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EFFECT OF DIFFERENT TEMPERATURE ON SOME BIOLOGICAL TRAITS OF RISE WATER WEEVIL, *PICIA MESOPOTAMICA* (TAURNIER) (COLEOPTERA: CURCULIONIDAE)*

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Abstract

This study was conducted to determine the effect of different constant temperatures on the developmental stages of the rice water weevil was identified as *Picia mesopotamica* (Taurnier) (Coleoptera: Curculionidae) from the egg stage to adult stage. There has been growth at all tested temperature (20, 20, 30 and 35^0 C). Results reveled growth of eggs at all the temperature tested, the incubation periods were (16.70, 7.93, 6.38 and 3.24 days), respectively. While, 33.69, 30.38, 28.62 and 5.95 days respectively for the larvae , and 12.67, 9.23, 6.81 and 5.11 days for the pupae and the same temperature successively. Result also showed that the studied temperatures significantly affected the period of development of adult females as it reached 31.51, 30.13, 29.73, and 6.14 days, respectively, while the adult males 29.62, 28.27, 27.25 and 5.58 days, respectively. There were no significant differences in the period of development of adult males at temperature 20 and 25^0 C, as well as between temperatures 25 and 30^0 C and no significant differences in the period of laying eggs at temperatures 20 and 25^0 C. As calculated temperature in the rate of female productivity of eggs has reached the highest rate of 248.17 eggs/female temperature of 30^0 C and the lowest rate of 53.49 eggs/female and the temperature of 35^0 C. Two generations of this species of insect were recorded and the duration of the generation was 95.57, 77.67, 71.54 and 20.44 days at the studied temperatures, respectively. No significant differences were recorded in the duration of the generation at 25 and 30^0 C.

Key words : Temperature, Biological, Water rise weevil.

Introduction

Oryza sativa L. is an herbaceous, annual and semi-aquatic plant belonging to the Poaseae family, in which 20 species were identified under Oryza genus, but the species sativa is common. There are few areas in Africa planted with perennial rice *O. glaberrma* (FAO, 2011). *Zizania aquatic* wild rice, which grows in lakes in the United States of America, is more oatmeal than *O. sativa* (Jadwa, 1970). It is believed that the rice is native to East Asia and is cultivated in the tropics and sub-tropical regions, some of them are likely the rice to be native to China (Aghaee and Godfrey, 2014). Rice is currently grown in more than 100 countries on all continents except Antarctica. Its growing areas extend at latitude 50 degrees north to 40 degrees south and from sea level up to 3,000 meters (Stout *et al*., 2011). World rice production reached 470.82 million tons in 2011 (FAO, 2011). In Iraq, the Babylonians started planting it on the banks of the Euphrates River around 2,000 years BC and continued to grow later.

Commercially, it was planted in the early 19th century (Jadwa, 1970). The cultivated area with rice was 317249 acres for the year 2014 and the average production is 787 kg/acres (Central Agency of Agricultural Statistics, 2014). The importance of rice in its nutritional value, which is the main food of half of the world's population and the economic resource of 95% of the population of Asia (Juliano, 1993). Its nutritional importance comes from containing a high amount of easily digestible carbohydrates and proteins with a balanced content of basic amino acids compared to other grain crops, it also contains a good proportion of vitamins A, B and E and nutrients such as potassium, sodium, manganese, iron, phosphorus, sulfur, iodine, mineral salts, high starch,

*The Rice water weevil was identified as, *Picia mesopotamica* (Taurnier) (Coleoptera: Curculionidae) which considered to be new record on rice in Iraq and the world by researcher.

vegetable fats and water (Al-Tai, 2000). The rice crop is infected with several insect pests, the most important of which is water rice weevil, which is cited by many researchers as causing quantitative and qualitative losses in the production of rice (Fritz *et al.*, 2011; Obrien *et al*., 2014), *Picia mesopotamica* (Taurnier) was first recorded in Iraq and the world as a major pest on rice and six of its associated weeds in Najaf and Qadissiya governorates in central Iraq in 2015 (Fatlawy, 2017). Due to its importance in rice fields in Iraq, the research was carried out to study the insect life cycle in the laboratory at four temperature levels 20, 25, 30 and 35°C and relative humidity of 70±5% on Yasmine rice crop. The study included egg incubation period, larvae development period, pupae development period, egg laying time and generation time.

Materials and Methods

P. mesopotamica (Taurnier) adults were collected from the rice fields of the Mahnawiya region of Qadissiya Governorate, the females were separated from the male during the mating process. The experiments were carried out in 20-foot cooled incubators equipped with internal light and a timer to ensure light processing at 12-12 hours Light: darkness.Plastic planting bowls with dimensions 10 × 20 cm were prepared, mixed soil with Peat mosswere placed with a ratio of 1: 2 and 0.7 g of NPK (12: 12: 12), respectively. The seeds of Yasmine rice were cultivated with 10 seeds per bowl. Three repeats for each treatment, the seedlings were reduced to three plants for each bowl. When the seedlings reach the age of two leaves, a male and female pair of adult insects were placed with three replicates at temperatures 20, 25, 30 and 35°C and placed in plastic basins watered with water whenever needed, at a rate a bowl for each basin, these basins were placed in the incubator, referred above, and a microscopic camera (Conrad) was used at 60X, that monitors the insect daily, and constantly changing the plants, which was consumed. The experiment was followed daily from hatching eggs and the development of subsequent stages until the adults are out and until they die. The data were analyzed according to the CRD design. The least difference method (LSD) was used to determine the significance of the difference between the mean of the different treatments at the level of 0.05 (Sahuki and Kareima, 1990). The statistical analysis was done using CRD design and LSD using (SAS, 2001) program in analyzing the data of the experiment.

