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THE CONFUSED FLOUR BEETLE (TRIBOLIUM CONFUSUM DUV) AND CONTROL MEASURES AGAINST IT

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Abstract. This paper presents the results of a laboratory breeding study on the development of the confused flour beetle, a pest that causes damage to agricultural products stored in warehouses.

Key words. warehouse, pest, agricultural product, larva, fungus, beetle, laboratory, optimal conditions.

Introduction. Global climate change not only inflicts significant damage on agriculture but also contributes to the increasing harm caused by insect pests and diseases of crops. Due to the negative impact of harmful organisms, more than 15% of agricultural products worldwide are lost. Therefore, ensuring the safety of agricultural food products and improving the system of protecting crops from insect pests and diseases remains one of the most pressing issues.

The confused flour beetle (Tribolium confusum Duv) is a pest of grain products found in warehouses, elevators, mills, pasta and confectionery factories, residential buildings, and other places; it also occurs in fields and grain threshing floors. It belongs to the Order Coleoptera (beetles) and the Family Tenebrionidae (darkling beetles) [Note: The original text incorrectly listed Chrysomelidae (leaf beetles)]. Warehouse pests are also found among representatives of the classes of birds and mammals. Warehouse pests are widespread throughout the world. Among these pests, the confused flour beetle causes significant damage. The confused flour beetle (Tribolium confusum Duv.) is a dangerous pest of flour products. Warehouse pests destroy reserves of food products, eating the germ and floury part of the grain, resulting in grain

and other products not keeping well, spoiling their nutritional quality, damaging seeds, and drastically reducing their germination capacity.

The Confused Flour Beetle (Tribolium confusum) is a beetle belonging to the darkling beetle family. It is one of the warehouse pests that damages reserves of grain, flour and flour products, as well as dried fruits. It is one of the most widespread and destructive insect pests of stored dry food products [1: p. 146].

The beetles and larvae damage flour, preferably coarse flour, bran, semolina, and less frequently buckwheat, rice, and dried fruits. If the damage is severe, the flour clumps, develops a bad odor, and becomes unfit for consumption. The unpleasant odor is produced by the beetles themselves, their feces, and especially the bodies of dead insects. Furthermore, the presence of the beetles can lead to the appearance of mold in the products [3].

The confused flour beetle causes particular damage in mills, where it develops throughout the year and nests inside various mechanisms that are difficult to clean. The pest easily tolerates vibration, so it lives inside roller machines, flour lines, augers, and other equipment [2; p. 9].

Equipment is first mechanically cleaned, and the premises are sealed. Fumigation is used to control the confused flour beetle [4].

To reduce the damage caused by the confused flour beetle and to develop control measures, a thorough study of the pest's developmental characteristics is required.

Research Materials and Methods. Entomological calculations and observations were carried out according to the methods of Sh.T. Khojayev, Kh.K. Kimsanboyev, B.E. Murodov, V. Yakhontov, and G.Ya. Bey-Bienko.

The study utilized 1- and 2-liter jars, rubber bands, air-permeable cloth, air thermometers, food products (grain) for pest breeding, and laboratory notebooks.

Research Results. Laboratory experiments were conducted at the Laboratory of Warehouse Pest Control of the Scientific Research Institute of Plant Quarantine and Protection, located in Qibray district, Tashkent region, from January 6 to August 1, 2025, with the aim of breeding the confused flour beetle, which causes severe damage to stored products. Observations were carried out by breeding the confused flour beetle to study its developmental stages.

Reserve products (wheat, mung bean, common bean, chickpea, bran) were filled into special 1- and 2-liter jars, 400 grams each, for the pests being bred

under laboratory conditions. Into the jars filled with reserve products, 10 reserve pests (confused flour beetles) were placed.

The average daily air temperature in the laboratory room where the experiment was conducted was +22^\circ\text{C}.

Jars were used to breed the warehouse pests on food products. The mouth of the jar was covered with an air-permeable cloth secured with a rubber ring. The pest eggs and larvae found among the flour products were examined under a microscope. Objective lenses with 10 \times magnification were used first, followed by 40 \times magnification. All results obtained from the laboratory experiments were recorded in a laboratory notebook. Clean flour and bran products, previously uninfested with other pests, were used to prevent the flour products from being infested by pests other than the confused flour beetle.

To study the reproduction and development of the confused flour beetle under laboratory conditions (temperature 22^\circ\text{C}, air humidity 30-35\%), 10 adult beetles (imagos of the confused flour beetle) were placed into wheat bran and wheat flour inside 1- and 2-liter jars. Larvae hatched from the eggs 30 days after the artificial infestation of the flour products with the confused flour beetle. After 2-3 weeks, the larvae pupate (Figure 1).

