

Click Beetles (Elateridae) Found in Eggplant Plantings in Azerbaijan

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Abstract. *The increase in the demand of the population of Azerbaijan for vegetable products has made it necessary to expand the cultivation areas of these plants. Therefore, along with other vegetable crops, various measures are being implemented in the country to increase eggplant plantings as well. In order to obtain high yield from eggplant fields, carrying out control measures against pests, diseases and weeds is of great importance. The conducted studies have shown that in eggplant cultivated fields of farmer farms engaged in vegetable growing in the republic where no control against harmful organisms is carried out, productivity decreases by approximately 55–60% every year. This situation negatively affects the economic condition of farmer farms. As a result of the research carried out in eggplant plantings it has been determined that the role of pests in the decrease of productivity is very important. In the Ganja–Gazakh region the species damaging eggplant fields were accurately identified for the first time. The studies have shown that 13 pest species belonging to four orders are distributed in these fields. Six species of them belong to the click beetle family and among this group one of the species causing the greatest damage to the crop is considered to be the field click beetle — *Agriotes sputator* L.*

Keywords: *eggplant, agroecosis, Elateridae, Coleoptera, Agriotes sputator L.*

Introduction

Eggplant (*Solanum melongena* L.) is one of the ten most widely cultivated and important vegetable crops in the world. This plant is grown on more than 2 million hectares of land and in total approximately 33 million tons of production are obtained. China holds the leading position in eggplant production in the world and more than half of the global cultivation areas fall to its share. India ranks second by producing approximately one quarter of the total world production. In addition, Indonesia, Egypt, Turkey, Iraq and the Philippines are also among the main eggplant producing countries. The Asian continent accounts for approximately 94% of the world's eggplant cultivation areas and 92% of the total production (FAO, 2007).

Eggplant can adapt well to conditions of high temperature and abundant rainfall and is considered one of the rare vegetable crops that give high yield in warm, humid climates (Hanson et al., 2006).

The composition of this plant is rich in nutrients; it contains dietary fiber, folic acid, ascorbic acid, vitamins K and B6, as well as minerals such as potassium, iron, magnesium, manganese, phosphorus and copper (USDA, 2009).

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The nutritional value of eggplant plays an important role especially during periods when other vegetables are scarce and in the nutrition of low-income populations. In tropical regions, eggplant production is seriously affected by various insect and mite pests. Among the main pests are the eggplant Colorado beetle, whiteflies, thrips, aphids, click beetles (wireworms) (Nikoukar & Rashed, 2022), stem borers and red spider mites (Rashed & van Herk, 2024). In order to protect the crop from these pests, farmers often make extensive use of chemical pesticides. For example, in Bangladesh some farmers carry out approximately 180 sprayings during the growing season (Rahman et al., 2018).

Excessive application of pesticides negatively affects both the environment and human health and leads to an increase in production costs. According to calculations carried out in the Philippines, compared with cabbage (49%) and tomato (31%), the share of pesticide costs in the total material costs in eggplant cultivation is approximately 55%. In Bangladesh this indicator varies between 40–50% (Rahman et al., 2018). Because of the high price of pesticides, many farmers prefer to abandon eggplant cultivation. This guideline provides eggplant growers and agricultural advisers with detailed information about the main insect and mite pests found on eggplant plants, as well as their management methods. The simple and low-cost integrated pest management (IPM) methods explained here make it possible to carry out effective and sustainable control and can help eggplant producers reduce their dependence on chemical pesticides. An IPM strategy for the management of eggplant pests was developed, tested and successfully implemented in the South Asia region by AVRDC – The World Vegetable Center during 2000–2005 (Alam et al., 2003; Alam et al., 2006).

Materials and Methods

During the research carried out in eggplant plantings in the Ganja–Gazakh region, the method proposed by I. Y. Polyakov (1958) was used during the vegetation period of the plant. Route observations were carried out in the farms of the Samukh, Goranboy, Shamkir and Tovuz districts where vegetable growing, including eggplant plantings, are conducted. Observations and soil sampling were conducted during 2024–2025 to determine the vertical distribution of click beetle larvae. Soil samples were taken at four depths (0–5, 6–15, 16–25, 26–35 cm), and adult beetles were monitored in the fields. Specimens were identified in the laboratory using standard taxonomic keys. Seasonal dynamics and soil-layer distribution of larvae were analyzed to support effective pest management.

Results

The composition of eggplant is rich in various vitamins (Jumshudov et al., 2015). The use of pheromone traps in the fight against eggplant moth is one of the widely applied methods. In the Republic of Belarus, the tomato moth is considered one of the dangerous pests. The main plants fed on by this pest are species belonging to the nightshade family and it damages all aboveground organs of the eggplant plant (Romanovich & Krishtofik, 2011).

In natural conditions the bracon parasitoid (*Habrobracon brevicornis*) can parasitize medium and large aged larvae of the cotton bollworm up to approximately 30%. Taking into account such beneficial effect of this entomophage, the bracon parasitoid is used in biological control measures against the cotton bollworm (Chernikalova, 2011). Species belonging to the order Coleoptera have also been studied by various researchers (Mammadov, 2008; Agayev, 2004).

Discussion

Information about the damage caused by these pests in eggplant fields is not sufficiently extensive. The formation of various farmer farms in our country has led to an increase in eggplant cultivation

areas. For this reason, clarification of the composition of the harmful fauna for farms has been one of the main objectives of the conducted research.

