SCREENING AND ECONOMICS OF SOME PYRETHROID INSECTICIDES AGAINST POWDER POST BEETLES

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Abstract

Synthetic pyrethroids Sherpa, Ripcord in 0.1%, 0.2% and 0.5%, Cyperkill, Sunmerin and Bulldock in 0.5% concentrations proved the most effective upto 16 months against powder post beetles attacking the fuel wood. In single spray Sherpa afforded 88, 92, 95% protection in 0.1%, 0.2%, 0.5% concentrations, while Ripcord protected 82, 90, 95% billets in the same concentrations for the same period. Cyperkill, Sunmerin and Bulldock in 0.5% concentration gave 82, 95 and 91% protection of billets, respectively as compared to control in which 41% billets remained safe from beetles' infestation. Sherpa and Ripcord in 0.1%,0.2%,0.5% gave net benefit over control of Rs. 9561, 9102, 7732 and 8292, 8442, 7757 per 1000 cft, respectively. Sunmerin (0.2%) and Bulldock (0.5%) gave net benefit of Rs. 8812 and 8965, respectively for the same volume of wood. Sundophos and Laser are the least effective and persistent, giving maximum net benefit of Rs. 4295 and 4224, respectively.

Introduction

Bostrychid beetles are the most polyphagous and destructive felled wood pest species attacking preferably leguminous tree. Among them *Sinoxylon anale* and *S. crassum* are the most common. The grubs feed by making tunnels in sap wood, thus render whole wood in powder. Nevertheless, severe attack has also been reported on standing trees in Israel and Thailand (Argaman, 1987; Hutacharern and Choldumrongkul, 1989). According to Chaudhry (1988), 30-50% firewood worth Rs 150 million is destroyed annually by these beetles within few months after felling. The loss to furniture, timber wood , boxes, packing cases, etc. is many folds than fire wood.

To prevent this colossal loss of wood, chlorinated hydrocarbons like dieldrin and heptachlor were successfully used against powder post beetles in

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irrigated plantations (Chaudhry, 1960). Similarly BHC, boric acid equivalent/ borax and/or debarking were successfully used for preventing planks of packing-case, logs in storage and saw mills (Anonymous, 1982; Gnanaharan *et al.*, 1982; Gnanaharan *et al.*, 1983; Gnanaharan *et al.*, 1985). But recently chlorinated hydrocarbons have been banned because of their carcinogenic and other negative effects on environment. Therefore, substitute like synthetic pyrethroids are tried for working out their affectivity, environmental safety and economics. Gul and Chaudhry (1991) have obtained 88%, 100% and 95% protection of billets from powder post beetles attack when treated with pyrethroids Perigen, Cypermethrin and Cislin, respectively.

In the light of these successes, present study was carried out with 6 pyrethroids and one phosphatic insecticide against *S. anale* and *S. crassum* for protecting the fuelwood.

Materials and Methods

Pyrethroids-Sherpa 5%EC, Cyperkill 5%EC, Ripcord 10%EC, Laser 25%EC, Sunmerin 5%EC, Bulldock 25%EC, and phosphatic-Sundophos 50%EC, were tested against powder post beetles (*Sinoxylon anale* and *S. crassum*) at Changa Manga, during February, 1994 at the rate of 0.1%, 0.2%, 0.5%, for evaluating their effectiveness, persistence and economics on stacks of 50 billets ($1.4m^3$) each of freshly felled shisham free of powder post beetles attack. Observations on protection were recorded after 3, 6 and 16 months. The infestation data were analyzed by analysis of variance and least significant difference test.

Economics for each insecticide was calculated according to the procedure of Chaudhry (1960) i.e; treatment cost of insecticide included cost of insecticide for one spray plus treatment expenses for 1000 cft. The number of holes per billet were counted and on the basis of these holes loss in weight of firewood was calculated. It was determined that 50 holes per 40 kg firewood caused 30% loss of weight, keeping this one as standard, loss of weight in different treatments was calculated and converted into monetary terms. On the average 35.31 cft fuel wood was taken equal to 700 Kg and market price of fuel wood was Rs. 65/40 Kg. The treatment cost and monetary loss were added up and subtracted from monetary loss of control to obtain net benefit.

