at 40 ppm concentration.

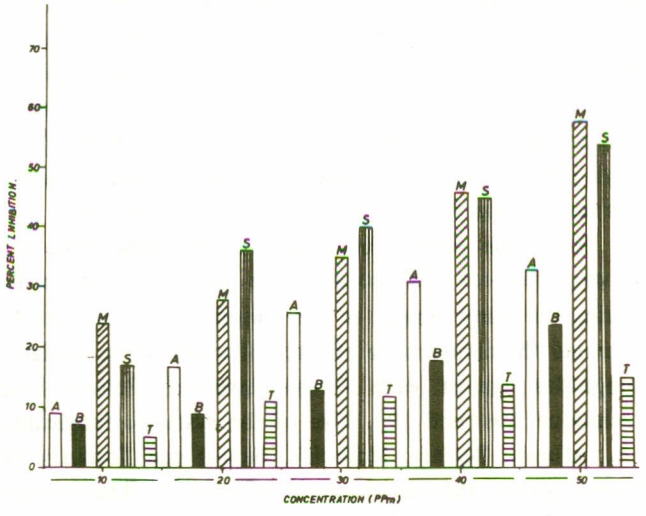

Fig. 1. Showing percentage inhibition of *Alterneria* sp. in Afugan (A), Benlate (B), Morocide (M), Saprol (S), and Topsin (T).

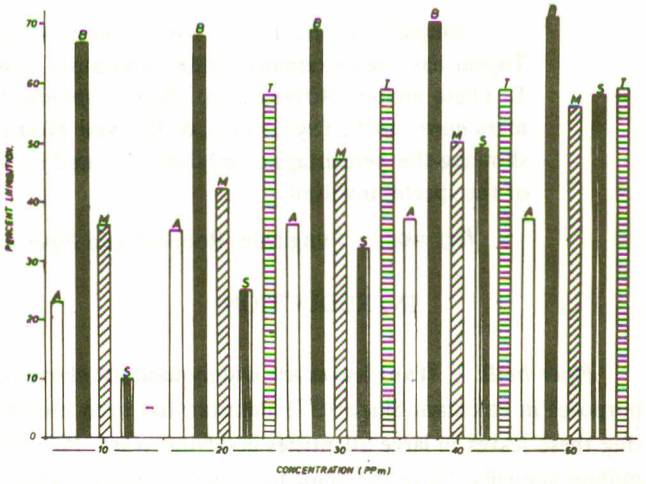

Fig. 2. Showing percentage inhibition of *Botryodiplodia theobromae* in Afugan (A), Benlate (B), Morocide (M), Saprol (S), and Topsin (T).

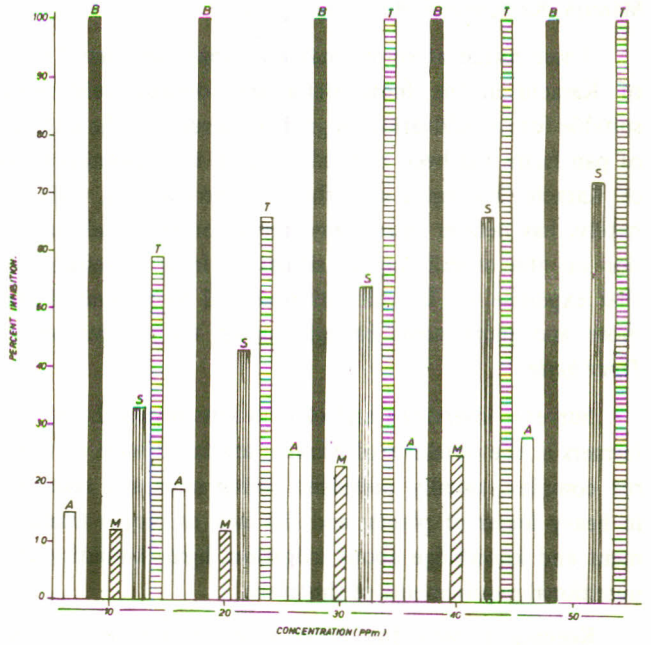

Fig. 3. Showing percentage inhibition of *Cephalosperium curtipes* in Afugan (A), Benlate (B), Morocide (M), Saprol (S), and Topsin (T).

Once against Benlate was found most effective as compared to other fungicides used against *Colletotrichum capsici* (Fig. 4). At 10 ppm concentration of this fungicide, 79% inhibition was achieved, whereas from 20 ppm concentration onwards it gave 80% inhibition uniformly.

Benlate also showed the maximum efficacy against *Fusarium vasinfectum* and absolutely no growth was observed in 10 ppm concentration onwards (Fig. 5). In the case of Topsin 88% inhibition was observed at 50 ppm. Afugan was the least effective and inhibition was 33% at 50 ppm concentration. In the light of these experiments and the data obtained, it is evident that Benlate is most effective amongst the five fungicides used. The root-rot fungi against which it has been found comparatively more effective include *Botryodiplodia theobromae, Cephalosporium curtipes, Colletotrichum capsici,* and *Fusarium vasinfectum.*

