



**REACTIONS THAT ENSURE THE PROTECTION OF THE COLORADO
BEETLE (COLEOPTERA, CHRYSOMELIDAE)**

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ANNOTATION

During the years 2020-2023, the behavior of the Colorado beetle *Leptinotarsa decemlineata*, a member of the family of leaf beetles (Coleoptera, chrysomelidae), was studied. The whole complex of protective actions is aimed at the realization of a goal that requires the species to reproduce, preserve, spread in a certain territory. Defensive behavior is closely related to other functional behavioral nodes. The article presents a variety of reactions of the Colorado potato beetle to external adverse effects.

Key words

leaf beetles, adults, larvae, complex of reactions, protective behavior, protective devices, passive defense, forms of behavior, thanatosis, insolation.

АННОТАЦИЯ

В течение 2020-2023 годов изучалось поведение колорадского жука *Leptinotarsa decemlineata*, входящего в семейство жуков-листоедов (Coleoptera, Chrysomelidae). Весь комплекс защитных действий направлен на реализацию цели, которая требует от вида размножения, сохранения, распространения на определенной территории. Защитное поведение тесно связано с другими функциональными поведенческими узлами. В статье представлено разнообразие реакций колорадского жука на внешние неблагоприятные воздействия.

Ключевые слова

жуки-листоеды, имаго, личинки, комплекс реакций, защитное поведение, защитные приспособления, пассивная защита, формы поведения, танатоз, инсоляция.

Introduction. It is known that the entire set of behavioral reactions of any insect is aimed at the realization of the goal that requires the reproduction, preservation, distribution of the species in a certain area. In the implementation of



this factor, it is possible to analyze the high success rate of leaf beetles (Colorado beetle - *Leptinotarsa decemlineata*) distributed in the biota. It is clear that the protective behavior in this process is "leading" in leaf-eating beetles compared to other beetle species.

In the natural environment, no organism can exist without a complex set of defense reactions [1-3]. Defense behaviors in different insects have different importance in relation to the value of the life of an organism or a whole family (colony, population): There are cases of "sacrifice" of the "soldiers" who protect. However, it would be wrong to consider defensive behavior in isolation from other forms of behavior, because defense leads to the survival of the species and, accordingly, to the formation of other behaviors. Naturally, defensive behavior is closely related to the morphological, anatomical and physiological characteristics of the organism (body shape, color, movement, etc.).

The purpose of the work: to study the protective behavior of leaf beetles (Colorado beetle) by summarizing the materials collected from field and laboratory observations. Materials were collected during 2020-2023. The following methods were used in the work:

- 1) Visual observation of beetles in nature (the studied area, microplot.);
- 2) Observing the natural behavior of beetles in special closed containers in the laboratory;
- 3) Experiments in special containers (as a result of creating artificial stressors, throwing various predators into containers);
- 4) Registration of defensive behavior of leaf beetles.

The analysis of the results shows that:

Passive protection (without additional effort and energy) is effective when insects use protective equipment or short-term immobilization (loss of movement) due to fear syndrome, cooling the body below the statistically possible threshold will be.

The protective means of beetles increase the body shape, the lack of moisture of the cuticle, the presence of hairs on the body, the presence of the diapause state, and the level of resistance to negative environmental conditions [5]. In particular, beetles are less affected by sudden changes in air temperature, wind and precipitation. Such adaptation to adverse weather parameters of the environment applies to all life stages of insects, including Colorado beetles.

Larva defenses. Larvae are more susceptible to environmental influences than mature forms. Defenses of these worms include: body shape; color; mimicry; the presence of barriers in the body that allow intensive evaporation of excess moisture; separation of hemolymph; cohabitation (1-2 years of larvae).



Insolation is the radiation of the insect organism in the flow of sunlight, usually in the morning to reach the optimal body temperature necessary for normal life [4].

Stabilization-passing the negative abiotic influence of the environment (rain, wind) in a stationary state (sticking firmly to the substrate, hiding in the soil, falling to the bottom of the plant or behind a leaf in a stationary state).

Hiding - by hiding the head and antennae.

Falling - allows you to move from the zone of contact with danger to a calm place "suddenly falling".

Thanatosis - imitation of death, sudden death during an unexpected attack by a predator.

Scaring is the removal of hemolymph fluid from the body.

Diapause (break) is a special physiological state [12] for experiencing an unfavorable season of the year in the development of insects, characterized by a sharp decrease in metabolic rate when the development and maturation of sexual products is stopped. This condition ensures the insect's resistance to cold and the successful wintering of the body.

Protective actions of imagos. Observations have shown that hemolymph fluid, accumulated in the body by eating insects from food plants and then released into the environment to avoid predators, quickly solidifies in the external environment and gradually loses its effectiveness.[6]

The salicin content of potato leaves was found to be significantly higher in the survival rate of leaf eaters than in other plants. The defensive reaction of insects can include a whole set of response actions. The nature of this response depends on environmental conditions, time of day, seasonal characteristics of the biology of leaf beetles, the sexual structure and density of their population, and other factors. Thus, the analysis of the defense behavior of the Colorado beetle made it possible to determine the types of defense reactions [7], to determine their dependence on weather conditions, to distinguish the individual characteristics of the danger from the response reactions of the beetles, at the moment the beetle considered as a risk stimulus that affects the body and determines one or another protective reaction.

All stimuli of danger, depending on the direction and nature of their influence, the growth rate is divided into fast and slow movement and is associated with specific protective reactions.

Spend the night on high vertical substrates (the upper part of the plant).

Such behavior was previously considered only as thermoregulation. However, when observing beetles, it was found that this nocturnal method is a very effective means of protection against predators (especially rodents that eat at night).



Hiding - hiding from excessive sunlight, raindrops, penetrating into the soil, under the leaf, into the sheath of the leaf.

Short-term transfer to another environment. (for example, temporary transition from the treated plant to the soil layer).

Long-term transfer to another environment (for 6-8 months) (for example, wintering in soil cavities).

Replacement - consumption of additional food with a lack of main food substrates allows imago and larvae to live for some time in the absence of main food plants.

Gujlash - Making the village a guj. (at cold temperature)

Conclusion. In conclusion, it should be noted that the protective behavior of leaf beetles seems to be complex and diverse, it is closely related to other behavioral nodes, but usually after the initiation of other functional reactions. then the manifestation of protective behavior is significantly weakened.

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