

# Simple bioassay for early detection of insecticide resistance in fall armyworm for multinational sharing

Production

Demonstration

Item: Maize

Chemical pesticide reduction

## Outline

A simple bioassay method was developed to detect insecticide-resistant populations of the fall armyworm (*Spodoptera frugiperda*), a transboundary pest, at an early stage and to enable rapid multinational information sharing to prevent their spread. This method involves three procedures: collecting test insects, mass rearing the insects on an artificial diet prepared from readily available materials, and applying insecticides using an artificial diet.

## Background/effect/note

The fall armyworm (*Spodoptera frugiperda*) is a lepidopteran pest that feeds on more than 80 crops, primarily maize (Fig. 1). The fall armyworm has rapidly expanded its range by invading Africa and Asia. An insecticide-resistant strain that emerges in one region will likely quickly spread to neighboring countries owing to its long-distance flight ability. Changes in susceptibility must be broadly and consistently monitored using the same method and results must be promptly shared to suppress the spread of insecticide-resistant strains. We established a simple bioassay method using readily obtainable materials to enable the monitoring of insecticide susceptibility in the fall armyworm in Southeast Asia, including developing regions (Fig. 2). This method can be applied for many insecticides. This method was validated in Thailand and Cambodia, where insecticide susceptibility was easily evaluated, showing that the method is useful for international comparisons and management strategies. The survival rate of larvae fed an artificial diet was comparable to that of larvae fed fresh maize leaves in the third to sixth instars but was lower in the first and second instars. Therefore, first- and second-instar larvae should be reared on fresh maize leaves when simultaneously testing many insecticides.

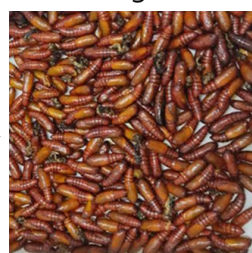


Fig. 1. Fall armyworm larva feeding on maize.

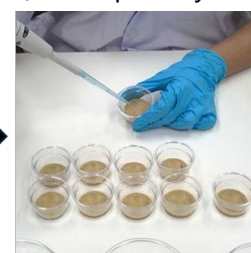
a) Collecting test insects    b) Mass rearing of test insect    c) Susceptibility test



Collect over 300 individuals per location.



First-instar larvae are reared to pupal stage on artificial diet.



Apply insecticide to artificial diet and evaluate mortality

Fig. 2. Outline of simple bioassay method for evaluating insecticide susceptibility. Susceptibility tests are conducted using 3rd-instar larvae within three generations of collection using a diet-overlay method. A total of 200  $\mu$ L of insecticide is serially diluted to any multiple with distilled water and applied to 5 mL of artificial diet. The diet is dried, 10 third-instar larvae are fed the diet, and the number of dead individuals is counted 72 h later. The  $LC_{50}$  value is calculated from the obtained results.



Technical details:

[https://www.jircas.go.jp/en/publication/research\\_results/2023\\_b06](https://www.jircas.go.jp/en/publication/research_results/2023_b06)

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