Mortality of pre-imaginal developmental period of *Bryobia rubrioculus* (Scheuten) (Acari: Tetranychidae) on sweet-cherry and assignment the highest temperature of growth

Nazila HONARPARVAR1,*, Mohammad KHANJANI1 and Seyed Hamid Reza FORGHANI2

1. Department of Plant Protection, College of Agriculture, Bu-Ali Sina University, Hamadan, Iran.
2. Seed and Plant Certification and Registration Institute, Karaj, P.O.B.: 31535-1516, Iran.

Corresponding author, N. Honarpvar, E-mail: honarparvarnazila@yahoo.com

Received: 23. August 2013 / Accepted: 8. January 2014 / Available online: 16. February 2014 / Printed: June 2014

Abstract. Brown mite (*Bryobia rubrioculus* Scheuten) is widely spread around the world. This mite is existing on some orchards in different areas of Iran especially in Hamadan province. In recent years, the mite has become economically important thus this study was conducted under the lab conditions at 9 constant temperatures (15, 17.5, 20, 22.5, 25, 27.5, 30 and 32.5 °C), (±0.5); Rh % (60±5) and L: D 16:8, on sweet-cherry leaf discs. Our findings showed that the lowest mortality of pre-imaginal developmental time was at 15 °C (52%) and highest at 32.5 °C (85%). Moreover, it demonstrated that at 35°C no eggs hatched therefore, this temperature must have been considered as the lethal temperature for the growth mite and so, mortality depends on some environmental factors, particularly temperature effects. Therefore, the results may be used to some aspect of integrated pest management of brown mite in sweet-cherry orchards.

Key words: Brown mite, *Bryobia rubrioculus*, mortality, Hamedan, sweet-cherry.

Introduction

Brown mite, *Bryobia rubrioculus* Scheuten (Acari: Tetranychidae) is dispersed in a few orchards all over the world such as northern and southern America, Europe, Asia (Japan) and Turkey furthermore, only female sex exists with thelytokous characteristic and spreads over the warmer wintering near to buds and spurs on some trees (Kasap & Cobanoglu 2006, Osakabe et al. 2000). Helle & Pflaanker 1985, Van de Vrie et al. 1972, Herbert 1962, Ehara 1959). It is mentioned that some fruit trees are considered as the host plants for this mite (apple, pear, peach, sweet-cherry, apricot, grape and almond). (Khanjani & Haddad Irani-Nejad 2006; Khanjani 2004, Kasap 2004). Population fluctuation and complementary of life process for the mite is related to ecology and biological conditions like temperature, host plant and natural enemies (Sabelis 1985, Jeppson et al., 1975). Recently, brown mite has been considered as a significant pest on apple trees in Turkey (Kasap 2004). Moreover, it had been reported on fruit trees around Tehran, Karaj and Shahryar for the first time in Iran in 1965 (Khalil-Manesh 1972). *Bryobia rubrioculus* activates and adapts on down surface leaves in all genders whereas, the laying egg and over wintering takes place at spurs and buds on bark of twigs or main wood of branches (Hoy 1985, Meyer 1974, Herbert 1962, Heme & Putman 1960, Morgan & Anderson 1957, Kremer 1956, Lienk & Chapman 1951). According to Khanjani and Haddad Irani-Nejad (2006), *Tetranychus urticae* Koch, *Panonychus ulmi* Koch, *Petioia latens* (Müller), *Eutetranychus orientalis* (Klein) and *Bryobia rubrioculus* are well-known as the most consequential spider mites which have produced some difficulties in some orchards the vicinities of Hamedan province. It was depicted by Honarpvarvan et al. (2012) fecundity and developmental time of the brown mite on sweet cherry somehow daily and total fecundity sequentially were 1.9 and 13.8 also, pre-imaginal development time assigned 25.8 days at 20 °C which was the best appropriate temperature for the mite development. What is more, egg production of *B. rubrioculus* had an increase on high diameter group of branch and stem sweet cherry than sour cherry, apple and plum (Honarpvarvan et al. 2011). Nemati et al. (2008), meanwhile in the research found *Tetranychus turkestani* Ugarov & Nikolski has the most fatality rate on different cultivars egg-plant (Ghasri, 0.385; Enche-rash, 0.571; Black-Beauty, 0.8 and Esfahani, 0.75). In a study, on cotton leaves it has been observed that the percentage of the death for early stages assumed about 28.4 for *T. urticae* (Forgiani 2005) also, in flowering process of tomato the egg, larvae and nymph stages of this mite showed the utmost mortality on Mern among nine cultivars (Osoli et al. 2008). Before our study, only four researches were conducted on *Bryobia rubrioculus* particularly on apple and black-cherry (Kasap 2008, Eghbalian 2007, Keshavarze-Jamshidian 2004, Herbert 1962). There was not any report on effects of temperature on the mortality of brown mite found on sweet-cherry. Therefore, objective of this study was to clarify effects of temperature on the mite egg hatching, which would be informative on decision making and integrated pest management in sweet-cherry trees. A part of this study was presented at ESA 58th Annual meeting, December 12-15, San Diego, CA.

