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PII: S1226-8615(16)00002-9
DOI: doi: 10.1016/j.aspen.2015.12.016
Reference: ASPEN 741

To appear in: *Journal of Asia-Pacific Entomology*

Received date: 4 March 2015
Revised date: 25 August 2015
Accepted date: 23 December 2015

Please cite this article as: Ren, Jin-Long, Tu, Xiong-Bing, Ge, Jing, Zhao, Li, Zhang, Ze-Hua, Influence of temperature on the development, reproduction, and life table of *calliptamus italicus* (L.) (orthoptera: Acridoidea), *Journal of Asia-Pacific Entomology* (2016), doi: 10.1016/j.aspen.2015.12.016

Influence of temperature on the development, reproduction, and life table of *Calliptamus italicus* (L.) (Orthoptera: Acridoidea)

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Competing financial interests: The authors declare no competing financial interests.

Abstract *Calliptamus italicus* is a migratory species of grasshopper that can cause serious damage to grasslands in Xinjiang, China. In this study, we examined the effects of different temperatures (23, 26, 29, 32 and 35 ℃) on the lifecycle and life table parameters. The results showed that temperature strongly influences the growth and development of *C. italicus*. At temperatures ranging from 23 to 35℃, the development time was negatively-linearly related to temperature ($P < 0.01$). The time of development from an egg- to- an adult (pre-oviposition) ranged from 86.8 days at 26 ℃ to 40.6 days at 35 ℃, and no oviposition occurred at 23 ℃. An average of 687.1 degree-days was required for complete development to occur above the lower threshold temperature (18.3 ℃). Egg hatching rates and, nymph and pre-adult survival rates were lowest at 23^{o}C (95.6%, 72.6%, and 0%, respectively), and highest at 32 ℃ (97.8%, 86.2%, and 88.7%, respectively). The mean total fecundity ranged from 41 eggs/female at 26 ^{o}C to 55 eggs/female at 32 ^{o}C. The sex ratio (% females) ranged from 30 to 52%. The intrinsic rate of population increase (r_m) at the different temperatures ranged from 0.0020 $d^{-1}$to 0.0447 d^{-1}, with the highest value recorded at 32 ℃. These results indicate that temperature significantly affects the biology of *C. italicus* and that the optimal temperature range for its development is 26-32 ℃.

Keywords: *Calliptamus italicus* (L.), life table, temperature, survival rate, reproduction.

1. Introduction

Calliptamus italicus (L.) (Orthoptera: Acridoidea) is a polyphagous species of grasshopoer that is widely distributed throughout Eurasia and North Africa (Darvishzadeh, and Bandani, 2012; Gapparov, 2001; Lachininsky, and Sergeev, *et al.*, 2002; Sergeev, 1992). In China, this species is mainly found in the northern Xinjiang, at an altitude of 800-2300 m in areas of desert and semi-desert grassland (Huang, and Zhang, *et al.*, 2013; Zhang, and Qiao, *et al.*, 1995; Li, and Xia,