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Persistence and residual activity of an organophosphate, pirimiphos-methyl, and three IGRs, hexaflumuron, teflubenzuron and pyriproxyfen, against the cowpea weevil, *Callosobruchus maculatus* (Coleoptera: Bruchidae)

Gamal E Abo-Elghar^{1,*}, Anwar E El-Sheikh¹, Ferial M El-Sayed², Hamdi M El-Maghraby³, Hesham M El-Zun²

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Abstract

Three insect growth regulators (IGR), the chitin synthesis inhibitors (CSI) teflubenzuron and hexaflumuron and the juvenile hormone mimic (JHM) pyriproxyfen, as well as the organophosphate (OP) pirimiphos-methyl, were evaluated for their activity against the cowpea weevil, *Callosobruchus maculatus* (F), in cowpea seeds stored for up to 8 months post-treatment. The initial activity data showed that, based on LC_{50} level, teflubenzuron had strong ovicidal activity ($LC_{50} = 0.056 \text{ mg kg}^{-1}$) followed by pirimiphos-methyl (1.82 mg kg^{-1}) and pyriproxyfen (91.9 mg kg^{-1}). The residual activity data showed that none of the IGRs tested had strong activity when applied at 200 mg kg^{-1} in reducing the oviposition rates of *C. maculatus* at various storage intervals up to 8 months post-treatment. However, teflubenzuron reduced adult emergence (F1 progeny), achieving control ranging from 96.2% at 1 month to 94.3% at 8 months. Hexaflumuron showed a similar trend in its residual activity, ranging between 93.8% control at 1 month to 88.2% control at 8 months post-treatment. However, pyriproxyfen was more active than the CSIs tested and caused complete suppression (100% control) of adult emergence at all storage intervals. Unlike the IGRs tested, pirimiphos-methyl applied at 25 mg kg^{-1} was more effective in reducing oviposition rates of *C. maculatus* up to 8 months post-treatment. A strong reduction of adult emergence was also observed at various bimonthly intervals (98.6% control at 1 month to 91.6% control at 8 months post-treatment). The persistence of hexaflumuron and pirimiphos-methyl in cowpea seeds was also studied over a period of 8 months. The loss of hexaflumuron residue in treated cowpeas (200 mg kg^{-1}) was very slow during the first month post-treatment (4.43%). At the end of 8 months, the residue level had declined significantly to 46.4% of the initial applied rate. The loss of pirimiphos-methyl residue in treated cowpeas (25 mg kg^{-1}) was relatively high during the first month post-treatment (36.7%) and increased to 81.6% after 8 months. Copyright © 2003 Society of Chemical Industry

Keywords:

Callosobruchus maculatus; insect growth regulators; OP; pirimiphos-methyl; ovicidal activity; residual activity; persistence; cowpea seeds

JOINT ACTION OF BIOINSECTICIDES AND IGRs IN BINARY MIXTURES WITH SEVERAL INSECTICIDES AND THEIR ROLE IN DEVELOPMENT OF RESISTANCE IN *SPODOPTERA LITTORALIS* (BOISD.)

H.S.A. Radwan, M.E. Nassar, A.E. El-Sheikh, Manal A.A. Abd El-Razik
Pesticide Dept., Faculty of Agric. Minufiya Univ., Egypt.,,

ABSTRACT:

The efficacy of 8 binary mixtures representing two naturally derived insecticides, spinosad and abamectin when combined with each of deltamethrin, furathiocarb, methomyl and profenfos at mixing ratios of 9:1, 4:1, 1:1, 1:4 and 1:9 was studied, by feeding 4th instar larvae of *S. littoralis* (Boisd.) on treated castor bean leaves for 24 hr. Also, the joint action of deltamethrin, chlorpyrifos and methomyl when combined with each of four IGRs, methoxyfenozide, chlorfluazuron, hexaflumuron and pyriproxyfen in binary mixtures at the same mixing ratio was studied. Therefore, the acute toxicity (LC₅₀) of each insecticide separately and those of binary mixtures was assessed. Based on LC₅₀ value of each insecticide separately or the mixtures and mixing ratios, the co-toxicity coefficient (CTC) of mixture was determined. At 24h post treatment neither naturally derived compounds in their mixtures showed synergism to the conventional insecticides except for methomyl at limited mixing ratios. However, chlorpyrifos in its mixtures with tested IGRs showed remarkable synergistic activity regardless mixing ratios, whereas deltamethrin in mixture with only methoxyfenozide and hexaflumuron exhibited synergistic activity at limited mixing ratios. In contrast methomyl recorded clear antagonistic action in all mixtures with IGRs, except with chlorfluazuron at 9:1 mixing ratio. When the most promising mixtures (showing the highest CTC) was used in selection at level LC₃₀ for 5 generations, the data obtained indicate remarkable delay in development of resistance in case of spinosad+methomyl (1:4) and chlorpyrifos+hexaflumuron (9:1), compared with relatively higher rate of resistance development for selection with each component alone. Using synergism from these promising insecticide mixtures should prove to be an additional tool in the overall resistance management strategy.

Key words: Joint action, resistance, insecticides, IGRs and cotton leafworm