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SENSITIVITY OF *PHYTOPHTHORA* SPECIES AFFECTING DIFFERENT PLANTATION CROPS IN KERALA TO METALAXYL

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Abstract : Metalaxyl sensitivity of 28 *Phytophthora* isolates obtained from seven hosts, namely, black pepper, arecanut, cardamom, rubber, cocoa, nutmeg and coconut was studied using poison bait technique. The estimated ED_{50} values of metalaxyl showed that arecanut isolates were the most sensitive, the lowest ED_{50} value being 0.01 μg/ml. Though variability to some extent was noticed among isolates of any host, almost all the isolates were quite sensitive to metalaxyl.

Keywords : *Phytophthora*, Metalaxyl, Spices, Plantation crops

The genus *Phytophthora* includes some of the most destructive plant pathogenic species causing serious diseases of both tropical and sub-tropical crops all over the world. Until recently, mainly contact fungicides were used to control diseases caused by this genus. Systemic fungicides with high efficacy against plant pathogenic fungi of this group were developed quite recently (Schwinn, 1977 and 1979; Urech *et al*, 1977; Cohen and Coffey, 1986). Metalaxyl, a phenylamide, is one such chemical which is being extensively used on many crops that are affected by *Phytophthora* spp.

Phytophthora spp. are responsible for large scale crop losses in many of the plantation and spice crops grown in Kerala, Karnataka and Tamil Nadu in India. The details of the diseases are given in Table 1. But information on the *in vitro* sensitivity of these *Phytophthora* spp. to metalaxyl is available only for a few crops (Kerkenaar and Kaars Sijpesteijn, 1981; Tey and Wood, 1983; Fuller and Gisi, 1985; Coffey *et al*, 1984). The present study was conducted to know the *in vitro* sensitivity of *Phytophthora* spp. from seven hosts to metalaxyl.

MATERIALS AND METHODS

Metalaxyl technical grade sample supplied by M/s Hindustan Ciba-Geigy Ltd, was used for the study. Stock solution of the fungicide was prepared using sterile distilled water, and appropriate quantities were incorporated into autoclaved corn meal agar medium before dispensing into petri plates. Three replicate plates of 10 cm dia, each containing about 16 ml medium, were maintained for each of the concentrations, namely, 0.01, 0.05, 0.1, 1.0 and 10.0 μg/ml. All the 28 *Phytophthora* isolates used in the study were from the collection maintained at National Research Centre for Spices, Calicut. They were isolated from the infected host samples collected from different parts of Kerala and were maintained on carrot agar slants.

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The inoculum was taken from the margins of three day old cultures grown on carrot agar medium. The fungicide amended medium was inoculated with 3 mm dia. culture discs and the culture plates were maintained in a BOD incubator at 25 ± 1°C. After 72 h of incubation, colony diameters were measured at two positions right angles to one another. The percentages of inhibition of the radial growth of the colonies in the metalaxyl amended medium were calculated compared to that in the unamended corn meal agar. The regression analysis was carried out and the dosage response slopes were obtained by plotting the log (100 × concentration) and probit values of inhibition percentages (Fig. 1). The ranges of ED_{50} and ED_{90} values of metalaxyl calculated for *Phytophthora* isolates from different hosts are given in Table 2.

RESULTS AND DISCUSSION

Phytophthora isolates from black pepper, arecanut, cardamom and cocoa showed wider variabilities in their sensitivity to metalaxyl compared to those of rubber and nutmeg. Of all the isolates tested, those from arecanut showed the highest sensitivity to metalaxyl, the lowest ED_{50} value being 0.04 μg/ml. Black pepper and cocoa isolates were comparatively less sensitive and the maximum ED_{50} values obtained were 1.63 μg/ml and 1.49 μg/ml respectively.

Considerable variability in the sensitivity of *Phytophthora* isolates to metalaxyl was observed in the present study. It is known that various species of *Phytophthora* differ in their response to metalaxyl (Fuller and Gisi, 1985; Farih *et al.* 1981; Karkenaar and Kaars Sijpesteijn, 1981). Wide variability is reported even among the isolates (Hunger *et al.* 1982; Shew, 1984) and races (Bruck *et al*, 1980) within a single species. The reported ED_{50} values for *Phytophthora palmivora* isolates from cocoa are 0.2 μg/ml (Fuller and Gisi, 1985) and 0.7 μg/ml (Tey and Wood, 1983), and they are within the ranges of ED_{50} values for isolates that we have studied. An ED_{50} value of 10 μg/ml for an isolate of *Phytophthora palmivora* from rubber was reported (Kerkenaar and Kaars Sijpesteijn, 1981) in comparison with the range of 0.21 0.42 μg/ml in the present study. Conditions,

TABLE 1 : Diseases caused by *Phytophthora* species in different plantation crops

Crop	Disease	*Phytophthora* spp.
Black pepper (*Piper nigrum* L.)	Quick wilt or foot rot	*P. palmivora* MF 4 (Morphological Form 4)
Cardamom (*Elettaria cardamomum*)	Azhukal or capsule rot	*P. meadii*
Rubber (*Hevea brasiliensis*)	Abnormal leaf fall, pod rot, bark rot, patch canker	*P. palmivora*, *P. meadii*, *P. nicotianae* var *parasitica*, *P. botryosa*
Arecanut (*Areca catechu*)	Koleroga, *Mahali* or fruit rot	*P. arecae*
Cocoa (*Theobroma cacao*)	Black pod and stem canker	*P. palmivora*
Coconut (*Cocos nucifera*)	Bud rot and nut fall	*P. palmivora*