Materials and Methods

Mite colony

Firstly, mites were collected from sweet-cherry trees (Hamedan, Iran) in February 2009. All experimental colonies were kept on sweet-cherry leaf discs in a growth chamber (25±1°C, 60±5 % RH, 16:8 L:D).

Rearing unit

The experiments conducted at nine constant temperatures (15, 17.5, 20, 22.5, 25, 27.5, 30, 32.5, 35°C) (±0.5), Rh% (60±5) and L:D 16:8, on leaf discs in the lab (Bu-Ali Sina University, Acarological laboratory, Hamedan, Iran). For each temperature, 60 replications (one egg on every rep.) assigned in separate growth chambers. Each detached sweet-cherry leaflets hosting one egg placed in a Petri 11cm diameter on pieces of water-soaked sponge and used as a test-plot. A narrow strip of paper tissue was placed on the periphery of each leaflet. The soaked sponge and tissue papers kept the leaflet moist during experiment. Daily recorded the mortality for different stages under a dissecting microscope at magnifications up to 70X. Since types of the data are whole numbers, standard deviation may be proportional to the mean and/or their effects may be multiplicative, therefore they were logarithmically transformed (Gomes & Gomes 1983). The mean mortality was compared using one-way ANOVA to statistical analysis. If significant differences were detected, multiple comparisons were made using the Tukey’s multiple range test (P< 0.05) (SPSS 2007).
Results

The mean population mortality of *B. rubrioculus* on distinctive stages is shown in Table 1.

The table displays that larval stage are presumed the highest fatality at 30 and 32.5 °C while it was the lowest at 20 and 22.5 °C. At 15 and 17.5 °C the mortality of protonymph observed around 5% even though; it was 13 percent at 30°C. Deutonymph stage was in the low level (%4) aspect of fatality however, 8 percent at 20 °C. On the whole, mortality was accounted about 52% at 15 °C whereas, 85% at 32.5 °C.

The following figure shows the death for nymph process which is the maximum at 27.5 °C and minimum at 15 °C. Also, it goes up from the early degree to up temperatures (Fig 1).

In this regards, the highest egg mortality was at 35 °C, now that no egg hatched on the other hand, the lowest egg mortality accounted at 15 °C (Fig. 2). Totally, from 15 to 35 °C the death for egg stage rose up.

Although at 35 °C there was not any egg hatched, we pursued the other stages of the mite and we found the process to be continued for a little time (Honarparvar et al. 2013). The following table presents the mean growth stages of *B. rubrioculus* at the highest growth temperature (Table 2).

Furthermore, the percentage of mortality for different stages are shown in Table 1.

