LABORATORY EVALUATION OF PENFLURON AND FURYLTRIAZINE, THE INSECT GROWTH REGULATORS, AGAINST *ANOPHELES STEPHENSI*

S. C. SAXENA and R. K. KAUSHIK
Department of Zoology, University of Rajasthan, Jaipur 302004, India.

ABSTRACT

Laboratory experiments were conducted to determine the effectiveness of Penfluron and Furyltriazine, the insect growth regulators with molt inhibiting activity, on developmental stages of *Anopheles stephensi*. The two compounds were applied in doses ranging from 0.0001 to 25 ppm. Results showed that the compounds exhibit potent larvicidal and pupicidal action. Dosage-mortality responses were for Penfluron and Furyltriazine against larvae and pupae by keeping them continuously in treated water. Dosage-mortality regressions differed among instars. Early instars in general are more susceptible than later ones. In laboratory studies Penfluron proved to be more active at lower dosages than did Furyltriazine against larvae and pupae.

INTRODUCTION

BENZOYLPHENYL urea compounds, a relatively new class of compounds for the suppression of insect pest population have been found to possess ovicidal and larvicidal properties besides being development disruptors. They have been successfully tested to contain the population considerably to safer limits of many economically important insect species[1-11].

In India *Anopheles stephensi* is one of the major vectors of urban malaria. Since the growth regulator compounds enjoy superiority over other insecticides being of highly selective activity, low toxicity to non-chitinous non-target[12] animals including man and low residual levels in aquatic environment[13, 14] Penfluron and Furyltriazine were studied to evaluate them against *A. stephensi*, the malaria vector.

MATERIALS AND METHODS

Test insect, *A. stephensi* was reared in the laboratory under the controlled condition (temperature 28 ± 2°C and humidity 70–80%). Both the compounds were dissolved in acetone to prepare 1% (V/V) stock solution. By further dilutions with distilled water different concentrations ranging from 0.0001 to 25 ppm were prepared. Tween-80 was used as an emulsifier at the concentration of 0.02% (V/V). In control, acetone and emulsifier were used separately.

Dosage-mortality responses were determined by keeping second-, third- and fourth- instar larvae and pupae in treated water until adult emergence. Twenty-five larvae of each instar were assayed against each dosage with four replicates. Larval and pupal mortality was taken as the response criterion and the observations recorded until all the test larvae either died or emerged as adults. Probit regression lines were plotted on logarithmic scale[15]. Linear regression equation was worked out for each instar.

RESULTS AND DISCUSSION

Both the compounds show larvicidal and pupicidal activity. Penfluron has been found more active than Furyltriazine (figures 1, 2 and 3A, B).

Low concentrations of Penfluron caused mortality during moulting and before pupation i.e. with 19 days after the treatment of second instar larvae (figure 1), about 12 days after the treatment of third-instar and about 7 days after the treatment for fourth-instar larvae. Intermediate concentration caused an increase in the pre-pupal mortality but the time taken for 100% mortality after treatment remains unaltered. High concentration caused an early response in all the instars and most of the deaths occurred within 5 days of treatment irrespective of the instar treated.

The response by second instar larvae treated with Penfluron at the concentrations of 0.0001 to 0.01 ppm show two peaks, one at an early stage when the larva moults to third instar, and the other at a later stage when the final instar larva moults to pupa (figure 1). Similar observations are made when third and fourth instar larvae are treated i.e. the peaks occur during moulting. These observations indicate that both the compounds probably have similar mode of action resulting in peak activity during moulting, which occurs periodically during the development of larvae.

