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CONTACT TOXICITY OF DIFFERENT INSECTICIDES TO THIRD AND FIFTH INSTAR NYMPHS OF BROWN PLANT HOPPER *NILAPARVATA LUGENS* STAL (DELPHACIDAE : HOMOPTERA)

BABY P. SKARIA and N. M. DAS
College of Agriculture, Vellayani-695522, Trivandrum, Kerala

Brown plant hopper, *N. lugens* is the most serious pest of rice in several parts of India. Adults and nymphs, clustering on the stem in large numbers cause an initial yellowing and later a burnt-up condition of the crop thus causing sometimes the total loss of the plants. Encarnacion and Dupo (1973) found monocrotophos as most toxic to *N. lugens,* followed by fenitrothion, carbaryl and fenthion. The efficacy of carbaryl and monocrotophos in controlling the pest in field has been reported from different field studies also (Das *et al.* 1972; Encarnacion and Dupo 1973; Anon. 1974; Anon. 1975; and Velusamy *et al.* 1978). Chandrika *et al.* (1976) worked out the relative toxicity of different insecticides by releasing adults of *N. lugens* on sprayed plants and in the order of their efficacy, the insecticides tested were ranked as follows: quinalphos > fenthion > ethyl parathion > lindane > dichlorvos > fenitrothion > carbaryl > endosulfan.

In the present study effectiveness of 12 contact insecticides to the third and fifth instar nymphs of *Nilaparvata lugens* was evaluated in the laboratory.

Materials and Methods

The insecticides used in this investigation were formulated as emulsions in the laboratory from technical grades. The chemicals used were carbaryl dichlorvos, fenitrothion phendal, (supplied by M/s. Bharat Pulverising Mills Ltd., Bombay), fenthion, methyl parathion, trichlorphon, (supplied by M/s. Bayer (India) Ltd., Madras) monocrotophos (supplied by CIBA-Geigy of India Ltd., Bombay), phosalone (supplied by Voltas Ltd., Bombay), endosulfan (supplied by E. I. D. Parry Ltd., Ranipet) and BHC (supplied by Kishala Industries, Trivandrum).

The emulsions were prepared using benzene as solvent and Triton X-100 (supplied by M/s. Indofil Chemicals Ltd., Bombay) as emulsifier. Stock solutions of 1 to 20% concentrations were prepared by dissolving required quantities of the technical grades of the pesticides in benzene and then diluted with water containing 0.625% of Triton X-100. Solvent and emulsifier in the final spray fluid were maintained at 5.0 and 0.625% respectively. Benzene emulsified in water containing Triton X-100 in the above proportions was sprayed on insects used as control.

The insect was reared on 30 day old potted rice plants enclosed in cylindrical rearing cages made of polythene sheet supported inside by a flat iron framework and open at both ends. The upper side of the cage was closed using muslin cloth. Each potted plant was exposed to 10 pairs of adult insects collected from field, for egg laying and these insects were removed from the plants at the end of 24 hours so that nymphs emerging on the same day alone were present on each plant. This facilitated collection of test insects of known age for the experiments. The third and fifth instar nymphs identified by the nature of wing pads were collected using an aspirator on 10th and 14th day after egg laying respectively and used for the experiments.

Ten insects of the same size and age were transferred to a specimen tube and they were just inactivated by exposing them to a mild dose of solvent ether and transferred to 9 cm petridish. The insects in each petridish were sprayed under a Potter's spraying tower at 2.5 kg/sq cm pressure with 1 ml of spray fluid. The dishes were then allowed to dry under an electric fan. A rice seedling was planted in wet soil taken in a petridish. The soil in the petridish was covered by blotting paper and a glass chimney was placed over the blotting paper enclosing the plant. Then the treated insects in each petridish were transferred to these glass chimneys and the open end of the chimney was covered using a muslin cloth. Each insecticide was applied at different graded doses and each dose was replicated thrice. The chimneys were placed at 27 $\pm$ 1°C and mortality counts were taken at the end of 24 hours after treatment.

Moribund insects were also counted as dead. The percentages of mortality calculated from the above data were corrected using Abbot's formula and they were subjected to probit analysis (Finney, 1952). The relative toxicity of the insecticides was calculated using the LC 50 value of carbaryl as standard. The cost of insecticides required for preparing 500 litres of emulsion at LC 50 level was calculated at the current market rates and the relative cost was worked out using the cost of carbaryl as standard.

