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Antifeeding Properties of Two Fentin Compounds in the Control of *Pericallia ricini* F. (Arctiidae) and *Spodoptera litura* Boisd. (Noctuidae) on Castor

By
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ABSTRACT

Experiments were conducted to study the antifeeding properties of Brestan and Brestanol (Triphenyltin acetate and chloride respectively) with different instars of *Pericallia ricini* and *Spodoptera litura* on castor. Brestan was found to be more toxic than Brestanol in causing mortality of first and second instars of *P. ricini* and third instar of *S. litura*, at higher concentrations. The effective concentrations to give 90 per cent protection are 0.3 to 0.4 per cent and 0.15 to 0.20 per cent Brestan and Brestanol respectively from *P. ricini* and 0.2 per cent of Brestanol from *S. litura*.

Employment of any means for combating pests without regard to the complexities of the agroeco system has been found to be a major cause of disruption in the biotic balance of pests in recent years. Antifeedants represent a different approach to crop protection in that they do not harm the beneficial insects and at the same time the crop is also protected. This selectivity makes an antifeedant very useful in contemplating pest management.

During recent years antifeeding effects of the Fentin acetate (Triphenyltin acetate) on *Spodoptera litura* (Solel, 1964; Ascher and Rones, 1964; Ascher and Nissim, 1965 and Joshi *et al.* 1967) on potato tuber moth, *Gnorimoschema operculella* and the striped maize borer, *Chilo agamemnon* (Meisner and Ascher, 1965) and of Fentin hydroxide (Triphenyltin hydroxide) on *S. littoralis* and *Agrotis ypsilon* (Ascher and Rones, 1964) and on *P. ricini* (Sundaramurthy and Kareem, 1968) have been established. An attempt was now made to study the antifeeding properties of Fentin acetate and the new compound Fentin chloride on *Pericallia ricini* and the latter compound alone on *Spodoptera litura*.

MATERIAL AND METHODS

Fentin chloride alone was used against third and fourth instar larvae of *Spodoptera litura* whereas against first, second and third instar larvae of *P. ricini* both the chemicals were used. Circular leaf bits were dipped in solutions of Brestan 60% WP (TTA) and Brestanol 40% WP (TTCl) in different concentrations and air dried. The treated bits were kept on a filter paper over a padding of moist cotton in a petri dish which prevented quick drying of leaves. In each treatment ten larvae were allowed for feeding in the case of first and second instars and two in other instars.

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The larvae in moribund state were also considered as dead in mortality counts. The arc √sine values of percentage corrected mortality were subjected to statistical analysis. The leaf area consumed was measured after 48 hours of treatment as followed by Regupathy (1971). The weights of the caterpillars before and 48 hours after allowing to feed were recorded. The starvation percentage was worked out on the lines suggested by Ascher and Nissim (1968). The percentage of leaf area protected and starvation were converted into probit values. The log concentration and probit protection and starvation relations between each instars of the insect and different chemicals were worked out and lc-p lines fitted by least squares (Brown, 1961).

RESULTS AND DISCUSSION

Mortality of larvae: The overall mean mortality of first and second instar larvae of *P. ricini* ranged from 16.9 to 100 per cent in treated as against 34.4 per cent in the starved larvae. The mortality increased with increase in concentration of both Brestan and Brestanol and the difference between concentrations was significant at high probability level ($p = 0.01$), whereas the differences between instars or chemicals or interactions were not significant.

There exists a positive relationship between mortality and concentration and a negative relationship between concentration and leaf area consumed. Consequently the leaf area protected is directly proportional to mortality and concentrations. In the case of Brestan (Tables 1 and 2) even at the higher concentrations with a record of high mortality, the per cent leaf area protected is less when compared to Brestenol. This clearly indicates that Brestan might have more toxic effect. The toxic effects of Fentin acetate (Ascher and Rones, 1964 and Joshi *et al.* 1967) and Fentin hydroxide (Sundaramurthy and Kareem, 1968) on *S. litura* have been reported.

In general the concentrations 0.15 to 0.4 per cent of both chemicals were found to be on par excepting second and third instar larvae of *P ricini* allowed to feed on leaves treated with Brestan. The remaining low concentrations were significantly less effective.

Leaf area protected: The percentage leaf area protected by various concentrations of Brestan ranges from 1.9 to 98.5 per cent as against 16.9 to 97.8 per cent by Brestanol. Even the concentration at lower level of 0.05 per cent was found to be effective on *S. litura* in preventing from feeding (Table 2). The lower most concentration was almost on par with the untreated control.

