



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2018; 6(3): 663-667

© 2018 JEZS

Received: 21-03-2018

Accepted: 22-04-2018

Divya Bharathi T

Department of Entomology,
Agricultural College, Bapatla
Andhra Pradesh, India

Krishnaya PV

Department of Entomology,
Agricultural College, Bapatla
Andhra Pradesh, India

Srinivasa Rao M

Central Research Institute for
Dryland Agriculture, Santhosh
Nagar, Hyderabad

Prasanna Kumari V

Department of Pathology,
Agricultural College, Bapatla
Andhra Pradesh, India

Effect of elevated CO₂ and temperatures on thermal requirement and thermal constants of beet armyworm, *Spodoptera exigua* (Noctuidae: Lepidoptera) on chickpea

Divya Bharathi T, Krishnaya PV, Srinivasa Rao M and Prasanna Kumari V

Abstract

The objective of this study was to examine the development of beet armyworm, *Spodoptera exigua* (Noctuidae: Lepidoptera) at six temperatures (20, 25, 27, 30, 33 and 35 °C) and to estimate temperature thresholds and thermal constants for the forecasting models based on heat accumulation units, which could be developed for use in forecasting. The developmental periods of different stages of *S. exigua* were reduced with increases in temperature from 20 to 35 °C under both ambient and elevated CO₂ conditions. The lower development threshold for egg, larva, pupa, adult and total development period required 11.57, 10.72, 9.05, 6.97 and 10.24 °C under eCO₂ conditions, whereas it was 11.61, 10.43, 10.49, 6.15 and 9.83 °C under aCO₂ conditions, respectively. The thermal requirement of *S. exigua* from egg to adult (total development period) was found to be 588.24 degree days under eCO₂ conditions as against 555.56 degree days under aCO₂ conditions. These estimated temperature thresholds and degree days can be predict the occurrence, number of generations and population dynamics of *S. exigua*.

Keywords: *Spodoptera exigua*, temperature thresholds, thermal constant, degree days, forecasting models and population dynamics

Introduction

Beet armyworm (*Spodoptera exigua* Hubner) (Noctuidae: Lepidoptera) possesses wide distribution, polyphagous, strong migration ability and high temperature suitability. It was reported as an important folivorous pest of numerous cultivated crops including cotton, tomato, celery, cabbage, onion and alfalfa in India [14]. Recently the infestation of *S. exigua* is noticed at significant levels in different states of South India and is gaining major insect pest status on chickpea.

The changes in temperature and CO₂ concentration can influence the growth and development of insect pests and in turn influence population dynamics and their status. Among the climatic factors, temperature is the most important, as it has profound influence on the development and survival of insects. The rate of insect development is affected by the temperature to which insects are exposed [2]. Numerous studies have shown that the annual average temperature of the earth will increase 1 °C by 2025 and the probable rise in temperature by the end of the century is expected to reach 3 °C [15]. Temperature influences the developmental rate of insects significantly and has direct effects, whereas the effect of eCO₂ is host-mediated and indirect. It is well known that development rate of insects increases with temperature up to certain levels beyond which they usually decrease [19]. Insects require a certain amount of heat units (degree days) to develop from one life stage to the other stage. Quantification of the relationship between insect development and temperature is useful to predict the seasonal occurrence and population dynamics of the insects. The ability of an insect to develop at different temperatures is an important adaptation to survive under various climatic conditions (tropical, subtropical, and temperate).

So far, there is no published report from India on the effect of constant temperatures on *S. exigua*. Hence, in the present study, developmental periods of different stages of *S. exigua* were examined at six constant temperatures and two CO₂ conditions to estimate the temperature thresholds and thermal requirements, which would be useful in developing models for predicting its distribution and abundance.

Correspondence

Divya Bharathi T

Department of Entomology,
Agricultural College, Bapatla
Andhra Pradesh, India