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The Thesis Submitted for Ph.D Degree in the Plant protection

**Ecophysiological mechanisms of cold hardiness of two
pistachio bug species, *Acrosternum milleri* and
Brachynema signatum (Hemiptera: Pentatomidae) in
Rafsanjan**

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January 2022

Abstract

Pistachios are one of the most important garden products of the country. The pistachio green stink-bug, *Acrosternum millieri* Mulsant & Rey and *Brachynema signatum* Jakovlev (Hemiptera: Pentatomidae) are the main important and key pests of pistachio in Iran. In this study, biochemical components changes, cold hardiness and supercooling point, fresh mass, dry mass and relative humidity were measured in the adult collected from pistachio trees from April 2018 to March 2019. Total sugar and Total sugar and glycogen content in the two green bug species were highest and lowest in November and December month, respectively. Changes in Average protein and lipid contents of adults in the overwintering period and non- overwintering adults were significant. The SCP decreased significantly from a mean value of -11.8 and -13.1 °C in July 2018 (non-diapause adult *A. millieri* and *B. signatum*) to -17.6 and -21.2°C in February 2018 (overwintering adult *A. millieri* and *B. signatum*), respectively. Cold tolerance increased during the cold season in adults. Overwintering adults accumulated low-molecular weight carbohydrates, trehalose, sorbitol, glycerol and myo-inositol as cryoprotectants during winter. The results of the present study suggest that *A. millieri* and *B. signatum* adults cumulate cryoprotectants to improve their supercooling capacity, and enrich cold hardiness by decreasing the supercooling point with respect to a reduction in ambient temperature. *A. millieri* and *B. signatum* adults seem to be freeze-intolerant. In the second part of this study, the adults of the pests collected from the pistachio orchards of Rafsanjan in 2017 and reared on fresh kernels of pistachio head ram species in the growth chamber at 27 ± 1 °C and the parameters of age-stage, two sex life table of the insects were determined. The net reproduction rate (R_0) in *A. millieri* and *B. signatum* adults were equal to 26.29 ± 4.11 and 78.78 ± 11.18 (offspring/individual), the gross reproduction rate (GRR) were equal to 54.28 ± 5.91 and 140.14 ± 15.17 (offspring/individual), rate of natural increase of population (r_m) were equal to 0.061 ± 0.0031 and 0.084 ± 0.0030 (female/female/day), the mean generation time (T) and the finite rate of population increase (λ) were 53.44 ± 0.50 and 1.088 ± 0.0032 (days) and 1.063 ± 0.0033 and 51.55 ± 0.387 (subject/substance/day), respectively.

Key words: Pistachio, Cold-tolerance, Green bugs, cryoprotectants