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ORIGINAL ARTICLE

EFFECT OF ENVIRONMENTAL CONDITIONS ON POPULATION DENSITY AND INFECTION SEVERITY TO RADDISH BEETLY *CALOPHELLUS APICALIS* MENETR (COLEOPTERA: CHRYSOMELIDAE) IN BASRAH PROVINCE

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Abstract: This study was conducted in the Shatt al-Arab region from December to the end of March 2019 in Basra province. The Aim of this study is to estimate population density, infection severity and the effect of environmental conditions on the radish beetle. Results showed that the average of insect density was 11 insects/leaf during December, Insect population density rates started to increase with increase temperature. The highest population density was recorded during March, it was 32 insects / leaf when temperature was 26 °C and the relative humidity was 51.2 %. This indicates that there is a positive correlation between insect density and temperature, as the correlation coefficient $r = 0.9241$. While the correlation between the relative humidity and population density was negative ($r = -0.89499$). The highest severity of infection was more than 100 insects/leaf, which means it covers all the surface of all leaf. The number of severely infected leaves severely was 13% of total number of leaves. Results also showed that the infection rate is 85% of the total number of leaves, while the damage rate was 76.79% .

***Key words*:** Radish, Humidity, Infection severity, Population density.

Cite this article

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1. Introduction

Radish is one of the edible root vegetables, it belongs to the Cruciferae family, white or red radish are eaten rich in antioxidants that protect from diseases, the first Radish agriculture was believed in South Asia, It was planted in 2780 BC in Egypt, the first agricultural species were black radish, then white radish, and later red radish [Khushk and Hisbani (2003)].

Radish was infected by a lot of insect pests, Calophellus apicalis is one of the most important radish beetle, radish beetle infects a number of plant families such as the Cruciferae family, the Chenopodiaceae family, the Solanaceae family, and barley from the Gramineae family. Al-Joboory *et al.* (2001) reported that species of Colaphellus sp were founded in Iraq, Turkey and Iran and considered as agricultural pests which infect vegetable crops.

Sapunaru *et al.* (2005) indicated that radish beetle insect is one of the important pests of Cruciferae family, in addition to, larvae and adult feed on leaves, flowers, and immature seeds, the damage appeared when larvae and adult eat leaves of plant and make small hole circle or oval shape.

Mahdi *et al.* (2005) showed that the severity of infection on the leaves recorded more than 100 insects /leaf, with percentage 92% and the damage ratio

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71.2%.

Yang *et al.* (2007) showed that cabbage unable to create a coiled head due to severity of infection. Nikolova and Vasileva (2007) reported the damage caused by radish beetle insect to the cabbage crop in Turkey in the agricultural season (2003-2004) reached to 9.89% of the production. Huang and Yuan (2009) noted that radish beetle is one of the most important cabbage pests in Japan.

2. Materials and Methods

2.1 Population density of the insect

To determine the population density of the radish beetle, 100 leaves of radish plant were taken randomly, and the average number of insects per leaf was calculated every 15 days, the data recording process for one season which started from December until March, while levels of temperature and relative humidity were recorded by the thermohygrometer. The insect was identified with classification keys [Al-Taie (2009)] and was confirmed by Professor Dr. Kazem Saleh Al-Hadlak, College of Science/Basra University.

2.2 Estimate the severity of infection in the field

100 leaves of radish plant were collected randomly to calculate the numbers of adults and larvae in each leaf and arrange in scale [Shaaban and Al-Mallah (1993)].

2.3 Percentage of infection

100 radish leaves were collected randomly, the infected leaves were isolated from the uninfected leaves and the infection percentage was calculated

Infection percentage = infected leaves / total leaves in the sample × 100 Percentage of damage (1)

The affected leaves were put on a graphic sheet divided into square centimetres, and the total area of the leaves was calculated then calculated the area of the eaten portion to calculate the percentage of the damage.

Damage percentage = eaten area in the leaves/ total area of the leaves in the sample × 100 (2)

3. Results and Discussion

Fig. 1 showed that the average density of the insect was 11 insects/leaf during December, when the average temperature was 13.35°C and relative humidity 72.5 as showed in Fig. 2. Population density average started to increase. It was 22 insects/leaf in January, when the