Results

Observations recorded on percent protection of billets are presented in Table 1. All the test insecticides, protected billets from powder post beetles attack, are statistically significant. After 3 months Sherpa (0.5%) gave 100% protection of billets 0.5% dose as against 19% infestation in the control. Albeit the insecticides have protected billets significantly higher over control, however the concentrations in trial did not differ significantly among themselves except Cyperkill ($P<0.05$). Similarly after 6 months all insecticides under trial have given significant high protection over control. In single spray maximum of 99% protection was afforded by Sherpa (0.5%), Ripcord (0.5%), Bulldock (0.5%) and Cyperkill (0.2%) while in control 43% billets were infested by *S. anale* and *S.crassum*. So far individual comparison of different concentrations within insecticides is concerned there was insignificant difference among all test insecticides except Laser where 0.1% concentration differed from 0.5%. Likewise, difference among Sherpa, Cyperkill, Ripcord, Sunmerin, Bulldock and Laser (0.5%) was insignificant. The three test concentrations of Cyperkill were non significant while they differed considerably from Sundophos and Laser. The Sundophos was the least effective among the test insecticides Table 1.

In case of double spray after 6 months maximum (100%) and minimum (57%) protection was recorded in Sherpa (0.5%) and control, respectively. Besides Cyperkill and Sundophos concentrations of all other insecticides did not differ significantly. Almost the same extent of protection of billets was observed in Sherpa, Ripcord, Sunmerin and Bulldock as was in Single spray.Interestingly after 6 months about the same level of protection was found in single and double spray (91.4% < 93.9%; T = 1.07, prob.= 0.15).

With the passage of time the insecticides in their effect segregated further and their effectiveness also decreased. Thus after 16 months in single spray maximum (95%) and minimum (41%) protection recorded in Sherpa, Sunmerin (0.5%) and control, respectively. There was non significant difference in control, Sundophos (0.1%, 0.2%), Laser (0.1%) and Sunmerin (0.1%). Similarly Sherpa, Ripcord (0.1%,0.2%,0.5%), Cyperkill , Sunmerin and Bulldock (0.2%, 0.5%) were insignificant among themselves. Sherpa and Ripcord were the most effective while Sundophos and Laser were the least effective. Parallel to single spray in double spray Bulldock (0.2%) protected the highest(99%) and control the lowest (41%) billets. Comparison of intra insecticide concentrations showed that Sherpa, Ripcord, Sunmarin and Bulldock were non significant. Similarly inter insecticides

comparison showed that Sherpa (0.1%,0.2%, 0.5%), Cyperkill (0.5%), Ripcord (0.1%,0.2%,0.5%0), Sunmerin (0.2%,0.5%) and Bulldock(0.1%,0.2%,0.5%) were inconsiderable among themselves. On the other hand non significant difference was recorded among control, Sundophos (0.2%,0.5%) and Laser (0.2%). Here once again Sherpa, Ripcord and Bulldock were found the most effective and sustainable, while Sundophos and Laser the least effective Table 1. After 16 months difference between single and double spray was statistically non-significant (74.8% < 81.5%; T=1.36, prob. =0.09)