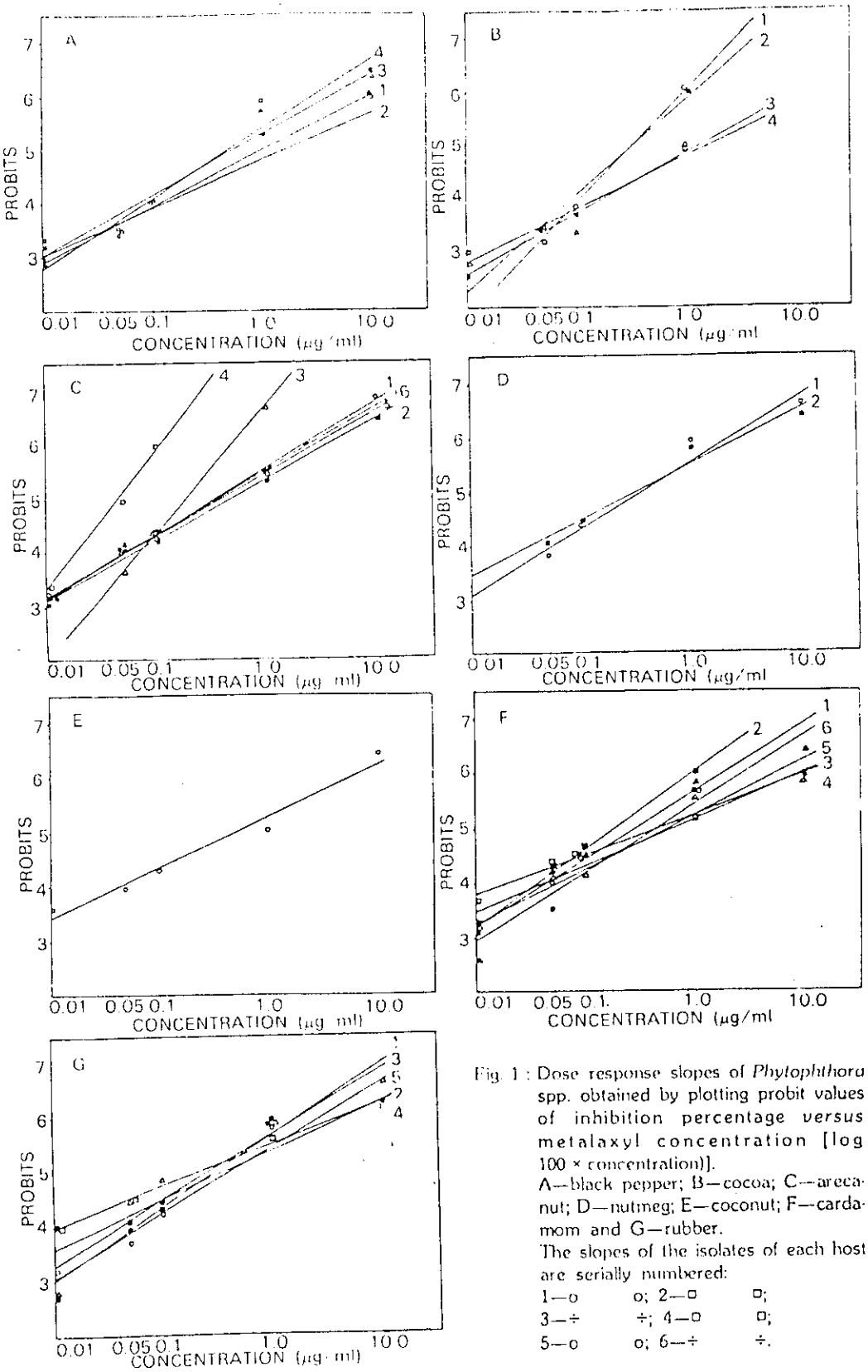

Fig. 1 : Dose response slopes of *Phytophthora* spp. obtained by plotting probit values of inhibition percentage *versus* metalaxyl concentration [log 100 × concentration)].
A—black pepper; B—cocoa; C—arecanut; D—nutmeg; E—coconut; F—cardamom and G—rubber.
The slopes of the isolates of each host are serially numbered:
1—o o; 2—□ □;
3—÷ ÷; 4—□ □;
5—o o; 6—÷ ÷.

TABLE 2 : Sensitivity to metalaxyl of *Phytophthora* spp. from different hosts

Host	No. of isolates tested	Sensitivity range (μg/ml)	
		ED_{50}	ED_{90}
Arecanut (*P. arecae*)	6	0.04-0.49	0.14-7.11
Black pepper (*P. palmivora*)	4	0.45-1.63	1.31-43.6
Cardamom (*P. meadii*)	6	0.17-0.64	1.38-28.36
Cocoa (*P. palmivora*)	4	0.32-1.49	1.31-28.97
Coconut (*P. palmivora*)	1	0.47	10.63
Nutmeg (*Phytophthora* sp.)	2	0.32 and 0.34	5.61 and 3.72
Rubber (*P. palmivora*)	5	0.21-0.42	2.77-11.36

such as culture media, incubation temperature and incubation period are known to affect the sensitivity of metalaxyl to *Phytophthora* (Fuller and Gisi, 1985; Shew, 1984). Inspite of the variability noticed, all the isolates tested were found to be highly sensitive to metalaxyl *in vitro*.

Since sensitivities of *Phytophthora* to metalaxyl both *in vitro* and *in vivo* were found to be similar (Shew, 1985; Staub and Young, 1980), the information obtained through this study will help in deciding the fungicide concentrations for controlling Phytophthora diseases in plantation crops.

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