Synergistic potential of dillapiole oil for synthetic pyrethroid insecticides against the fall armyworm.

Murilo Fazolin[1], Joelma Lima Vidal Estrela[1], André Fábio Monteiro Medeiros[1], Maria Samylla de Farias Silva[2], Iriana Maria da Silva[2], Luiara Paiva Gomes[2]

[1]Embrapa Acre, Rodovia BR 364 Km 14 s/n, 69900-056, Rio Branco, AC, Brazil.
[2] União Educacional do Norte (UNINORTE)
murilo.fazolin@embrapa.br

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Spodoptera frugiperda (J.E. Smith) is a serious lepidopterous pest of several economically important crops. Control of the fall armyworm has depended exclusively on insecticides. As a result, this pest has developed resistance to major classes of insecticides. There has been mounting interest in the use of synergist to reduce this resistance by combined application of insecticide with synergists. A highly effective, expensive insecticide might be used at a diluted rate with a less expensive chemical to give satisfactory control of a target insect and minimize the contamination of agro ecosystem. It was shown that piperonyl butoxide (PBO) and others methylenedioxyphenyl compounds inhibited the microsomal oxidation of many insecticides and other xenobiotics in a number of insect species. *Piper aduncum* L. is a widespread tropical shrub, known as an invading plant in Amazon areas deforested after timber exploitation. The leaves and stems of *P. aduncum* contain an essential oil composed mainly of dillapiole (5-allyl-6,7-dimethoxy-1,3-benzodioxole) (1) which has been demonstrated to have synergistic effects with several pesticides (2). The objective of this study was to evaluate the synergy and response homogeneity of the *S. frugiperda* larvae population to the essential oil of *P. aduncum* in combination with pyrethroid insecticides: α-cypermethrin, β-cypermethrin, fenpropathrin and γ-cyhalothrin, compared with piperonyl butoxide (PBO positive controls). By the ratio of the LC_{50} and LD_{50} of the insecticides taken singly and their respective synergistic combinations with essential oil and (PBO), the synergism (FS) factors for comparison with each other were obtained. The slope of the dose/concentration-mortality curves was used to establish the relative toxicity increase promoted by synergistics and to determine the response homogeneity. Residual contact revealed a significant potentiation for commercial insecticides formulated with β-cypermethrin (FS= 9.05-0.5), fenpropathrin (FS= 34.05-49.77), when combined with the essential oil of *P. aduncum*. In the topical contact, there occurred significant potentiation only for the α-cypermethrin (FS= 7.55-3.68), fenpropathrin (FS= 3.37-1.21) and γ-cyhalothrin (FS= 5.79-10.48) insecticides when combined with the essential oil. Except fenpropathrin and γ-cyhalothrin, other synergistic combinations presented homogeneous response by topical contact as well as residual, for at least a synergistic combination with the essential oil of *P. aduncum*. The FS significance values of combinations of the *P. aduncum* essential oil with insecticides α-cypermethrin, β-cypermethrin, Fenpropathrin and γ-cyhalothrin, may indicate that this essential oil as an alternative to PBO.

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