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Short Communication

Pesticidal Activities of Some Schiff Bases Derived from Benzoin, Salicyl-aldehyde, Aminophenol and 2,4 Dinitrophenyl Hydrazine

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Abstract

The pesticidal activities of three Schiff bases namely PDH [N- (1 phenyl 2 hydroxy 2 phenyl ethylidine) 2′4′ dinitrophenyl hydrazine], PHP [N(1-phenyl 2 hydroxy -2 phenyl ethylidine) 2′ hydroxy phenyl imine] and HHP [N (2-hydroxy benzylidine) 2′ hydroxy phenyl imine] derived from benzoin, salicylaldehyde, 2 aminophenol and 2,4 dinitrophenyl hydrazine were evaluated against *Tribolium castaneum*. Probit mortality were studied by surface film treatment method at different doses of the compounds. The results showed that the LD_{50} values as recorded after 24 hours of treatment were 15.1268, 3.0922 and 3.0922 mg /cm^2 for PDH, PHP and HHP, respectively as compared with 0.2416 mg/cm^2 for a standard pesticide λ-cyhalothrin. With Schiff base complexes of cobalt(II), copper(II) and zinc(II), the LD_{50} values were 1.5206, 14.8576 and 3.2829 mg/cm^2 respectively. Better results were obtained when recorded with longer treatment time. These three compounds may, therefore, be considered as potent pesticides.

Keywords: Pesticidal activities; Schiff bases; Surface film treatment method.

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1. Introduction

The chemical protection of plants is based on the use of various organic and inorganic compounds toxic to harmful organisms. The use is especially effective to control dangerous pests both to improve quality and to increase yield of the produce [1]. These agents are also used to preserve food grains from the pests. For this purpose, several thousand chemical agents have already been formulated. However, none of

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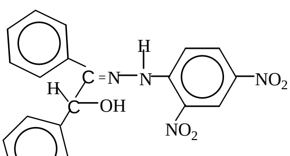
these possesses all the characteristics of an ideal pesticide. Most of these are not selective in action, rather kill non target organisms useful in restoring the fertility of the soil. Further many of these are not biodegradable in nature. After application these are most often found to exist in sublethal doses in the environment for a long time. Under this condition, the survived pests develop resistance to these agents [2]. To get rid of this situation, the farmers are used to apply such pesticides in enhanced doses and frequencies. This causes severe pollution to the soil and water environment. Consequently this leads to translocation of the residual pesticides in to the plant body and ultimately enter into the internal environment of worm blooded animals and humans. These agents localize in important organs and fat rich tissues of the victim and stimulate dangerous chronic diseases.

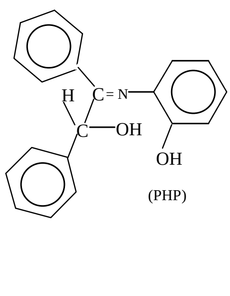
One way of overcoming this awkward situation is to formulate new chemical agents which are more specific in action and less persistent in the open environment. With this end in view, a number of compounds are being formulated in recent times [3, 4]. Since Schiff bases are found to possess antibacterial [5], antiviral [6], antimalarial [7, 8], antileukemic [9] properties, attempts have been made here to find out the pesticidal properties of such compounds. Consequently Jesmin *et al.* [10] successfully studied the possibility of using some Schiff base complexes as pesticides. These compounds have got the extra advantages over others in that most of them are biodegradable in nature. Recently three schiff bases namely PDH [N(1 phenyl 2 hydroxy 2-phenyl ethylidine) 2′, 4′ dinitrophenyl hydrazine], PHP [N-(1 phenyl 2 hydroxy- 2 phenyl ethylidine) 2′ hydroxy phenyl imine] and HHP [N(2-hydroxy benzylidine) 2′ hydroxy phenyl imine] have been reported as effective antimicrobial agents [11]. These compounds also have shown strong cytotoxic effect towards brine shrimp naupli. In the present paper, we have studied the pesticidal activities of these three compounds (PDH, PHP and HHP) against the pest *Tribolium castaneum.*

2. Structures

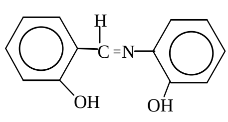
The structures of the compounds used are as follows:



(PDH)



(PHP)



(HHP)

3. Materials and Methods

3.1. Chemicals

All chemicals used during the research work were purchased from BDH (England) and used as received.

3.2. Insects

Adults of red flour beetle *Tribolium castaneum* were used for the experiment. They were collected from the "Crop Protection and Toxicology Laboratory", Department of Zoology, Rajshahi University, Bangladesh.

3.3. Experimental detail

Residual film treatment was followed for the experiment [12]. The compounds were dissolved in alcohol and then poured in to the petridishes (60 mm. diameter) and allowed them to dry. Pilot experiments were done to obtain doses in which mortality rate was in between 10 to 90%. The actual dose was calculated from the amount of the compounds present in 1 ml of the solution. The amount of the active ingredient was expressed in mg/cm^2. For PDH, the doses were 0.708, 1.414, 2.123, 2.831 and 3.539 mg/cm^2 and for both PHP and HHP, the doses adjusted were 0.354, 0.708, 1.062, 1.414 and 1.709 mg/cm^2. Thirty insects were released in each of treated petridishes. All the petridishes were kept in an incubator at a fixed temperature (30±0.5°C). A control experiment was also conducted by applying the solvent only instead of the solution under similar condition. The mortality of these beetles was observed by every 24 hours and the data were recorded. A simple microscope was used to check each and every beetle by tracing natural movement of its organ.