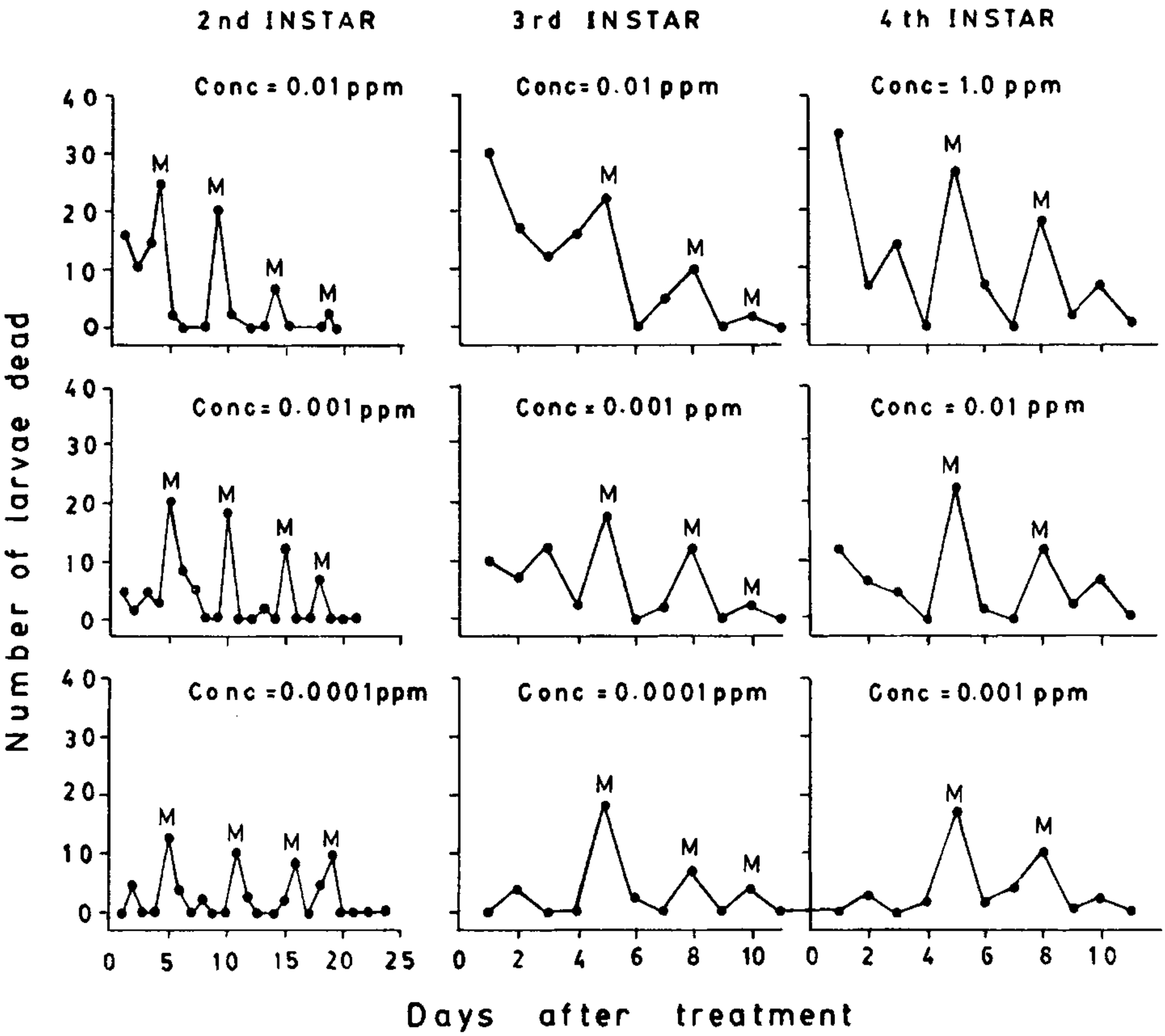

Figure 1. Daily mortality in 100 second, third and fourth instar *A. stephensi* larvae following continued exposure to Penfluron.

Reports[16, 17] on the mode of action of Penfluron and Diflubenzuron suggest that they inhibit the incorporation of glucose in the biosynthesis of chitin by immature insects, which could be the cause of abortive moulting in Penfluron-treated larvae due to insufficient availability of chitin.

Similar results were obtained when the larvae were treated with Furyltriazine (figure 2), except that the effective concentration is higher than that of Penfluron, ranging from 0.1 ppm to 20 ppm for different larval instars.

The probit regression lines for 100% mortality for all the instars show variation among their slopes (figures 3A, B). At all the doses applied (0.0001, 0.001, 0.01, 0.1, 1.0 and 5.0 ppm) the second-instar larvae died faster than the fourth-instar ones and the total per cent mortality also differed; the earlier instars showing higher per cent mortality than the later ones at the same dose level. Similar observations were made when *Culex pipiens*[18] and *Anopheles stephensi*[19] were treated with other growth regulating compound, the Dimilin.

Based on the above observations it is concluded that Penfluron is more effective than Furyltriazine and would be more economical.