During the studies carried out in 2024–2025, 6 species belonging to this family were collected from stationary eggplant fields: *Agriotes gurdistanus* Fald., *Selatosomus latus saginatus* Men., *Agriotes obscurus* L., *Athous hirtus* Hbst., *Athous haemorrhoidalis* F. and *Agriotes sputator* L. The main pest of the eggplant plant – Field click beetle (*Agriotes sputator* L.). During the research, since it was determined that the representative of this beetle order is a first-degree pest for eggplant plantings, its bioecological characteristics were studied in more detail. In our country the distribution of this species in all districts was noted in the data of B. I. Agayev (2004).

Click beetles (family Elateridae) belong to the order Coleoptera. It is considered necessary to determine the species composition of pests in eggplant fields, clarify the main species and conduct environmentally safe and economically efficient scientific studies against them. The studies have shown that various genera of click beetles are distributed in Azerbaijan.

During our observations this species was detected in almost all stationary eggplant fields. It was especially encountered more densely in the cultivated fields of the Shamkir district. It was also frequently observed in the grain fields near it. Taking into account the wide distribution of this species and the significant damage it causes, further studies on its bioecological characteristics are essential, as wireworms (larvae of click beetles) have been shown to be difficult to control and to impact crop health without integrated pest management approaches (Nikoukar & Rashed, 2022; Pagani et al., 2023; Gümüş Askar et al., 2023) (Fig.1).



Figure 1
Wireworms

Literature data and observations carried out in stationary fields have shown that the larvae are located in different layers of the soil and at different depths. For this reason, in 2024 soil samples were taken at different depths in the eggplant planting field of the Samukh district and it was determined that the larvae move vertically within the soil depending on the season.

The results of the research are presented in Table 2. Observations carried out in the Samukh district show that the vertical location of the larvae in soil layers shows significant changes depending on the season. It can be seen from Table 2 that in different seasons of the year the distribution of larvae in the soil undergoes sharp variations according to depths.

Table 2

Vertical displacement of larvae in soil layers depending on the season

Excavation place and date	Number of excavations	Number of larvae		Distribution by depths (in numbers), t, °C			
				up to 5 cm	6–15 cm	16–25 cm	26–35 cm
Samukh: 26.04.24	13	46	T ⁰	19,1 ± 2,1 17,8 ⁰	24,2 ± 1,44 17,2 ⁰	3,3 ± 0,33 17,1 ⁰	0 17 ⁰
21.05.24	17	55	T ⁰	7,2 ± 1,2 24,1 ⁰	20,4 ± 2,04 23,7 ⁰	27,1 ± 1,11 23,5 ⁰	1,1 ± 0,1 22,6 ⁰
18.07.24	12	49	T ⁰	5,5 ± 0,15 25,7 ⁰	21,3 ± 0,33 25,0 ⁰	22,5 ± 0,25 24,5 ⁰	1,2 ± 0,12 23,6 ⁰
19.08.24	13	47	T ⁰	6,8 ± 1,16 26,8 ⁰	18,4 ± 2,4 26,1 ¹	20,4 ± 0,28 25,2	3,3 ± 0,31 24,3 ⁰
03.10.24	15	79	T ⁰	11,5 ± 0,25 19,9 ⁰	38,2 ± 4,12 20,8 ⁰	25,5 ± 2,5 21,6 ⁰	5,1 ± 0,11 21,9 ⁰
20.11.24	15	71	T ⁰	5,1 ± 0,01 12 ⁰	37,3 ± 3,31 13,2 ⁰	22,4 ± 2,61 14,4 ⁰	7,3 ± 1,1 14,9 ⁰

Thus, observations show that the amount of larvae of the field click beetle shows significant variability according to the season. The number of larvae at a depth of 5 cm in the soil is lowest in November, July and August, and highest in April and October. At a depth of 6–15 cm the number of larvae was observed least in August, May and July, and most in October and November. In the 16–25 cm soil layer the number of larvae remained approximately stable starting from April and during May, July, August, October and November. At a depth of 26–35 cm the number of larvae during the season was very low. In general, from April to November the number of larvae in the soil gradually increased.

In Table 2 the dynamics of the change in the amount of click beetle larvae according to the depth of soil layers is also presented. It becomes known that in April the number of larvae is greater at depths of 5 cm and 6–15 cm, and less in the 16–25 cm and 26–35 cm layers. In May, July, August, October and November they were observed mostly at depths of 6–15 cm and 16–25 cm. It can be seen from the table that the larvae of the field click beetle are mainly located at a depth of 16–25 cm in the soil. In these layers optimal temperature and humidity conditions are more favorable for their development.

Along with the theoretical significance of the obtained results, their practical importance is also great. Thus, knowing the soil layer of the larvae makes it possible to carry out pest control measures more purposefully and efficiently.

Conclusion

Observations show that the number of larvae of the field click beetle differs significantly as the season changes. The number of larvae at a depth of 5 cm in the soil is lowest in November, July and August, and highest in April and October. In the 6–15 cm layer the number of larvae was recorded as minimal in August, May and July, and maximal in October and November. At a depth of 16–25 cm the number of larvae remains relatively stable from April to November. In the 26–35 cm layer the number of larvae during the whole season has been very low. In general, from April to November the number of larvae in the soil shows a gradual increase.

Table 2 shows that depending on the depth of soil layers the number of larvae has different dynamics across different months. In April the number of larvae is mainly high at depths of 5 cm and 6–15 cm, and low in the 16–25 cm and 26–35 cm layers. In May, July, August, October and November they were observed mostly in the 6–15 cm and 16–25 cm layers. It becomes clear from the table that the larvae of the field click beetle mainly accumulate at a depth of 16–25 cm where optimal temperature and humidity conditions are provided for them. These results have both theoretical and practical importance. Knowing the soil layer where the larvae are located makes it possible to carry out pest control measures more purposefully and effectively.

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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