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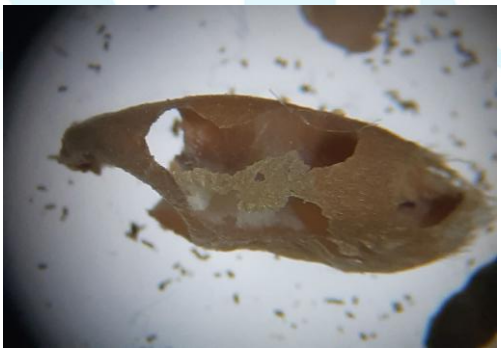

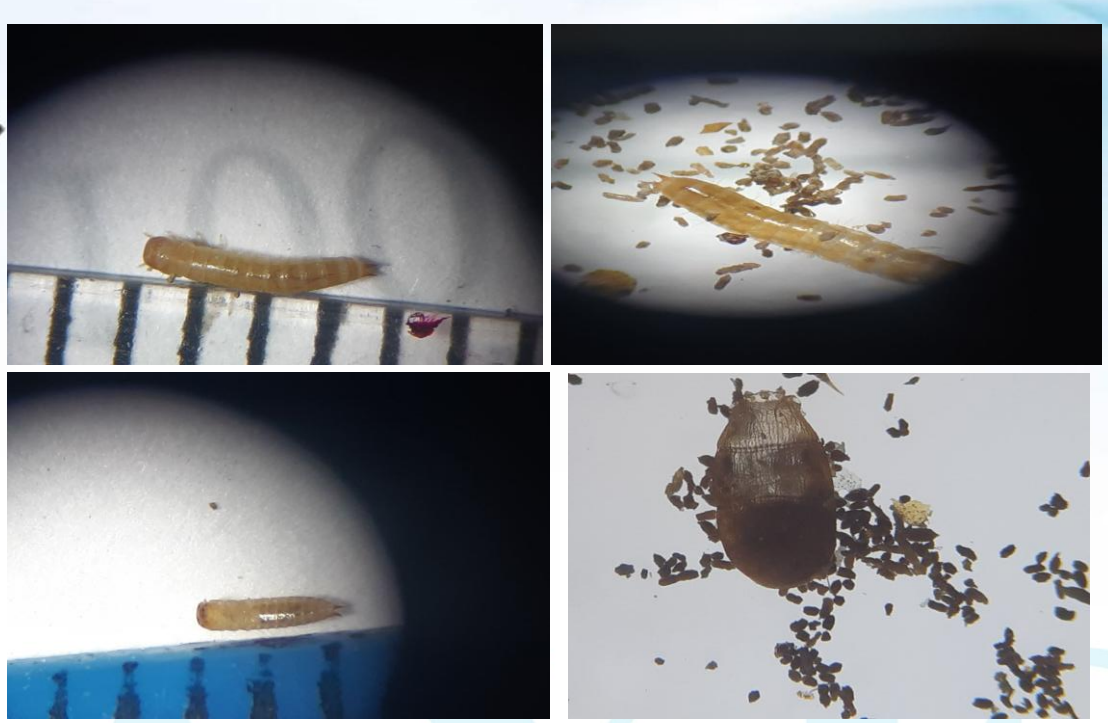

Figure 1. Developmental stages of the reserve pest, the confused flour beetle.

Conclusion. The results show that the confused flour beetle overwinters in the adult imago (beetle) stage and, after supplementary feeding, mates after 6-7 days, and the females begin laying eggs. Throughout its development, it passes through the stages of egg, larva, pupa, and adult beetle, i.e., imago.

The following organizational-economic and prophylactic measures are recommended against the confused flour beetle:

1. Every year, before receiving the new harvest, warehouses, sheds, raw material platforms should be repaired, and equipment and containers should be prepared.

2. The rules for storing agricultural products must be constantly observed, including regularly ventilating the premises to prevent the moisture level from increasing.

3. Before placement in the warehouse, the grain should be thoroughly sorted. Damaged grain should be stored separately and used first for farm needs.

4. Before accepting the new harvest, warehouse buildings, adjacent areas, containers, and sheds should be thoroughly cleaned of waste, dirt, various spills, and dust, and disinfested against harmful insects and mites using one of the fumigants authorized for use in Uzbekistan.

5. Warehouses, platforms, sheds, containers, and the products stored in them must be checked three times every month to determine the presence or absence of pests.

6. If the confused flour beetle or other pests are detected, immediate disinfestation must be carried out using one of the fumigants authorized for use in Uzbekistan.

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