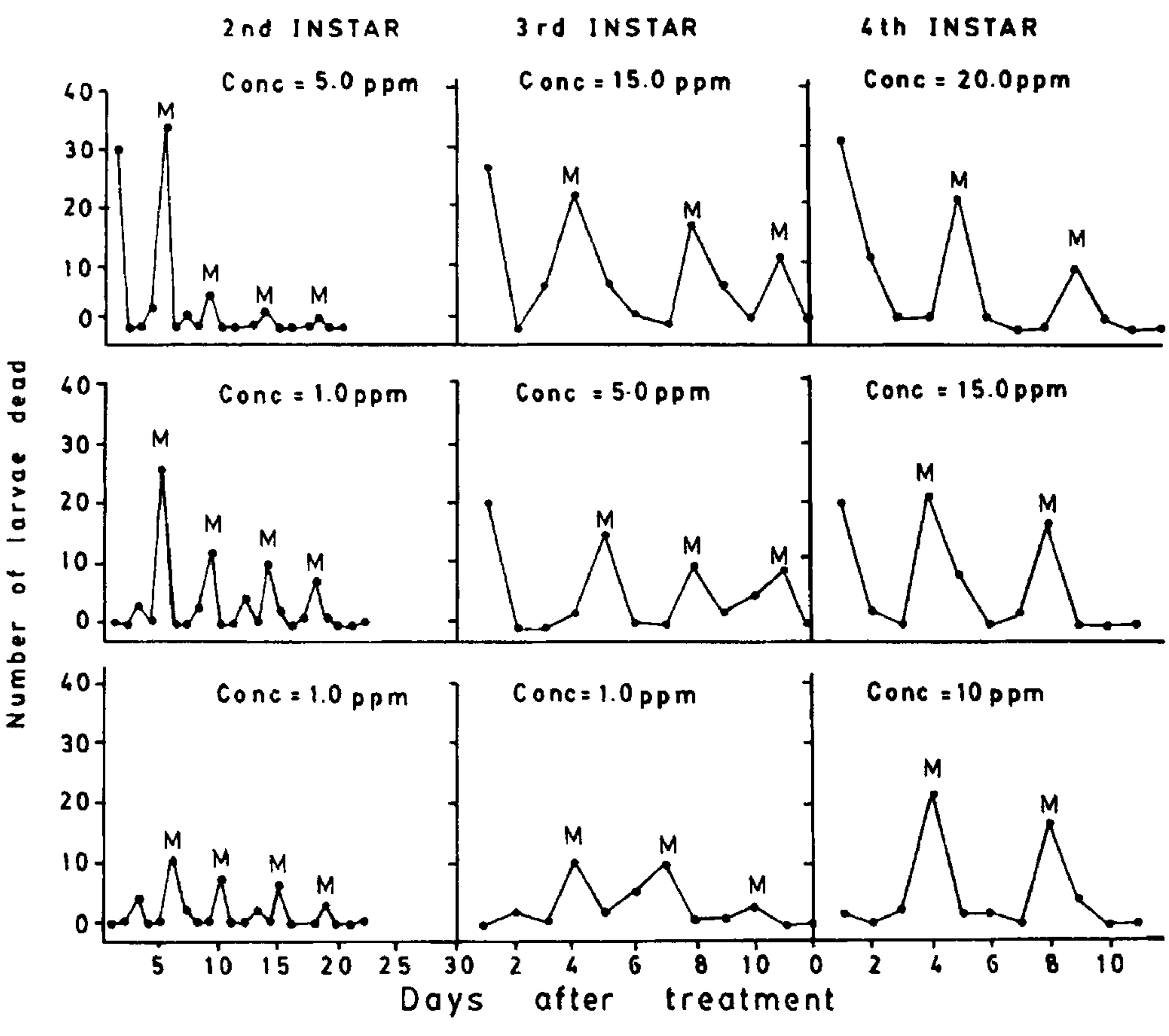

Figure 2. Daily mortality in 100 second, third and fourth instar *A. stephensi* larvae following continued exposure to Furyltriazine.