Results and Discussion

Period of egg incubation

The results showed that the temperature has a significant effect in the egg incubation period, which reached the lowest rate of 3.24 days at 35°C and the longest 16.70 days at 20°C, while 7.93 and 6.30 days at temperatures 25 and 30°C, respectively (Table 1). These results were similar to those of Fattalawi (2017) that the duration of egg incubation for *P. mesopotamica* was 7.63 days when larvae and insect adults were grown on the Yasmine rice in the laboratory at 27 ± 3°C. Ukishior *et al*. (1990) reported that the duration of embryonic development decreases with an increase in temperature to a certain extent when studied for an incubation period of *Lissoehoptrus oryzophilus*, which belongs to the family Curculionidae at 9, 6 and 4 days at 25, 30 and 35°C, respectively. The reason is that temperatures play a major role in influencing physiological processes and the development of embryos within eggs.

Larva stage

The duration of the larval stage development of water rice weevil *P. mesopotamica* was affected at different temperatures in a significant difference with the highest rate of 33.69 days at the temperature of 20°C while the lowest 5.95 days at 35°C, while at the temperature of 25 and 30°C was 30.38 and 28.62 days, respectively (Table 1). Al-Fatalawi (2017), when studying the same type of rice weevil, mentioned that the average duration of larval development was 38.76 days at 27 ± 3°C for the Yasmine rice yield. In the same field, Stout (2013), when studying water rice weevil *L. uryzophilus*, mentioned that the duration of larval development was 26.16 days at 20 and 35°C.

Temperature is affected significantly the speed of the biological reactions in metabolic processes by increasing the effectiveness of certain enzymes responsible for these reactions, resulting in a decrease in the duration of larval development (Voss *et al*., 1988).

Pupa stage

The temperature was found to have a significant effect on the duration of pupaedevelopment. The longest period was 12.67 days at 20°C and the shortest was 5.11 days at 35°C, while it was 9.23 and 6.81 days at 25° and 30°C, respectively (Table 2). In the same field, Al-Fatalawi, 2017, noted in his study the life of *P. mesoptonica* at 27 ± 3°C when cultivating the same insect on the Yasmine rice in the laboratory, the average length of development for the pupa stage was 9.40 days. Results almost agree with the results of this study. These findings disagree with Zhang *et al*. (2004) when studying the development of the pupa stage of water rice *L. Oryzophilus* at a temperature of 20°C, which reached to 21 days, this may be due to the difference in the type

Table 1 : Period of development of eggs and larvae stages of *P. mesopotamica* rice at different temperatures on rice.

Temperature (^{0}C)	Incubation period/day	Larval development period /day
20	16.70	33.69
25	7.93	30.38
30	6.38	28.62
35	3.24	5.95
L.S.D = 0.05	1.14	0.89

Table 2 : The period of pupae development of *P. mesopotamica* at different temperatures on rice.

Temperature (^{0}C)	Pupae development period /days
20	12.67
25	9.23
30	6.81
35	5.11
L.S.D = 0.05	1.64

Table 3 : Means of males and females ages and generation time of *P. mesopotamica* at different temperatures on rice.

Temp. (^{0}C)	Mean of males age /day	Mean of females age/day	Mean of generation time/day
20	29.26	31.51	95.57
25	28.27	30.13	77.67
30	27.25	29.73	71.54
35	5.58	6.14	20.44
L.S.D = 0.05	1.14	1.005	6.49

Table 4 : The average of egg lying time and eggs number per female of *P. mesopotamica* at different temperatures on rice.

Temp/^{0}C	Female productivity rate/egg	Egg lying rate/day
20	7.16	67.33
25	6.60	231.17
30	3.41	248.17
35	1.62	53.49
L.S.D = 0.05	0.91	12.64

of insect and the type of plant host.

The adult stage

Table 3 shows the age means of the adult insect were different at different temperatures, the lowest rate was (6.14) days at 35°C, while the highest rate was (31.51) days at 20°C. In the same table, there was no significant effect of the age mean of the adult insect *P. mesopotamica* at 25°C and 30°C, 30.31 and 29.73 days, respectively. These results are not compatible with those of Al-Fattalawi (2017), he found the lowest rate of development of the adult of *P. mesopotamica* was (6.14) days at 25°C on the Yasmine rice yield, this may return to the difference in temperature and age of the plant used for insect breeding.

Egg laying time

The highest rate of egg laying time for *P. mesopotamica* was recorded at 20°C, which was 7.16 days, with the lowest mean of 1.62 days at 35°C (Table 4). The results showed no significant differences between the two temperature 20°C and 25°C, while the significant differences were observed between the other tested temperatures.In the same field, Al-Fattalawi (2017) pointed out that egg laying rate was (11.75) days when studying some life aspects of the same insect in the laboratory at a temperature of 27 ± 3°C on Yasmine rice yield.

The rate of female productivity of eggs

Table 4 shows the effect of different temperatures on the rate of eggs produced by *P. mesopotamica*. The effect was significant in all tested temperatures, the highest egg-laying rate was 248.17 eggs / female at 35°C. Al-Fattalawi (2017) indicated that the average of eggs number per female of water rice weevil *P. mesopotamica* was 185.17 eggs/female at 27°C when feeding the insect on the Yasmine rice yield.

The rate of generation time

The results in table 4 showed that the effect of temperature on the generation time of the *P. mesopotamica* was significant at 20 and 35°C, while the results did not indicate any significant differences in the generation time of the insect at temperatures 25 and 30°C. The highest rate was 95.57 days at 20°C and the lowest rate was 20.44 days at 35°C. At the same field, Al-Fattalawi (2017) explained that the insect has two generations a year in the rice fields in central Iraq and adults began to appear in the field in earlier May and reached a peak in July and disappeared after the middle of December.

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