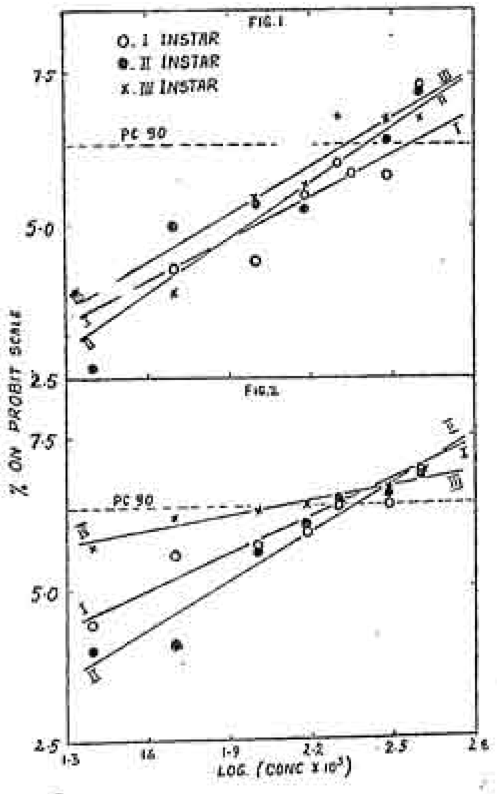
The relative efficiency of the chemicals in preventing the insects from feeding are summarised below :

Test insect	*Chemical*	*Order of response (PC 90) of instars*
P. ricini	Brestan	III > II > I
P. ricini	Brestanol	III > I > II
S. litura	Brestanol	III > IV

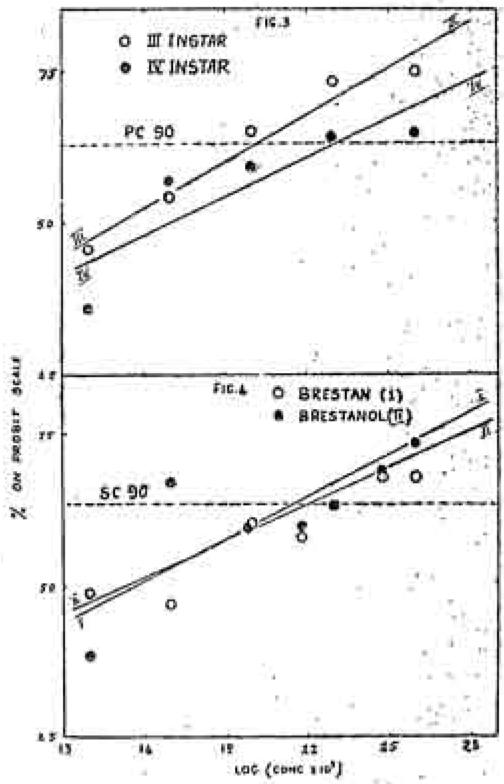
Brestanol was found to exercise more anti-feeding properties than Brestan.

Larval weight: The percentage starvation caused by Brestan ranged from 45.9 to 102.6 per cent and that by Brestanol from 14.6 to 98.8 per cent on third instar larvae of *P. ricini* and from 73.9 to 106.9 per cent on the fourth instar larvae of *S. litura*. The starvation effect was markedly seen in *S. litura*, as even the third instar larvae could not withstand starvation [Table 3] whereas *P. ricini* is hardier as no death was observed in third instar. The order of efficiency of the chemicals in causing starvation is Brestan > Brestanol [Fig. 4].

When the efficacy of the chemicals was assessed based on SC 90 [90 per cent starvation concentration] both chemicals were more or less on par, though Brestan was better. But on the basis of PC 90 [90 per cent protective concentration] Brestanol was found to be a more powerful antifeedant [Figs. 1 - 3]. Probably due to toxic effect of Brestan, the loss in weight of the caterpillar of both the species might be increased, though it could allow the caterpillars to feed.



Protection from *P. ricini* larvae due to Brestan (fig. 1) and Brestanol (fig. 2)



Protection from *S. litura* larvae due to Brestonal (fig. 3)

Starvation caused in *P. ricini* by Brestan and Brestanol (fig. 4)

The increased concentrations of the chemical made the caterpillar to starve more which is nothing but the result of prevention of feeding. The effective concentrations of Brestan and Brestanol to prevent the different instars of *P. ricini* and *S. litura* from feeding are given below.