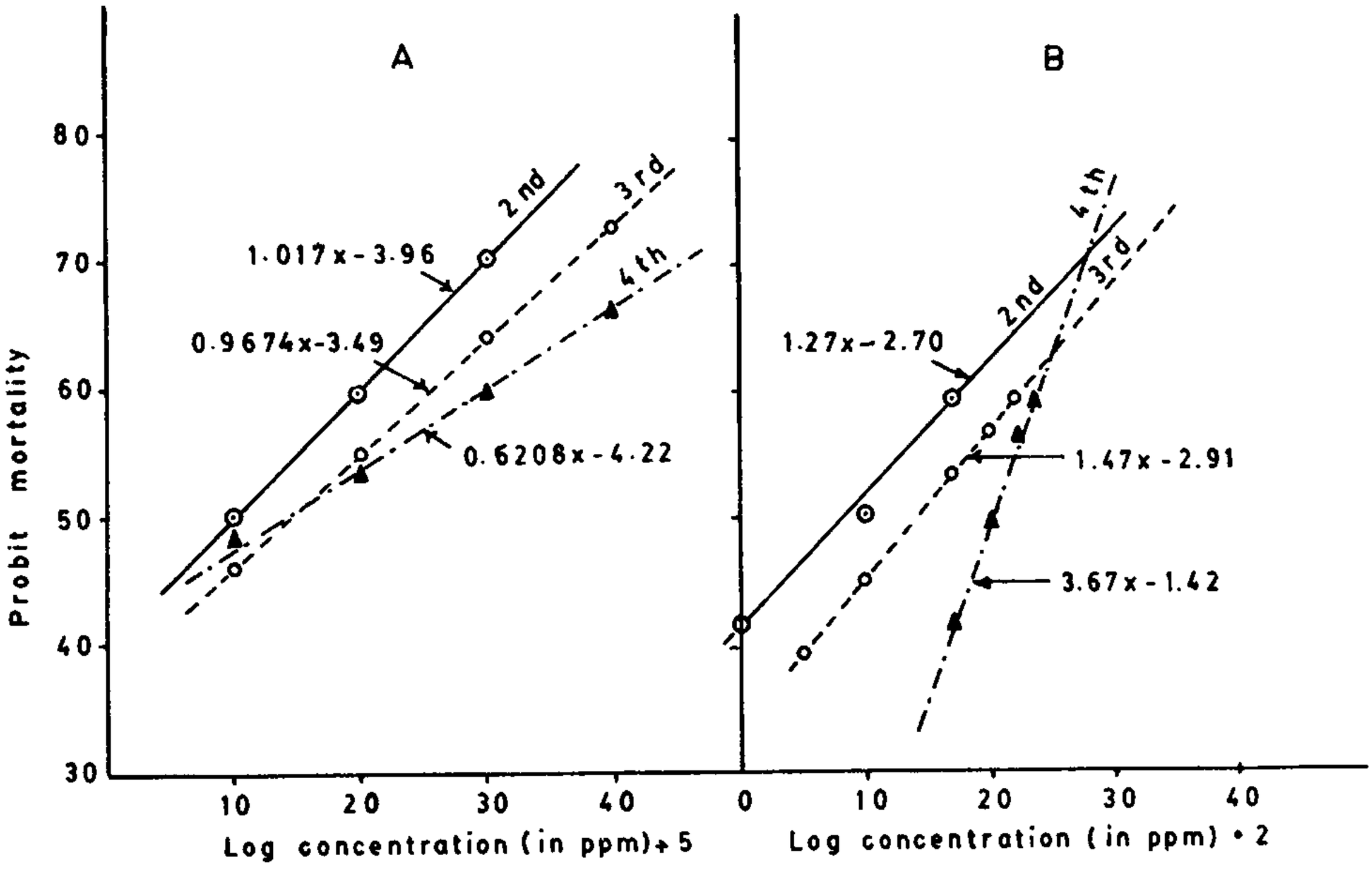

Figure 3A, B. Linear regression lines drawn between probit mortality and log concentration (in ppm) representing the toxicity of Penfluron (**3A**) and Furyltriazine (**3B**) against different larval instars of *A. stephensi.*

ACKNOWLEDGEMENTS

The authors are grateful to Dr A. B. Borkovec, Insect Reproduction Laboratory, USDA Agricultural Research Centre, Beltsville, Maryland, USA for providing the compound as gratis. Thanks are due to ICMR, New Delhi, for financial assistance.

28 April 1986

1. Jakob, W. L. and Schoof, H. F., *Mosquito News*, 1971, **31,** 737.
2. Jakob, W. L. and Schoof, H. F., *Mosquito News*, 1972, **32,** 6.
3. Jakob, W. L., *Mosquito News*, 1972, **32,** 592.
4. Jakob, W. L., *J. Med. Entomol.*, 1973, **10,** 452.
5. Schaefer, C. H. and Wilder, W. H., *J. Econ. Ent.*, 1972, **656,** 1066.
6. Steelman, C. D. and Schilling, P. E., *Mosquito News*, 1972, **32,** 350.
7. Mulla, M. S., Darwazeh, H. A. and Norland, R. E., *J. Econ. Ent.*, 1974, **67,** 329.
8. Mathis, H. L. *et al.*, Unpublished document WHO/VBC/75.44.
9. Saxena, S. C. and Kumar, V., *Indian J. Entomol.*, 1982, **44,** 49.
10. Saxena, S. C. and Mathur, G., *Environ* Res., 1980, **1,** 38.
11. Saxena, S. C. and Kaushik, R. K., *Ad. Bios.*, 1985, **4,** 63.
12. MacGregor, J. T., Gould, D. H. and Mitchell, D., *Mutat. Res.*, 1979, **66,** 45.
13. Booth, G. M. and Ferrell, D., *Environ. Sci. Res.*, 1976, **10,** 221.
14. Ivie, G. W., Bull, D. L. and Veech, J. A., *J. Agric. Food Chem.*, 1980, **28,** 330.
15. Finney, D. J., *Probit analysis*, 3rd ed, *Cambridge University Press, Cambridge*, 1971, pp. XV + 333.
16. Post, L. C., Dejong, B. J. and Vincent, W. R., *Pestic. Biochem. Physiol.*, 1974, **4,** 473.
17. Mulder, R., and Gijswijt, M. J., *Pestic. Sci.*, 1973, **4,** 737.
18. Sharma, V. P., Batra, C. P. and Brooks, G. D., *WHO/VBC/* 75, 549, 1975.