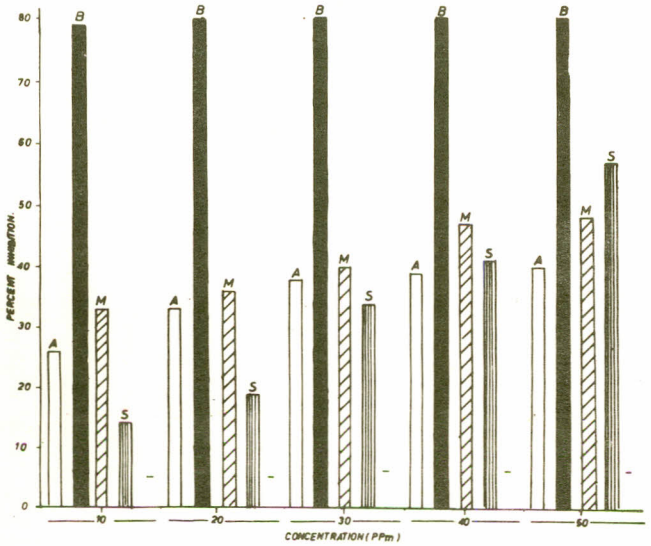

Fig. 4. Showing percentage inhibition of *Colletotrichum capsici* in Afugan (A), Benlate (B), Morocide (M), Saprol (S), and Topsin (T).

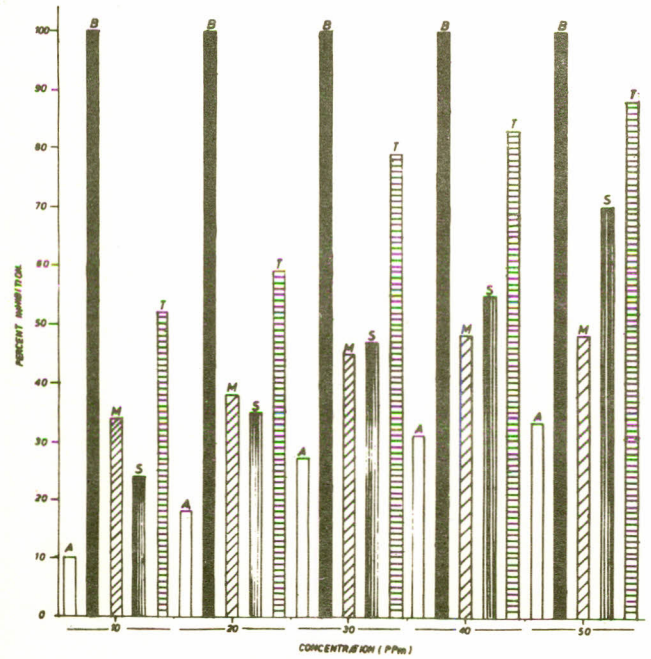

Fig. 5. Showing percentage inhibition of *Fusarium vasinfectum* in Afugan (A), Benlate (B), Morocide (M), Saprol (S), and Topsin (T).

As indicated from the above analysis of histograms, the growth inhibition of fungi is usually very prominent when the effect of Benlate is compared with others. For example, in the case of *Cephalosporium curtipes* no growth is found even in 10 ppm Benlate concentration, which means there is 100% control even at the lowest concentration used. On the contrary Topsin provides only 59 and 66% inhibition at 10 ppm and 20 ppm concentrations respectively and was placed second to Benlate. In the case of *Botryodiplodia theobromae* also, Benlate has shown maximum efficacy as compared to others.

It was not possible to record the percentage of inhibition of Topsin for *Colletotrichum capsici* owing to contamination in petriplates. However, Benlate is considered most effective for *Colletotrichum capsici* as well, since it gives 80% inhibition at 20 ppm concentration, whereas Morocide is considered the next best and gives only 48% inhibition at the maximum concentration of 50 ppm. Again, in the case of *Fusarium vasinfectum,* none is a match to Benlate. No growth has been recorded in 10 ppm Benlate onwards, whereas all other fungicides have *Fusarium* growth even in 50 ppm concentration. All these observations do indicate that Benlate is the most effective fungicide out of the five used against the five test fungi except *Alternaria* sp.

The *Alternaria* sp. is controlled better by Morocide as compared to other fungicides. However, the inhibition is only 58% at the highest concentration of 50 ppm.

Based on experience and present experiments, Banlate in combination with Morocide may be used for an effective control of root-rot of *Piper betle* mostly prevalent during rains.

REFERENCES

1. A. Hafiz and M. Ayub, Agr. Pakistan, **1**, 25 (1961).
2. S.I. Ahmed and N. Sultana, Bangladesh J. Sci. Ind. Res., **17**, 231 (1982).
3. J.C. Gillman, *"A Mannual of Soil Fungi"* (The Iowa State University Press, Iowa, USA, 1959).
4. H.L. Barnett, *"Illustrated Genera of Imperfect Fungi"*

(Burgess Publishing Company, USA, 1960).
5. A. Hafiz and K. Ghafoor, FAO Plant-Prot. Bull., **6**, 24 (1957).
6. A. Hafiz, K. Akber and M.M. Sheriff, Biologia, **2**, 216 (1956).
7. S. Hussain and Q.A. Ahmed, Agr. Pakistan, **14**, 204 (1963).
8. L. Gorden, Can. J. Bot., **30**, 209 (1952).
9. R. Falck, Wachstumgesetze, Wachstumfakotren and Temperaturwerten der holzerstorenden Mycelien, **1**, 53 (Jena) Abstr. in Centr. Bakt. Parasit und Infek., **20**, 348 (1908), cited by Oster and Golden (1953).
10. L.T. Richardson and D.M. Miller, Can. J. Bot., **38**, 163 (1960).
11. J.G. Horsfall and S. Rich Cont. Boyce Thompson Inst., **167**, 313 (1951).