Table 1. Efficacy of Pyrethriods against Powder post beetles

Insecticides	Dose (%)	% Protection afforded after (months)				
		3	6		16	
			1-Spray	2-Spray	1-Spray	2-Spray
Sherpa 5EC		**	**	**	**	**
	0.1	98 ab	93 abc	95 abcd	88 abcd	94 ab
	0.2	98 ab	98 a	98 ab	92 ab	89 abc
	0.5	100 a	99 a	100 a	95 a	96 ab
Cyperkill 5EC	0.1	95 b	89 abcd	89 cd	67 bcdef	69 cdef
	0.2	99 a	99 a	99 ab	76 abcde	73 bcde
	0.5	97 ab	89 abcd	89 cd	82 abcd	96 ab
Ripcord 10EC	0.1	98 a	95 ab	98 ab	82 abcd	81 abcd
	0.2	99 a	94 ab	99 ab	90 abc	93 ab
	0.5	99 a	99 a	99 ab	95 a	96 ab
Sundophos 50EC	0.1	97 ab	77 de	71 f	43 gh	68 cdef
	0.2	98 a	81 cde	79 e	47 fgh	55 efg
	0.5	97 ab	78 de	89 d	68 bcdef	60 efg
Laser 25EC	0.1	97 ab	76 c	89 cd	64 defgh	66 def
	0.2	98 a	83 bcde	93 bcd	67 bcdefg	50 fg
	0.5	98 a	95 ab	96 abc	73 abcdef	83 bcd
Sunmerin 5EC	0.1	100 a	92 abc	97 ab	51 efgh	69 cdef
	0.2	99 a	98 a	99 ab	81 abcd	97 a
	0.5	99 a	98 a	99 ab	95 a	98 a
Bulldock 25EC	0.1	98 a	94 ab	98 ab	65 cdefgh	88 abcd
	0.2	98 ab	94 ab	98 ab	74 abcde	99 a
	0.5	98 a	99 a	95 abcd	91 ab	92 ab
Control		81 c	57 f	57 g	41 h	41 g

** Significant at 1% level.

- Figures in same column sharing same letters are non significant

Discussion

All the test insecticides were found effective against powder post beetles except Sundophos and Laser. However the persistence and affectiveness varied greatly with insecticide dose and time. The lowest dose (0.1%) is as effective as the highest one (0.5%) in Sherpa and Ripcord both at single and double spray, while Sundophos and Laser have not given an impressive protection of billets from powder post beetles.

Table 2. Cost Benefit Ratio of Fuelwood per 1000 cft sprayed with some pyrethroid Insecticides

Insecticide	Dose (%)	Quantity (ml)	Infestation (%)	Treat* cost (Rs.)	Monet. Loss** (Rs.)	Net*** benefit (Rs.)
Sherpa 5EC	0.1	1800	12	1075	1354	9561
	0.2	3600	8	1728	1160	9102
	0.5	9000	5	3687	571	7732
Cyperkill 5EC	0.1	1800	33	980	7613	3397
	0.2	3600	24	1538	3426	7026
	0.5	9000	18	3212	2283	6495
Ripcord 10EC	0.1	900	18	1034	2664	8292
	0.2	1800	10	1646	1902	8442
	0.5	4500	5	3482	751	7757
Sundophos 50EC	0.1	180	57	1034	6661	4295
	0.2	360	53	1646	6090	4254
	0.5	900	32	3482	5518	2990
Laser 25EC	0.1	360	36	1430	6851	3709
	0.2	720	33	2438	5328	4224
	0.5	1800	27	5462	4568	1960
Sunmerin 5EC	0.1	1800	49	944	6470	4576
	0.2	3600	19	1466	1712	3812
	0.5	9000	5	3032	381	8577
Bulldock 25EC	0.1	360	35	676	3806	7508
	0.2	720	26	930	3616	7444
	0.5	1800	9	1692	1333	8965
Control	-	-	59		11990	-

Total value of 1000 cft intact fuelwood is Rs. 32215

* Treatment cost = cost of insecticide + labour (Rs.150/1000cft) + expenses of spray machine (Rs.72/1000cft) + supervision (Rs.200/1000cft)

** Monetary Loss = $\frac{\%\ \text{weight loss}}{100} \times$ Price of 1000 cft intact fuelwood

*** Net Benefit = Loss in control - (Treatment cost + Monetary Loss in (No treatment) respective treatment).

After 16 months Sherpa 5EC and Ripcord 10EC are the most persistent insecticides giving 88-95% and 82-95% protection, respectively. On the other hand Sundophos 50EC and Laser 25EC were the least persistent as protecting only 43-68% and 64-73% billets insect spray treatment. While Cyperkill 5EC, Sunmerin 5EC and Bulldock 25EC are moderate in persistence at low concentrations (0.1%.0.2%), and at the highest dose (0.5%) they are as effective as Sherpa and Ripcord. In the light of these findings Sherpa and Ripcord at low dose rate should be preferred over Cyperkill and Sunmerin at higher doses for more economic return and minimizing hazardous impacts of insecticides on environment. The difference in wood protection between single and double spray after 6 months was 2.5% and after 16 months that was 6.8%.

