1495

Proceedings of Placrosym XV (2002): 572-575

EVALUATION OF DUST FORMULATION OF HEXACONAZOLE FOR THE CONTROL OF POWDERY MILDEW DISEASE OF *HEVEA BRASILIENSIS*

E. Edwin Prem, Manju, M. J.*, Sadanand K. Mushrif, Sabu P. Idicula and C. Kuruvilla Jacob

Rubber Research Institute Of India, Kottayam-686 009, Kerala

*Hevea Breeding Research Station, Kadaba - 574 221, Karnataka

ABSTRACT

Field experiments were conducted to evaluate a triazole fungicide, hexaconazole, for the management of powdery mildew disease of rubber (*Hevea brasiliensis*) caused by *Oidium heveae* Steinm. on a susceptible clone PB 5/51 in Cheruvally estate, Kottayam, Kerala and also in a disease-prone area on clone RRIM 600 in Vaikundam estate, Kanyakumari district, Tamil Nadu for four seasons (1999 to 2002). Hexaconazole (2%) dust was evaluated as such and in alternate schedule with sulphur and in combination with recommended sulphur fungicide and at three concentrations. Results indicated that application of hexaconazole (2%) as such and in alternate schedule with sulphur was found to give better control. Combination of hexaconazole (2%) and sulphur and hexaconazole (1%) as such were observed to reduce powdery mildew disease. Alternate use of hexaconazole with sulphur is suggested to avoid the development of resistant strains.

INTRODUCTION

Powdery mildew disease of rubber caused by *Oidium heveae* Steinm. casues severe defoliation of young leaves during refoliation after wintering. The resultant poor canopy and vigour of trees reduce yield (Radziah *et al.* 1992; Jacob *et al.*, 1996). Protective dusting of sulphur fungicide either as dust or wettable powder has been in practice as a conventional method for the control of powdery mildew disease of rubber in all rubber growing countries. Four to six rounds of sulphur are to be applied at five to seven-day-intervals throughout the period of refoliation. (Ramakrishnan and Pillai,1962; Wastie and Mainstone, 1969). Low volume ground spraying of systemic fungicides in oil was recommended as an alternative to sulphur dusting in Malaysia (Lim, 1976). Fogging oil-based tridemorph-in-oil was reported from Malaysia and Brazil (Lim, 1982). Thermal fogging of tridemorph was also reported to be effective (Edathil *et al.*, 1984; Radziah *et al.*, 1992). Thermal fogging did not gain popularity due to fire hazards. The use of dust formulation of tridemorph (Edathil *et al.*, 1988) and integrated approach with tridemorph and sulphur dust were found to be effective (Edathil *et al.*, 1992). Carbendazim dust has proved to be effective and could be used in integration with sulphur (Jacob *et al.*, 1996). The present investigation was undertaken to evaluate hexaconazole, a triazole group systemic fungicide for controlling the powdery mildew disease of rubber.

MATERIALS AND METHODS

Field experiments were laid out in Cheruvally estate in Kottayam district, Kerala for three disease seasons (1999,2000, and 2002) and in another disease-prone location of Vaikundam estate in Kanyakumari district in Tamil Nadu (2001). The clones included were PB 5/51 and RRIM 600 respectively. During 1999, efficacy of the hexaconazole and sulphur combination was compared with both the fungicides alone while in 2000, dust formulation of carbendazim (1.5%), tridemorph (1.5%) and hexaconazole (2%) as such and in integration with sulphur was evaluated. An attempt was made to reduce the concentration of hexaconazole and accordingly hexaconazole at 0.2% and 2% concentration in 2001 and 1% and 2% in 2002 was evaluated. The recommended fungicide sulphur dust (70%) was maintained as control in all the trials. Undusted control could not be maintained in few seasons due to pressure from estate management. Dusting of fungicide was undertaken using power-operated micron sprayer-cum-duster. First round of dusting was given depending on the time of refoliation when about 10 per cent of the trees had bud break. Three rounds of dusting were given at an interval of 10 days at Cheruvally estate. At Vaikundam estate, four rounds of dusting were undertaken at seven-day-interval due to high inoculum load. The dosages of fungicides tested are presented in Table. 1. The disease intensity was assessed after each round of dusting by grading diseased leaves on a

0 – 4 scale based on the percentage leaf area infected. Percentage disease index (PDI) was calculated (Horsfall and Heuberger,1942) and analysed statistically.

