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Temperature-dependent life history of *Sipha maydis* (Hemiptera: Aphididae) on wheat

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Abstract: *Sipha maydis* (Passerini) is a pest of Poaceae in many cereal-growing area of the world and Iran. The effects of temperature on biology and life table were investigated at five constant temperatures (15, 20, 25, 30 and 32.5±1°C), 60±5% relative humidity (RH) and a photoperiod of 16L : 8D h. The results indicated that aphids failed to complete development at 32.5°C. Developmental time was ranged between 17.28 to 9.55 days at 15 and 30°C, respectively. The lower developmental threshold (T_0) and thermal constant of *S. maydis* were estimated to be –5.52°C and 332.22 degree-days, respectively. The Analytis-3/Briere-1 model (as non linear model) is highly recommended for the description of temperature dependent development of *S. maydis*. The highest life expectancy of adults at emergence was 33.35 days at 20°C. The mean adult longevity of females and nymphipositional period were the highest at 20°C. The mean lifetime fecundity at 15, 20, 25 and 30°C were 21.24±1.97, 44.82±3.18, 22.25±2.33 and 16.39±1.15 nymphs/female, respectively. The survivorship curves of *S. maydis* were type I at 20 and 25°C ($H < 0.5$) and type III at 15 and 30°C ($H > 0.5$). The highest and lowest values of intrinsic rate of increase (r_m) were observed at 20 (0.173±0.012 females/female/day) and 15°C (0.109±0.003 females/female/ /day), respectively. The growth index (*GI*) at 15, 20, 25 and 30°C were 0.033, 0.069, 0.062 and 0.038, respectively. According to this research the optimum temperature for population growth of *S. maydis* was 20°C. Our findings provide fundamental information and when this information is used in association with other ecological data, it may be valuable in development and implementation of management programs of *S. maydis*.

Key words: cereal aphid, development, demographic parameters, Iran

Introduction

Cereal aphids are problem in agricultural ecosystems (Vickerman and Wratten 1979). *Sipha maydis* (Passerini) living mainly on a wide range of wild grasses and cereal crops and it has been reported on 30 genera of Gramineae (Imwinkelried *et al*. 2004; Blackman and Eastop 2006). It is distributed in Europe, central and middle Asia, North and South Africa (EI-Yamani and Hill 1991) and has recently distributed in Argentina (Delfino 2002; Ortego *et al*. 2004). This aphid has significant damage on youngest leaves of wild grasses and cereals sown early in autumn and mature cereal plants in late spring. The *S. maydis* feeds on the upper surface of leaf, ligula region of flag leaves, ears and sometimes on the stem and inflorescences (Saluzzo 2004; Blackman and Eastop 2006; Corrales *et al*. 2006) and it can transmit several important viruses such as cucumovirus (*Cucumber mosaic virus*) and luteovirus (*Barley yellow dwarf virus*) (EI-Yamani and Hill 1991; Blackman and Eastop 2000). It has been shown that *Rhopalosiphum padi* (Hemiptera: Aphididae) play an important role in the epidemiology of certain diseases, such as Barley Yellow Dwarf (BYD) on winter barley in Poland (Strażyński 2011). Heavily infested plants often become yellowed, rolled into tubes and desiccated (Blackman and Eastop 2000). It is an economically important pest of all cereal crops in drier climates (Blackman and Eastop 2000).

Climate and weather variables such as temperature have effect on aphid phenology and population growth rate (Walters and Dewar 1986; Andreev *et al*. 2009). Population mortality depends upon several interrelated factors such as snow, precipitation and temperature (Armstrong and Peairs 1996). Among these variables, temperature has the most impact (Huffaker *et al*. 1999). However, many intrinsic characteristics of plants such as nutritional value, secondary chemicals and morphology can influence the fecundity, growth and survival of insect herbivores (Goławska 2010). Host plant quality is also known to be an important factor affecting aphid demography, survival, fecundity and life expectancy (Rostami *et al*. 2012).

The entomopathogenic fungus *Lecanicillium longisporum* (Hypocreales: Ascomycota) is recently reported as a capable alternative control agent against *S. maydis* (Fadayivata *et al*. 2014).

Mathematical models such as linear and nonlinear models have been used to explain insect development rates and estimate various critical temperatures (Campbell *et al*. 1974; Logan *et al*. 1976; Lactin *et al*. 1995; Briere *et al*. 1999).

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