### Table 2: Mean growth stages for *B. rubrioculus* at 35 °C

<table>
<thead>
<tr>
<th>Growth stage</th>
<th>Mean ± SE</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td>0.0 ± 0.0</td>
<td>60</td>
</tr>
<tr>
<td>Larvae</td>
<td>0.2 ± 0.0</td>
<td>16</td>
</tr>
<tr>
<td>Protochrysalis</td>
<td>0.06 ± 0.0</td>
<td>16</td>
</tr>
<tr>
<td>Protonymph</td>
<td>0.24 ± 0.0</td>
<td>5</td>
</tr>
<tr>
<td>Deutochrysalis</td>
<td>0.11 ± 0.0</td>
<td>37</td>
</tr>
<tr>
<td>Deutonymph</td>
<td>0.45 ± 0.0</td>
<td>36</td>
</tr>
<tr>
<td>Teliochrysalis</td>
<td>0.21 ± 0.0</td>
<td>54</td>
</tr>
<tr>
<td>Pre-oviposition</td>
<td>0.49 ± 0.0</td>
<td>8</td>
</tr>
<tr>
<td>Oviposition</td>
<td>0.44 ± 0.0</td>
<td>8</td>
</tr>
<tr>
<td>Post-oviposition</td>
<td>0.45 ± 0.0</td>
<td>8</td>
</tr>
<tr>
<td>Longevity</td>
<td>0.60 ± 0.0</td>
<td>8</td>
</tr>
</tbody>
</table>

Means following by different letters with in a column are not significantly different at the 0.05 level.
stages of *B. rubrioculus* at 35°C defines (after egg stage in the second step) protonymph process has the most death even if it is minimal for Teloichrysalis at the same condition (Fig. 3).

**Discussion**

Our findings showed that temperature 35°C could be considered as the highest growth permitting temperature for the brown mite since no egg hatched at this temperature however, the other stages stayed alive and to be continued their growth process for a while. Therefore, it would be assumed that in the nature when the temperature reaches to 35°C only egg could not follow the process and other stages will carry on for part times. The previous report showed that at 30°C *T. turkestani* had the further egg mortality (7.14%) on green bean (Sohrabi & Shishehbor 2008). For *Eutetranychus orientalis* on Lebbek tree was found that the maximum death in egg process with 100% at 35°C. This is in agreement with our results. Similarly, Hazan et al. (1973) concluded in egg process with 100% at 35°C. This is in agreement with *T. evansi* on tomato from 21 to 36°C in chronology with the low and the most mortality of nymph stages (Bonato 1999). According to these research from the low temperature to up, mortality has increased then, it could be though over that the biological conditions is not appropriate at the least degree therefore, in the upper degree the long of life cycle becomes shorter. As a case in point, the furthest fatality on some stages of the brown mite especially on 30, 32.5 and 35°C was calculated in our research. Thus, it is believed that temperature roles as an effective feature of mortality, so it is according to Bonato (1999), Northcraft & Watson (1987), Bonato et al. (1993) and Sohrabi & Shishehbor (2008). On the same basis, temperature 25 on black-cherry (Eghbalian 2007) also, temperature 23°C on apple (Morgan & Anderson, 1957) were mentioned as the convenient temperatures for *B. rubrioculus*. It is clear cut that some features like race of mite, temperature, host characteristics, nourishment, surrounding and ecological trends are cumulative effects on mortality and effect on growth process (Crooker 1985, Yano et al. 1998, Van de Vrie et al. 1972, Tomczyk & Kropczynska 1986). To sum up, mortality of *B. rubrioculus* is related to some aspects of the mite and environment ecological tendency. The findings might have been provided a guidance for future studies on evaluating the performance of *B. rubrioculus* and the efficiency of its natural enemies in sweet-cherry orchards under variable surrounding circumstances and could be used as the basis methods to conduct field experiments.

**Acknowledgement.** We would like to thank Dr. Javad Shaterian, Seed and Plant Certification and Registration Research Institute (SPCRI), Karaj, Iran, for reviewing this paper.

**References**


SPSS (2007): SPSS base 16.0 user’s guide, SPSS Incorporation, Chicago IL.