RESULTS AND DISCUSSION

The results in the trial conducted at Cheruvally estate during 1999 indicated no significant difference among the treatments. (Table. 2). The combination of sulphur and hexaconazole (2%) recorded 33.05 per cent disease intensity. Sulphur dusted plots recorded the maximum disease. Evaluation of different schedule of application of systemic dust formulations during 2000 showed less disease in all the plots where hexaconazole (2%) was included and hexaconazole treatments were on par with sulphur. (Table. 3). The lowest disease intensity was observed in plot alternatively dusted with sulphur and hexaconazole (2%) and maximum disease was recorded in the plots dusted alternatively with sulphur and carbendazim (1.5%), followed by sulphur and tridemorph (1.5%). Results on the evaluation of the efficacy of different concentrations (0.2% and 2%) of hexaconazole on powdery mildew disease at Vaikundam estate during 2001 revealed significant control with hexaconazole (2%) dust formulation. (Table. 4). Hexaconazole (0.2%) dust recorded the highest disease intensity. Sulphur was on par with hexaconazole (2%). In the trials at Cheruvally estate for the evaluation of 1 and 2 per cent hexaconazole dust formulations during 2002, higher disease intensity was observed in all the treatments. (Table.5). Hexaconazole 1 and 2 per cent were found to be significantly superior to sulphur. Maximum disease intensity (76.86%) was recorded in sulphur dusted plot, whereas hexaconazole 1 and 2 per cent were on par.

Powdery mildew disease is known to be very severe in Kanyakumari district (Pillai *et al.*, 1960) and crop loss of about 13.5 to 28 per cent was recorded in clone RRIM 600 (Jacob *et al.* 1992). In the same agroclimatic region, significant control of powdery mildew disease was obtained using hexaconazole (2%) on RRIM 600 during 2001. However, high disease intensity was observed during 1999 and 2002 seasons on a more susceptible clone PB 5/51. In rubber, application of five rounds of hexaconazole @50g/ha gave better control and good canopy density (Shamshuri *et al.*,1997). Effectiveness of hexaconazole in reducing the severity on the powdery mildew of *Lathyrus sativus* L. caused by *Erysiphe pisi* was reported by Malani *et al.* (1998). Topper *et al.* (1999) observed that hexaconazole was more effective than sulphur dust on the powdery mildew of cashew caused by *Oidium anacardii*. In the present study, hexaconazole(2%) was proved to be effective. Four rounds of hexaconazole (2%) application reduced the disease intensity as much as 16.75 and 17.12 per cent during 2000 and 2001 seasons at Cheruvally and Vaikundam estate respectively but comparable with sulphur.

Systemic fungicides by virtue of its penetration and improved distribution suffer less surface weathering and consequently show better disease control (Evans,1971). This is relevant in rubber as disease control operations are hampered by intermittent rains and use of contact fungicides becomes less effective in such situations. Whereas repeated use of a systemic fungicides could lead to development of resistance in the pathogen due to specific mode of action. This can be overcome by the use of fungicides with different mechanisms of action either as mixure or alternatively (Delp, 1980; Staub,1991). Hence, the alternate use of hexaconazole with sulphur can form an effective control measure.

Table 1. Dosage and concentration of the dust formulation of evaluated fungicides

Chemical Name	Trade Name	Concentration (%)	Dosage(Kg/ha)
Carbendazim (C)	Bavistin	1.5	7
Hexaconazole (H)	Contaf	0.2, 1 & 2	7
Tridemorph (T)	Calixin	1.5	7
Sulphur (S)	Sulphur	70	12

Table 2. Powdery mildew disease intensity in clone PB 5/51 (1999)

Treatments	Percentage Disease Index
Sulphur	41.30
Hexaconazole (2%)	39.13
Hexaconazole (2%)+Sulphur	33.05
CD (P=0.05)	NS

Table 3. Powdery mildew disease intensity in clone PB 5/51 under different schedule of dusting (2000)

Treatment schedule				Percentage Disease Index
1	2	3	4	
S	C	S	C	31.57
S	T	S	T	30.87
S	H	S	H	11.87
H	H	H	H	16.75
H+S	H+S	H+S	H+S	14.37
S	S	S	S	14.10
CD (P=0.05)				5.26

Table 4. Effect of different concentration of hexaconazole on powdery mildew disease intensity in clone RRIM 600 (2001)

Treatments	Percentage Disease Index
Hexaconazole(2%)	17.12
Hexaconazole(0.2%)	52.62
Sulphur	23.00
CD (P=0.05)	12.88

Table 5. Effect of different concentration of hexaconazole on powdery mildew disease intensity in clone PB 5/51 (2002)

Treatments	Percentage Disease Index
Sulphur	76.86
Hexaconazole (1%)	63.02
Hexaconazole (2%)	61.98
CD (P=0.05)	12.44

ACKNOWLEDGEMENT

The authors wish to express their gratitude to Dr. N. M . Mathew for the facilities provided for the studies. The co-operation extended by the management of Cheruvally and Vaikundam estates is gratefully acknowledged.