Test insect	Instar	Brestan	Brestanol
P. ricini	I	0.3 – 0.4 %	0.1 - 0.15 %
	II	0.2 – 0.3 „	0.15 – 0.2 „
	III	0.2 – 0.3 „	0.025 – 0.05 „
S. litura	III	–	0.1 – 0.2 „
	IV	–	0.2 – 0.4 „

It would be practically useful if the efficacy of antifeeding chemicals is expressed in PC 90 rather than in SC 90 values for unbiased assessment of antifeeding properties In the present experiment, the concentration given is that of formulation and not based on active material.

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Table 1.

Effect of Brestan and Brestanol on the mortality of I and II instar larvae of *P. ricini*.

(Figures in parenthesis are transformed values)

Concen-tration	Brestan						Brestanol						Mean	
	I Instar		II Instar		Mean		I Instar		II Instar		Mean			
	*	**	*	**	*	**	*	**	*	**	*	**	*	**
0.025	—	—	50.0	47.4	25.0	—	—	—	17.5	10.8	8.8	—	16.9 (17.6)	—
0.5	50.0	—	50.0	47.4	50.0	20.0	50.0	—	17.5	10.8	33.8	3.6	41.9 (50.6)	11.4
0.1	55.0	—	80.0	78.9	67.5	48.0	100.0	100.0	100.0	100.0	100.0	100.0	83.8 (74.6)	75.3
0.15	85.0	50.0	85.0	84.2	85.0	76.0	100.0	100.0	100.0	100.0	100.0	100.0	92.5 (83.5)	88.6
0.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	97.5	97.3	98.8	98.3	99.4 (90.0)	99.1
0.3	95.0	83.3	100.0	100.0	87.5	80.0	100.0	100.0	100.0	100.0	100.0	100.0	98.8 (86.1)	98.2
0.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0 (90.0)	100.0
Starved	70.0	—	5.0	—	37.5	—	55.0	—	7.5	—	31.3	—	34.4 (32.5)	—
S. E.													15.7	
C. D.													30.9	

* — Observed mortality ** — corrected mortality

Table 2.

Effect of Brestan and Brestanol on leaf area consumption (cm^2) of different instars of *P. ricini* and *S. litura*

	BRESTAN			BRESTANOL				
	P. ricini						*S. litura*	
		Instar						
Concentration	I **	II **	III *	I **	II ***	III *	III *	IV *
0.025	13.8	25.5	32.8	20.3	37.0	6.8	22.9	28.1
0.05	13.0	13.5	36.5	7.8	36.8	3.0	11.3	6.9
0.1	12.5	9.5	7.8	7.5	10.5	2.6	2.2	5.6
0.15	5.5	10.3	11.0	5.1	6.5	2.1	–	–
0.2	3.5	4.5	1.6	2.3	3.3	2.3	0.3	2.3
0.3	5.3	2.3	1.8	2.3	2.8	1.1	–	–
0.4	0.3	1.0	1.8	0.6	1.3	0.8	0.3	2.3
Control	16.8	26.0	41.3	28.8	44.5	28.3	33.9	30.3
S. E.	1.78	1.34	0.70	5.09	1.56	2.47	4.64	4.4
C. D.	5.95	4.47	2.33	17.03	5.23	7.07	10.34	9.7

* – Two larvae / replication
** – Ten larvae / replication
*** – Twenty larvae / replication

TABLE 3. Effect of Brestan and Brestanol on III instar larval wt. of *P. ricini*

	Brestan			Brestanol		
Concen-tration	Meant wt. in mg			Mean wt. in mg		
	Initial	Final	Difference ±	Initial	Final	Difference +
0.025	244.5	333.5	+ 89.0	164.5	193.0	+29.5
0.05	228.0	335.0	+107.0	172.0	162.0	– 9.5
0.1	218.0	234.0	+ 16.0	173.5	170.5	– 3.0
0.15	220.0	246.0	+ 26.0	175.0	171.5	– 3.5
0.2	245.3	224.5	– 21.0	153.5	146.5	– 7.0
0.3	229.0	220.0	– 9.0	157.5	147.0	–10.5
0.4	231.5	223.5	– 8.0	171.5	162.0	– 9.5
Control	232.0	410.0	+178.0	146.5	183.0	+36.5
Starved	220.5	203.5	– 16.0	171.5	160.5	–11.5
Effect of Brestanol on III and IV instar larval wt. of *S. litura*						
0.025	120	283	+163	520	406	–114
0.05	123	298	+175	508	313	–195
0.1	118	*	*	492	368	–124
0.2	121	*	*	511	357	–154
0.4	127	*	*	494	365	–129
Control	121	486	+365	471	538	+ 67
Starved	127	*	*	521	343	–178

* Died within 48 hours