

Susceptibility of *Spodoptera frugiperda* to chemical insecticides and control failure likelihood estimation in Burkina Faso

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Abstract

Fall armyworm has recently invaded sub-Saharan African countries. It threatens the food and nutritional security of millions of people due to damage to maize, pearl millet, sorghum, rice and other crops since 2016. Several insecticides have been promoted, but farmers have reported control failures.

In order to identify effective insecticides against this pest, we collected seven populations in as many maize-producing areas in Burkina Faso. The IRAC-approved foliar bioassay protocol was used to evaluate the susceptibility of third instar larvae to six chemical insecticides commonly used by maize growers, including different active ingredients: methomyl, deltamethrin, emamectin benzoate, abamectin, lambda-cyhalothrin, and chlorpyrifos-ethyl. Lethal concentrations (LC₈₀) and control failure likelihood (CFL) were calculated.

The results show that the manufacturers' recommended concentrations are lower than those needed to eliminate 80% of the larvae (LC₈₀) for abamectin, deltamethrin and lambda-cyhalothrin and their CFL is high (66 - 97%). In contrast, the recommended concentrations are higher than the LC₈₀ values for emamectin benzoate (0.001 mg/l), methomyl (43 - 278 mg/l) and chlorpyrifos-ethyl (284 - 659 mg/l). For these active ingredients, the CFL is null, which makes them the most effective for the control of this new pest in Burkina Faso. Because of the pest's ability to develop rapid resistance to these active ingredients, we recommend alternating their use to delay this phenomenon.



Introduction

- The fall armyworm, *Spodoptera frugiperda* Smith (Lepidoptera: Noctuidae) invaded sub-Saharan Africa in 2016. It causes significant losses to maize and threatens food and nutritional security (SDG2).
- The control of this pest relies mainly on the use of chemical insecticides whose effectiveness is often questioned by producers.
- In this work, we evaluated the susceptibility of the pest to six chemical insecticides commonly used by maize producers in Burkina Faso.

Methodology

Insects

- ❖ Collection of seven fall armyworm populations in the provinces of Houet (4) and Kadiogo (3).
- ❖ Rearing of insects in the laboratory with fresh maize leaves.

Susceptibility test (Adapted from IRAC No. 020)

- Cutting maize leaves into blades;
- Dipping in an insecticide solution (5 - 9 concentrations);
- Use of 40 larvae (L3 stage) of the first generation (F1) per concentration;
- Assessment of mortality after 48 h exposure;
- LC₈₀ and Control Failure Likelihood (CFL, using Guedes 2017 formula) calculation.