Economics of the insecticides worked out is presented in Table 2. Maximum loss of Rs. 11990 per 1000 cft is incurred by *S. anale* and *S. crassum* in control which is about 37% of the total price of 1000 cft intact fuelwood. Maximum net benefit of Rs. 9561 is got by Sherpa (0.1%) while it gives Rs. 9102 and 7732 net benefit in the dose rate of 0.2% and 0.5% respectively. So in case of higher dose rates use of Sherpa is uneconomical. In the same manner, the lowest dose (0.1%) and the highest dose (0.5%) of Ripcord and Bulldock have given benefit of Rs. 8292, 7757 and 7508, 8965, respectively. Here Ripcord @ 0.5% is less economical and Bulldock is economical. Similarly the highest dose (0.5%) of Cyperkill (Rs. 6495), Sunmerin (Rs. 8577) are nearly as economical as Sherpa and Ripcord Table 2. Sherpa, Ripcord (0.1%,0.2%); Bulldock (0.5%) and Sunmerin (0.2%) have given almost same net benefit. On the other hand, Sundophos and Laser proved the least effectiveness and uneconomical with maximum net benefit of Rs. 4294 and 4224 respectively, so these are not recommended for the control of the pest.

Conclusion

Considering the results of effectiveness, persistence and economic in view, Sherpa 5%EC, Ripcord 10EC (0.1%), Sunmerin 5%EC (0.2%) and Bulldock 25%EC (0.5%) are recommended for the control of powder post beetles.

Acknowledgement

The authors are thankful to Mr. Ajmal Rahim, Divisional Forest Officer, Kasur for providing facilities to carry out these experiments at Changa Manga. The assistance of M/S. Shazada Khan and Muhammad Tufail the Pakistan Forest Institute, staff stationed at Changa Manga is also acknowledged with thanks.

References

Anonymous. 1982. Protection of packing-case material from insect and fungal attack. Evergreen, No. 9: 3-4

Argaman, Q. 1987. *Sinoxylon anale* - a new destructive wood borer in Israel. Phytoparasitica, 15(3): 257.

Chaudhry, G.U. 1960. The amalgamated scheme for control of Shisham defoliator, *Plecoptera reflexa* Guen. and trial of insecticides to control the powder post beetles, *Sinoxylon* spp. in the irrigated plantations of west Pakistan. Fin. Rep. PFI. Peshawar, pp. 48.

Chaudhry, M.I. 1988. Pest problems in forests of Pakistan and their solutions. Proc. Nation. Sem. Role of plant health and care in agricultural production, Faisalabad, pp.157-168.

Gnanaharan, R., G. Mathew and T.K. Damodharan. 1983. Protection of rubber wood against the insect borer *Sinoxylon anale* Les. (Coleoptera: Bostrychidae). Journ. Indian Acad. Wood Sci. 14(1): 9-11.

Gnanaharan, R., K.S.S. Nair and W. Sudheendrakumar. 1982. Protection of fibrous raw material in storage against deterioration by biological organisms. Res. Rep. Kerala For. Res. Instt. No.12, pp. 24.

Gnanaharan, R., W. Sudheendrakumar and K.S.S. Nair. 1985. Protection of cashew wood in storage against insect borers. Material und Organismen, 20(1): 65-74.

Gul, H. and M.I. Chaudhry. 1991. Efficacy of pyrethroids against powder post beetles attack on ruel wood. Pak. Journ. For. 41(4): 178-80.

Hutacharern, C. and S. Choldumrongkul. 1989. A note on the insect pests of multipurpose tree species in Thailand. Journ. Trop. For. Sci., 2(1): 81-84.