

Factors responsible for estivation in spotted stem borer, *Chilo partellus* (Swinhoe)

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Abstract

Diapause is an important adaptive trait in certain groups of insects at a particular stage, which contribute in controlling insect ecology, phenology, and physiology. Considering the importance of various factors in appropriate combinations, we studied effects of different temperature and photoperiod conditions on larval morphometrics, development, induction, and termination of estivation, and overall mortality due to estivation in *Chilo partellus* (Swinhoe). Weight, length, and head capsule width of *C. partellus* larvae significantly increased with increase in temperature and photoperiod treatments upto certain age and duration of exposure. According to Dyar's ratio, overall head capsule width progressed geometrically with minimum constant ratio of 1.20, and second-degree polynomial regression equations were best fitted to all the test treatment conditions. The mortality of diapausing *C. partellus* individuals varied between 7.0% and 37.3% under different constant and varying temperature and photoperiod regimes, which at 38°C + 14L:10D reached upto 100.0%. However, the exposure to 30°C + 12.5L:11.5D and 32°C + 13L:11D along with dry food accelerated the process of estivation, wherein the diapause larval survival was significantly higher and overall mortality of individuals due to diapause was lower suggesting these conditions appropriate for induction of estivation in *C. partellus*. These studies have implications for better understanding the bioecology and population regulation system under varying climatic conditions and devising novel strategies for management of *C. partellus*.

KEYWORDS

Chilo partellus, diapause, ecology, management, morphometrics, population dynamics

1 | INTRODUCTION

Temperature and photoperiod are considered as the dominant environmental factors which contribute in the developmental biology of arthropods (Haghani, Fathipour, Talebi, & Baniamari, 2007; Hassall, Thompson, French, & Harvey, 2007). Combinations of these factors affect the seasonal adaptation and population dynamics, and determine the limit of ecological, biological, behavioral, and physiological activities in insects (Roy, Brodeur, & Cloutier, 2002). Temperature along with photoperiod mimicking natural fluctuations

forms the temperature and photoperiod conditions consisting of cryoscotophase and/or thermophotophase. The responses to these temperature and photoperiodic fluctuations are detrimental to growth, development, and survival of insects during summer and winter extremes (Beck, 1991; Dhillon & Hasan, 2017b).

Every insect population has an optimum temperature at which they develop at faster rate, and the lower- and upper-temperature thresholds beyond which they cannot develop (Shelford, 1918, 1963; Stinner, Gutierrez, & Butler, 1974; Wagner, Olson, & Willers, 1991). Insects are small-bodied poikilothermic organisms and noticeably susceptible to