REFERENCES

Delp, C.J. 1980. Coping with resistance to plant disease control agents. *Plant Disease*, **64**: 652-657

Edathil, T.T., Krishnankutty,V. and Jacob,C.K. 1984. Thermal fogging. A new method for controlling powdery mildew disease of rubber in India. *Pesticides*, **18**(5): 35-36

Edathil, T.T., Krishnankutty,V., Idicula, S.P. and Jayarathnam, K. 1988. Powdery mildew disease management in *Hevea brasiliensis* using non-sulphur fungicides. *Indian Journal of Natural Rubber Research*, **1**(2): 61-65

Edathil, T.T., Krishnankutty,V., Idicula, S.P. and Jayarathnam, K. 1992. Economic and effective management of powdery mildew disease of *Hevea* rubber in South India. *Journal of Plantation Crops*, **20**(Supplement): 61-64

Evans, E. 1971. Systemic fungicides in practice. *Pesticide Science*, **2**: 192-196

Horsfall, J. G. and Heuberger, J. W. 1942. Measuring the magnitude of a defoliation disease of tomato. *Phytopathology*, **32**: 226-232

Jacob, C.K., Edathil,T.T., Idicula, S.P. and Jayarathnam,K. 1992. Effect of powdery mildew disease on the yield of rubber trees in Kanyakumari district. *Indian Journal of Natural Rubber Research*, **5** (1&2): 245-247

Jacob, C.K., Idicula, S.P., Edathil,T.T. and Jayarathnam,K. 1996. Evaluation of dust formulation of two systemic fungicides for the control of powdery mildew disease of *Hevea brasiliensis*. *Journal of Plantation Crops*, **24** (Supplement): 229-232

Lim,T.M. 1976. Low volume spraying of an oil-based systemic fungicide for controlling *Oidium* secondary leaf fall . In : *Proceedings of RRIM Planter's Conference*,1976, Kuala Lumpur, Malaysia, pp.231-242

Lim,T.M. 1982. Fogging as a technique for controlling rubber leaf disease in Malaysia and Brazil. *Planter*, 58: 197-212

Malani, S.S., Khare, N., Lakpale, N. and Rajivekumar. 1998. Efficacy of some fungicides against powdery mildew of grasspea (*Lathyrus sativus* L). *Annals of Plant Protection Sciences*, 6(2): 131-135

Radziah, N.Z., Hashim, K and Shamshuri, M.H. 1992. Effect of selected fungicides on *Oidium heveae* and *Corticium salmonicolor* affecting rubber in West Malaysia. *Indian Journal of Natural Rubber Research*, 5 (1&2) : 66-72

Ramakrishnan, T.S. and Pillai, P.N.R. 1962. Powdery mildew of rubber caused by *Oidium heveae* Steinm. *Rubber Board Bulletin*, 5: 187-201

Shamshuri, M.H., Radziah,N.Z., Shamsulkumar, A. S. and Hashim.I. 1997. *IRRDB Symposium on Natural Rubber. Volume II: Physiology and Exploitation and Crop Protection and Planting Methods Sessions*. Ho Chi Minh City, Vietnam,14-15 October 1997. pp 92-100

Staub, T. 1991. Fungicide resistance: Practical experience with anti-resistance strategies and the role of integrated use. *Annual Review of Phytopathology*, 29: 421-442

Topper, C.P., Boma, F. and Mhando,H. 1999. Evaluation of fungicides for the control of powdery mildew (*Oidium anacardii* Noock) on cashew in Tanzania. A. Fungicide development trials. In : *Proceedings of the International Cashew and Coconut Conference: Trees for life – the key to development*, Dar es Salaam, Tanzania, 17-21, February 1997

Wastie, R.L. and Mainstone, B.J. 1969. Economics of controlling secondary leaf fall of *Hevea* caused by *Oidium heveae* Steinm. *Journal of Rubber Research Institute of Malaysia*, 21(1):64

* * *