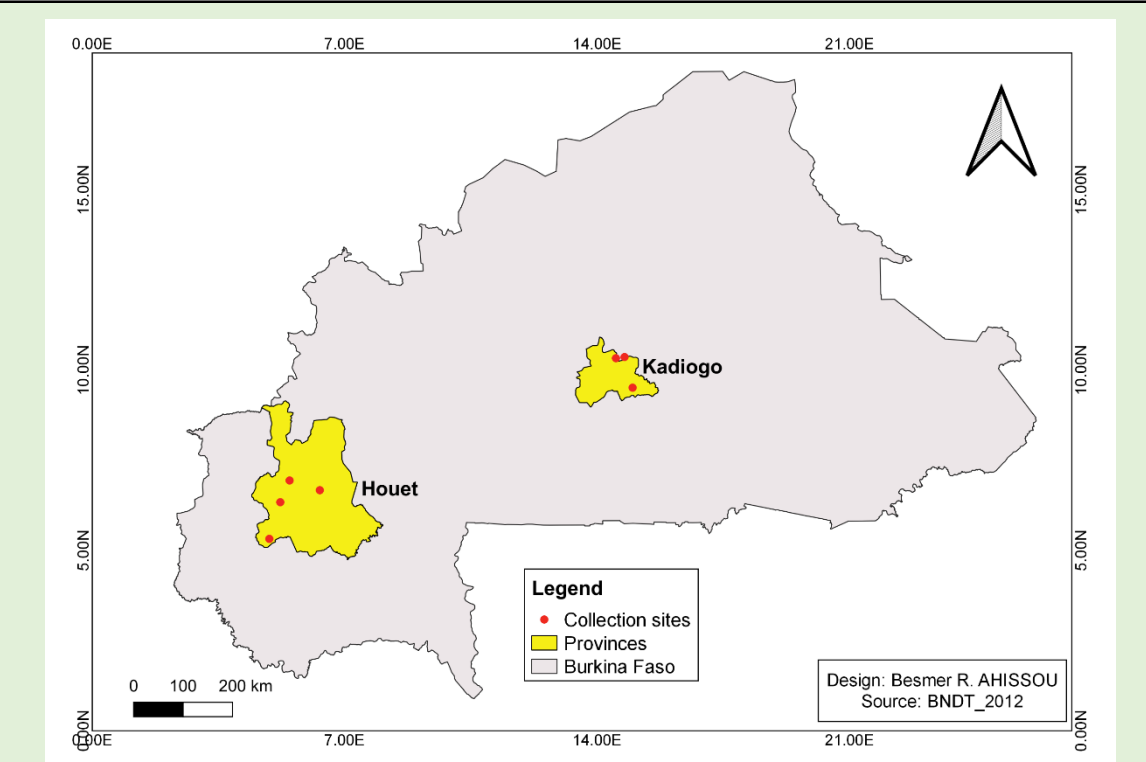


Fig. 1. Larvae collection sites



Results

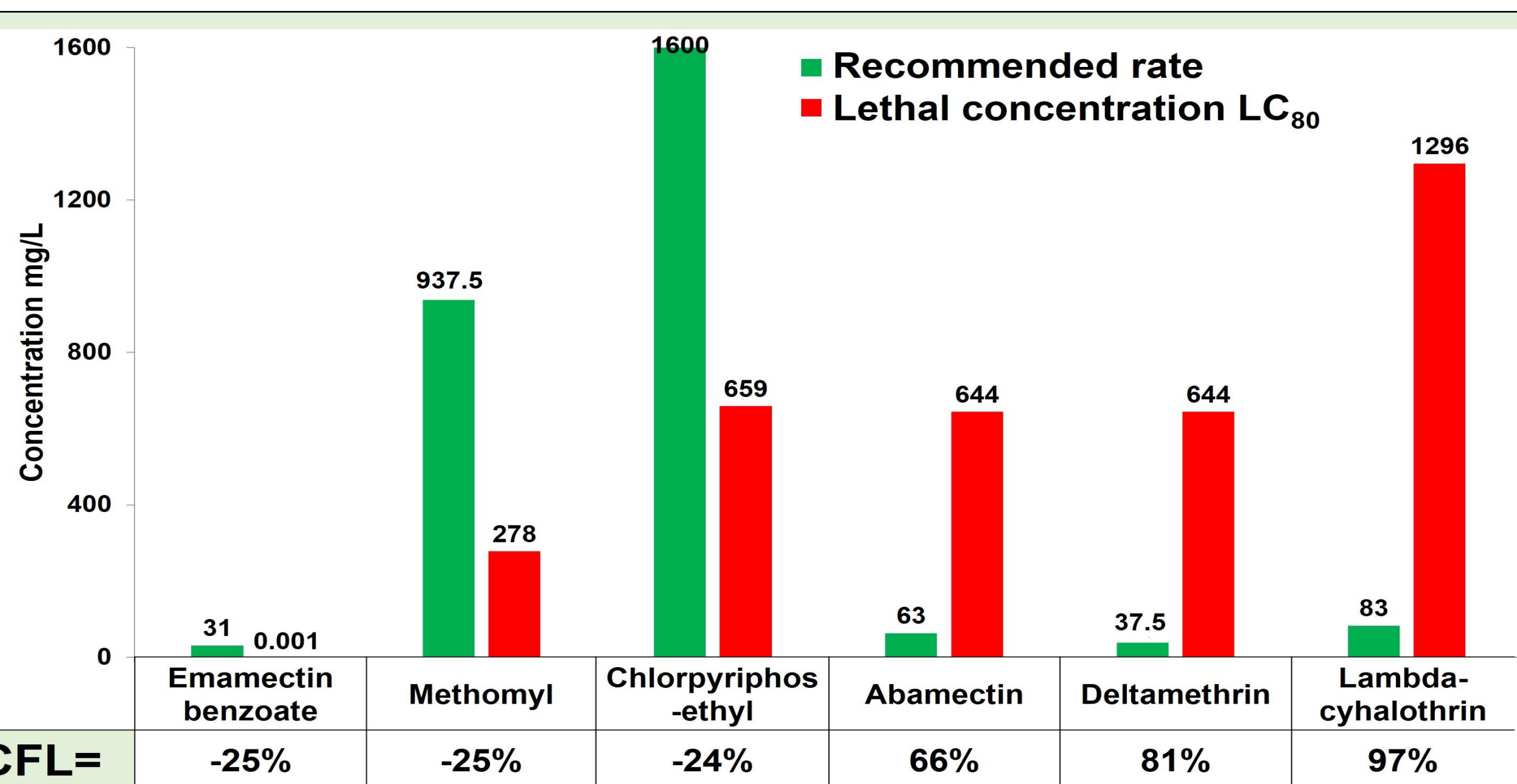


Fig. 2. Recommended concentrations, mean LC₈₀ values and Control Failure Likelihood of insecticides for different populations.

❑ High susceptibility of all *S. frugiperda* populations to emamectin benzoate, methomyl, and chlorpyrifos-ethyl, as LC₈₀ values were lower than recommended doses. The Control Failure Likelihood is therefore null.

❑ Control Failure Likelihood is very high with abamectin, deltamethrin and lambda-cyhalothrin (66-97%).

Conclusion

- ❖ Emamectin benzoate, methomyl and chlorpyrifos-ethyl insecticides are the most effective for the sustainable control of fall armyworm in Burkina Faso.
- ❖ They should be alternated in the control of the pest to delay the development of resistance.

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Developing smallholder-oriented IPM strategies for fall armyworm (*Spodoptera frugiperda* Smith) management
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