

Standardisation of artificial diet for fall armyworm, *Spodoptera frugiperda* (J. E. Smith) mass culturing to accomplish research needs of management strategies

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Standardising artificial diets for mass-rearing insects in laboratory is crucial for deepening our understanding of insect biology, behaviour and nutritional needs, which are pre-requisite for developing effective integrated pest management strategies. The present study was focused on formulating an optimal artificial diet for the invasive pest *Spodoptera frugiperda* by evaluating various diet ingredients and their impact on insect development. Out of 32 diet compositions tested, 16 diets supported developments to the adult stage and these 16 diets were further evaluated to identify the best-suited diet. Among these, a diet based on lab lab beans emerged as the most effective for rearing fall armyworm in the laboratory. Larvae fed with a diet of lab lab beans soaked and supplemented with maize leaf powder, excluding Wesson's salt, achieved the highest larval weight (0.3807 g on the 7th day after hatching), the shortest larval duration (14.47 days), the highest pupal weight (0.2520 g), the shortest pupal duration (10.03 days) and the highest adult emergence rate (94.50%). These results were comparable to the diet of soaked lab lab beans without maize leaf powder and Wesson's salt, which recorded a larval weight of 0.2343 g, a larval duration of 15.50 days a pupal weight of 0.2107 g, a pupal duration of 10.25 days, and an adult emergence rate of 93.00. The addition of Wesson's salt did not significantly enhance growth parameters. Although the diet including maize leaf powder supported the highest adult emergence, its cost and the difficulty of sourcing pesticide-free maize leaf powder make it impractical. Therefore, the diet without maize leaf powder has been standardized as the most efficient and reliable method for producing a large and continuous supply of insects for research purposes. This optimized diet not only ensures the robust growth and development of *S. frugiperda* but also provides a cost-effective and practical solution for laboratory rearing, significantly advancing research capabilities in pest management.

Keywords: Artificial diet, fall armyworm, mass culturing, *Spodoptera frugiperda*.

FALL armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) is one of the recent alien pests infesting various crops such as maize, sorghum, beans and cotton. In maize, FAW infestation starts during vegetative stage with leaf injury damage and persists till ear damage at late stage¹. In India, FAW was first reported on maize by Sharanabasappa *et al.*² in Shivamogga district of Karnataka during May–June 2018. In India, majority of the farmers are dependent on pesticides³ and the cost of crop protection using pesticides to manage FAW in maize increased to US\$ 71.23, 64.48 and 56.01 per hectare in 2018, 2019 and 2020 respectively⁴. Management of this pest is challenging due to its cryptic, polyphagous and migratory behaviour⁵. The key to minimize the losses caused by FAW lies in the framework of integrated pest management, which involves the combination of cultural, mechanical, chemical, biological control and use of resistant/tolerant maize varieties. Being an invasive pest, identification of effective insecticides require rigorous bioefficacy testing in laboratory and production of biological control agents like parasitoids requires large quantities of FAW eggs/larvae. Artificial diets, if available/standardised allow continuous laboratory rearing of insects of known quality throughout the year for carrying out various laboratory tests⁶. To meet various research needs, FAW larvae has to be produced in enormous quantity in laboratory, for which designing an artificial diet is mandatory. With this view, the present study was carried out to standardise an artificial diet for FAW.

Materials and methods

Standardisation of artificial diet was carried out under laboratory condition at the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu during 2021–2022.

Source of fall armyworm insects

FAW eggs were collected from