Results and Discussion

The results of the experiment using the third instar nymphs of *N. lugens* showed that carbaryl was most toxic at LC 50 level and was followed by monocrotophos, quinalphos, fenthion, phosalone, fenitrothion, dichlorvos, methyl parathion, phendal, BHC, endosulfan and trichlorphon; their relative toxicities being 1.00, 0.91, 0.69, 0.68, 0.45, 0.44, 0.35, 0.27, 0.22, 0.16, 0.15 and 0.07 times that of carbaryl.

On relative cost basis the insecticides can be ranked in the following descending order of preference against the third instar nymphs; carbaryl, monocrotophos, dichlorvos, phosalone, fenitrothion, quinalphos and methyl parathion, their relative cost being 1.00, 2.60, 6.19, 7.01, 7.357, 7.571, 9.524 and 12.524 times that of carbaryl respectively. Toxicity of BHC is only 0.1587 times that of carbaryl, but on relative cost basis it ranks as the second, being 1.262 times costlier than carbaryl.

Against the fifth instar nymphs based on the LC 50 values the insecticides can be ranked in the following descending order: quinalphos. carbaryl, monocrotophos, fenthion, fenitrothion, phosalone, BHC, endosulfan, dichlorvos, phendal, methyl parathion and trichlorphon. Their relative toxicities taking carbaryl as standard were 1.594, 1.00, 0.63, 0.381, 0.314, 0.242, 0.17 0.142, 0.133, 0.132, 0.132, and 0.084 respectively. The insecticides seen as effective against fifth instar nymphs on relative cost basis are carbaryl followed by BHC, monocrotophos, quinalphos, fenitrothion, fenthion and phosalone, their relative cost being 1.0, 1.171, 3.709, 4.188, 10.598 12.821, and 12.974 times as that of carbaryl respectively. The other chemicals were less economical.

The relative toxicities of various insecticides to the third and fifth instar nymphs do not show variations. Carbaryl, moncrotophos, quinalphos, fenthion, phosalone, fenitrothion and dichlorvos can be considered effective against the pest and these can be ranked on cost basis as carbaryl, monocrotophos, dichlorvos, phosalone, fenthion, fenitrothion and quinalphos against third instrar nymphs and carbaryl, monocrotophos, quinalphos, fenitrothion, fenthion, phosalone and dichlorvos against fifth instar nymphs. The efficacy of these insecticides against *N. lugens* has been reported by earlier workers also. (Das *et al.* 1972, Encarnacion and Dupo. 1973, Anon. 1974, Velusamy *et al.* 1978, Chandrika *et al.* 1976).

Summary

The relative efficacy of 1 2 contact insecticides to the third and fifth instar nymphs of the brown plant-hopper *Nilaparvata lugens* was assessed in the laboratory by assessing their LC 50 values. These chemicals were found to be equally effective against both the stages of the pest. Insecticides found most effective were carbaryl, monocrotophos, quinalphos, fenthion, phosalone, fenitrothion and dichlorvos. On relative cost basis these may be ranked as carbaryl, monocrotophos dichlorvos, phosolone, fenthion, fenitrothion and quinalphos, against third instar nymphs and carbaryl, monocrotophos, quinalphos, fenitrothton, fenthion, phosalone and dichlorvos against fifth instar nymphs.

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നെൽച്ചെടിയുടെ ffi^61J^(/3C തുവായ ബ്രൗൺ ഹോപ്പറിനെ നിയന്ത്രിക്കാനുള്ള പന്ത്രണ്ട് സ്പർശകകീടനാശിനികളുടെ കഴിവ് പഠന വിധേയമാക്കിയപ്പോൾ കാർബറിൽ, മോണോക്രോട്ടോഫോസ്, ക്വിനാൽഫോസ്, ഫെൻതയോൺ, ഫോസലോൺ, ഫെനിട്രോത്തയോൺ

Table 1

Relative toxicity and preference of different insecticides to the third instar nymphs of *Nilaparvata lugens* Stal