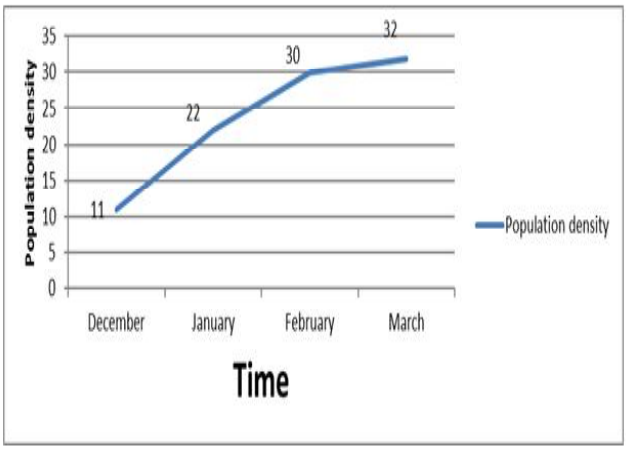

Fig. 1: Population density of insect during the study season

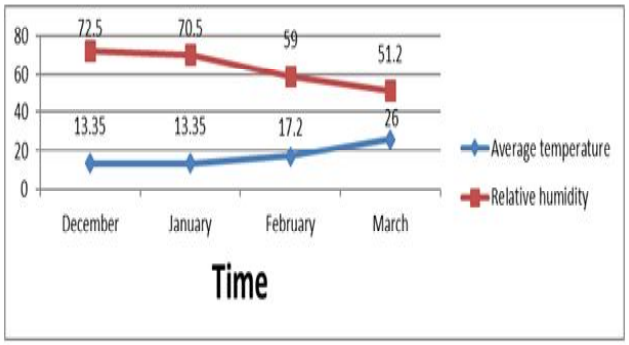

Fig. 2: Temperatures and Relatives humidity during the study season

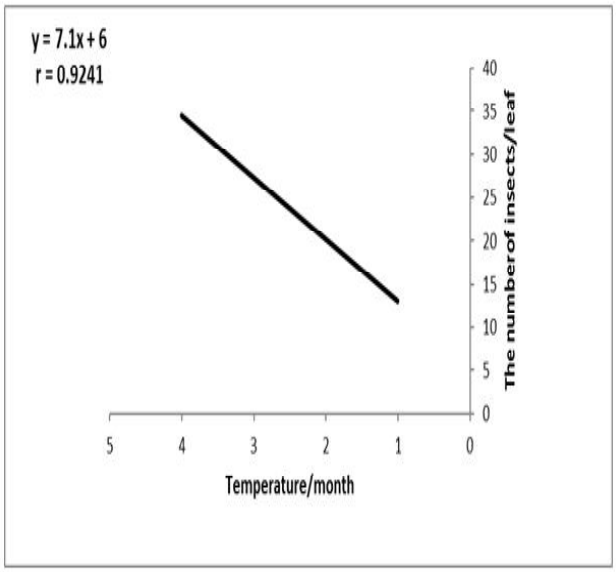

Fig. 3: Correlation between temperature population density

average temperature was 13.5°C and relative humidity 70.5. The insect population density average increased significantly in February it was 30 insects/leaf. This increase was accompanied with increased temperature, and when temperature recorded 17.2°C and relative

humidity 59. The highest population density average was recorded during the month of March, it was 32 insects/leaf when the average temperature was 26 °C and relative humidity 51.2. Through the results, it appears that there is a relationship between the environmental conditions and the population density of the insect. Through the work of a correlation relationship between the population density and temperature, a positive correlation relationship was found in which the correlation coefficient was $r = 0.9241$ shown in Fig. 3 during the study period, which indicates a positive correlation between the degree of heat and population density. This agrees with Al-Jassany and Abu-Ragheef (2018) who showed that high temperature at certain limits leads to high metabolism, which increase metabolism then accelerated growth and increase reproductive activity and thus increase in the population density of the insect, whereas the correlation between humidity and population density was negative, as the correlation coefficient reached $r = -0.89499$. Fig. 4 indicates a negative relationship between humidity and population density insects and their ability to reproductive and grow are greatly affected by the amount of humidity of medium in which it live, whether soil, air or food, this is because humidity of medium affects the water balance in insect bodies, as well as, the reproductive period is usually the critical period in relation to the growth of living organisms, as it is known that the ability of suffer for reproductive organs such as eggs, embryos, larvae *etc* are less than the boundaries of the adults. It is noted that environmental conditions is the main effect on insect spreading, while there was a large effect of temperature and humidity on the population density of radish beetle. Fig. 1 showed that increased temperature and low humidity in March had a positive effect on the population density of the insect. Gallot (1992) showed that high temperature and humidity in hot regions lead to increase insect's body temperature until it reaches to the environment's temperature. At the same time, the insect cannot reduce body temperature due to the high humidity. The final result of these two factors is slow growth with lower reproduction which lead to decrease population density of the insect.

3.1 Estimate severity infection of radish insect in the field

First: The number of insects on the leaf was dependable as a scale.

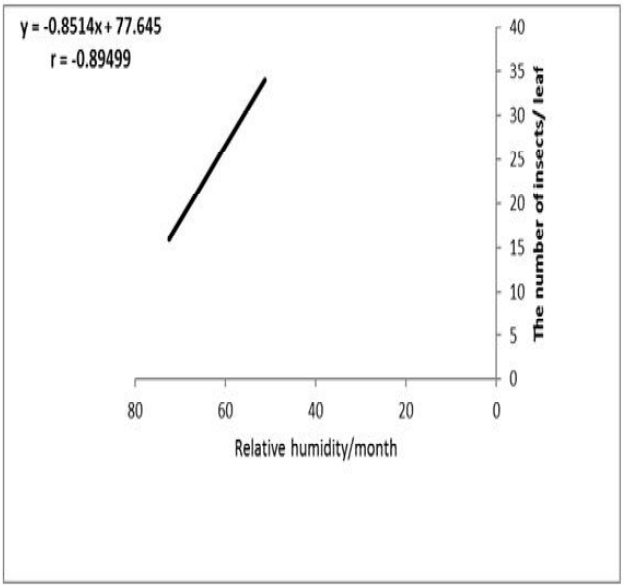

Fig. 4: Correlation between relative humidity and population density

Fig. 5: Adults and larvae covered the surface of the leaf

Table 1: The severity of infection and the number of infected leaves.

Severity of of infection	Number of infected leaves	The number of insects on the leaf
1	17	0-10
2	20	11-50
3	30	51-75
4	20	76- 100
5	13	More than 100 insects

The severity infection of radish leaves was graded in five levels as shown in Table 1. The highest severity infection is more than 100 insect/leaf, that mean they cover all the surface of leaf, the number of severely infected leaves was 13% from total leaves, this agrees with Mahdi *et al.* (2005) when they reported that adults and larvae covered the surface of the leaf as shown in Fig. 5.

Second: Percentage of infection and percentage of damage.

The results showed that the infection rate was 85% of the total number of leaves. The average area of eaten leaves was 42.65 cm^2, average total leaves area was 55.45 cm^2, and from Equation (2) the damage percentage can be known and it was reached to 76.79%.

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