ORGANOPHOSPHATE AND CARBAMATE RESISTANCE IN FOUR SPECIES OF RICE INSECT PESTS

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Continuous exposure to organophosphorous and carbamate insecticides, for more than three decades, has caused insecticide resistance in insect pests of rice in Sri Lanka. Major mechanisms, responsible for organophosphorous and carbamate resistance in insects, are the increased activity of insecticide metabolizing carboxylesterases and insensitive target-site acetylcholinestrase (AChE). Present study was carried out to determine the level of insecticide resistance and the prevalence of these two mechanisms in four species of rice insect pest populations.

Adults of brown planthopper *Nilaparvata lugens*, green leafhopper *Nephotettix virescens*, white planthopper *Cofana spectra* and paddy bug *Leptocorisa oratorius* were collected from rice fields at Batalagoda Rice Research and Development Institute. Insecticide bioassays were carried out with organophosphates; chlorpyrifos and dimethoate, carbamates; carbosulfan and butylphenyl methylcarbamate (BPMC). Adult insects (n=100) were exposed to different dosages of insecticides by topical application using a microapplicator. Mortality was recorded after 24 hours and LD_{50} and LD_{90} values were obtained using log probit mortality curves. Highest LD_{50}s for dimethoate (10.0μg/g) and BPMC (3.75μg/g) were shown by *N. lugens*. *N. virescens* showed highest LD_{50} for chlorpyrifos (5.12μg/g) and carbosulfan (0.25μg/g). Lowest LD_{50}s for all the tested insecticides were from *L. oratorius* (dimethoate - 0.14μg/g, chlorpyrifos - 0.17μg/g, BPMC - 0.09μg/g, and carbosulfan - 0.03μg/g).

Mean carboxylesterases in crude homogenates (n>200) of *N. lugens* (0.768 ± 0.569 μmol/min/mg) and, *N. virescens* (1.1346 ± 0.7763 μmol/min/mg) were much higher than in *L. oratorius* (0.018 ± 0.0356 μmol/min/mg) and *C. spectra* (0.0442 ± 0.036 μmol/min/mg). Native polyacrylamide gel electrophoresis also showed the increased activity of carboxylesterases in *N. lugens* and, *N. virescens*. Bimolecular rate constants were determined for the inhibition of AChE, by paraoxon (100μm) and propoxur (100μm). High rates of inhibition (0.034×10^5 to 0.129×10^5 M^{-1} min^{-1} for paraoxon and 0.18×10^5 to 0.29×10^5 M^{-1} min^{-1} for propoxur) insecticide target-sites AChEs are sensitive to insecticides.

Results show that organophosphate and carbamate resistance in these four insects species of rice pests is due to increased activity of insect carboxylesterases and not due to altered target-site.

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