Insecticides	Heterogeneity	Regression equation*	LC 50	Fiducial limits	Relative toxicity	Relative cost
Carbaryl	$X^2(3)=0.57$	$Y=2.53x+2.86$	0.007011	0.005335 0.009215	1.000	1.000
Monocrotophos	$X^2(3)=0.44$	$Y=1.12x+4.01$	0.007678	0.004782 0.012320	0.913	2.600
Quinalphos	$X^2(3)=2.19$	$Y=1.04x+3.96$	0.010090	0.006442 0.015810	0.695	9.524
Fenthion	$X^2(3)=1.03$	$Y=0.90x+4.09$	0.010300	0.006230 0.017040	0.681	7.357
Phosalone	$X^2(3)=0.64$	$Y=1.92x+2.71$	0.015560	0.011230 0.021560	0.451	7.010
Fenitrothion	$X^2(3)=0.15$	$Y=1.13x+3.64$	0.015860	0.009809 0.025610	0.442	7.571
Dichlorvos	$X^2(3)=0.35$	$Y=0.97x+3.74$	0.019960	0.011480 0048280	0.351	6.190
Methyl parathion	$X^2(5)=036$	$Y=0.91x+3.71$	0.026250	0.015890 0.043350	0.267	12.524
Phendal	$X^2(3)=0.15$	$Y=1.11x+3.33$	0 031880	0.019540 0.052010	0.220	12.152
BHC	$X^2(3)=0.17$	$Y=1.54x+2.47$	0.044180	0.029610 0.065920	0.159	1.262
Endosulfan	$X^2(3)=0.06$	$Y=1.23x+2.94$	0.046850	0.029230 0.075080	0.150	12.762
Trichlorphon	$X^2(5)=1.01$	$Y=0.94x+3.15$	0.095260	0.055300 0.164100	0.076	24.949

*Regression equation of probit mortality (Y) on log-concentration (X)

LC_{50}—Concentration calculated to give 50% mortality

Table 2

Relative toxicity and preference of different insecticides to the fifth instar nymphs of *Nilaparvata lugens* Stal

Insecticides	Heterogeneity	Regression equation *	LC_{50}	Fiducial limits	Relative toxicity	Relative cost
Quinalphos	$X^2(5)=1.43$	$Y=0.78x+3.69$	0.004881	0.002762 0.008628	1.594	4.188
Carbaryl	$X^2(5)=3.32$	$Y=1.58x+3.60$	0.007778	0.005716 0.010550	1.000	1.000
Monocrorophos	$X^2(3)=0.68$	$Y=1.26x+3.62$	0.012340	0.088137 0.018700	0.630	3.709
Fenthion	$X^2(3)=0.12$	$Y=1.23x+3.39$	0.020110	0.012710 0.031840	0.387	12.821
Fenitrothion	$X^2(5)=1.33$	$Y=1.26x+3.25$	0.024810	0.016630 0.037010	0.314	10.598
Phosalone	$X^2(3)=0.21$	$Y=1.67x+2.49$	0.032180	0.022760 0.045510	0.242	12.974
BHC	$X^2(5)=2.19$	$Y=0.85x+3.59$	0.045640	0.026830 0.077640	0.170	1.171
Endosulfan	$X^2(3)=0,23$	$Y=0.94x+4.30$	0.054810	0.032220 0.111200	0.142	13.385
Dichlorvos	$X^2(5)=0.82$	$Y=0.98x+3.27$	0.058280	0.034640 0.098040	0.133	16.222
Phendal	$X^2(5)=0.97$	$Y=0.87x+3.45$	0.059060	0.035130 0.099280	0.132	20.205
Methyl parathion	$X^2(4)=4.42$	$Y=1.20x+2.88$	0.059120	0.038440 0.090900	0.132	25.256
Trichlorphon	$X^2(5)=1.01$	$Y=0.84x+3.35$	0.092170	0.053680 0.158200	0.084	21.664

* Regression equation of probit mortality (Y) on log-concentration (X)

LC_{50} —Concentration calculated to give 50% mortality.

ഡൈക്ളോർവോസ് എന്നിവയാണ് ഏററവും അനുയോജ്യമായിക്കണ്ടത്. ഇവയിൽ കാർബ റിൽ, മോണോക്രോട്ടോഫോസ് എന്നിവയുടെ ഉപയോഗമാണ് ഏററവും ലാഭകരമായിക്കണ്ടത്.

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