3.4. Statistical Analysis

The mortality percentage was calculated by using Abbott's formula [13]:

$$P_t = \frac{P_0 - P_c}{100 - P_c} \times 100$$

where, P_t = modified mortality (%), P_0 = observed mortality (%), and P_c = controlled mortality (%).

The observed data were subjected to statistical analysis according to Busvine [12] by using a software which adopted the traditional calculations to automatic computation. Heterogeneity was verified by a Chi-square test. In case if the probability was greater than 5%, an automatic correction of heterogeneity was introduced. The programme also calculated confidence limit for LD_{50}. The data were entered in to a special programme which fitted a regression line on to a probit-log dose concentration graph. Percentage mortality and dose concentration were determined from the graph using probit transformation tables [14].

4. Results and Discussion

The probit mortality obtained after 24, 48 and 72 hours of surface film treatment method has been shown in Table 1.

Table 1. Dose mortality data of Schiff bases.

Strain	*Treatment hours*	Dose, mg/cm^2	Number of insects used	Number killed	% mortality
PDH	24	0.708	30	3	10.00
		1.414	30	4	13.33
		2.123	30	5	16.67
		2.831	30	6	20.00
		3.539	30	9	30.00
		control	30	0	0.00
	48	0.708	30	3	10.00
		1.414	30	6	20.00
		2.123	30	9	30.00
		2.831	30	12	40.00
		3.539	30	12	40.00
		control	30	0	0.00
	72	0.708	30	6	20.00
		1.414	30	9	30.00
		2.123	30	12	40.00
		2.831	30	15	50.00
		3.539	30	21	70.00
		control	30	0	0.00
PHP	24	0.354	30	3	10.00
		0.708	30	4	13.33
		1.062	30	6	20.00
		1.414	30	9	30.00
		1.769	30	12	40.00
		control	30	0	0.00
	48	0.354	30	3	10.00
		0.708	30	6	20.00
		1.062	30	9	30.00
		1.414	30	12	40.00
		1.769	30	15	50.00
		control	30	0	0.00
	72	0.354	30	6	20.00
		0.708	30	9	30.00
		1.062	30	12	40.00
		1.414	30	15	50.00
		1.769	30	21	70.00
		control	30	0	0.00

Table 1. Continued.

Strain	Treatment hours	Dose, mg/cm^2	Number of insects used	Number killed	% Mortality
HHP	24	0.354	30	3	10.00
		0.708	30	4	13.33
		1.062	30	6	20.00
		1.414	30	9	30.00
		1.769	30	12	40.00
		control	30	0	0.00
	48	0.354	30	3	10.00
		0.708	30	6	20.00
		1.062	30	8	26.67
		1.414	30	12	40.00
		1.769	30	15	50.00
		control	30	0	0.00
	72	0.354	30	3	10.00
		0.708	30	6	20.00
		1.062	30	9	30.00
		1.414	30	15	50.00
		1.769	30	18	60.00
		control	30	0	0.00

It is noticed from Table 1 that in all cases the mortality percentage increases both with doses of the strain and duration of this treatment. The 95% confidence limits and regression equation with χ^2 values are presented in Table 2 which indicates the good

Table 2. Lethal dose, confidence limit, regression equation and chi-squared (χ^2) value of the test compounds to *Tribolium castaneum* (DF= Degrees of freedom).

Test compound	Exposure (Hours)	LD_{50} mg cm^{-2}	95% confidence limits		Regression equation	χ^2 (DF=3)
			Lower	Upper		
PDH	24	15.1268	1.8237	125.4732	Y = 2.752 + 1.031 X	0.664
	48	4.6217	2.5280	8.4493	Y = 2.392 + 1.566 X	0.171
	72	2.4402	1.8443	3.2286	Y = 2.421 + 1.856 X	2.215
PHP	24	3.0922	1.3682	6.9886	Y = 2.697 + 1.545 X	1.091
	48	1.9366	1.2506	2.9987	Y = 2.637 + 1.836 X	0.240
	72	1.2200	0.9223	1.6140	Y = 2.979 + 1.860 X	2.218
HHP	24	3.0922	1.3682	6.9886	Y = 2.697 + 1.546 X	1.091
	48	1.9836	1.2626	3.1162	Y = 2.640 + 1.820 X	0.500
	72	1.5247	1.1536	2.0152	Y = 2.334 + 2.253 X	1.263

fit of the lines. The LD_{50} values are 15.1268, 3.0922 and 3.0922 mg/cm^2 for PDH, PHP and HHP respectively after 24 hours of treatment. Although these values are comparatively larger than that of the standard pesticide λ-cyhalothrin (0.2416) as recorded earlier [15] but like those of the Schiff base complexes studied recently [10]. They may be useful as they are biodegradable in the environment and the fission products are practically harmless to the soil microorganisms [11]. Better results are obtained when recorded after longer treatment time (Table 1).

4. Conclusion

All the Schiff bases are fairly active in killing pest *Tribolium castaneum.* The compounds specially PHP and HHP may be considered as effective pesticides.

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