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PROTEIN SYNTHESIS OF EDIBLE INSECTS

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Abstract: *this article analyzes the synthesis of the Tenebrio molitor (Coleoptera: Tenebrionidae) protein belonging to edible insect, depending on its nutrient content. In particular, it was noted that TMO-2 and TMO-6 T.molitor* (F_6) *larvae are synthesized on average 31.02% protein in wheat bran, 38.13% in L.minor and 30.87% in A.carolina.*

Key words: *T.molitor, yellow mealworm, edible insects, L.minor, A.carolina.*

Introduction. Insects can also consume various processed wastes, turning them into food feeds with high nutritional value. It was shown that, reproducing a large number of insects on an industrial basis, they can be used as an alternative to the production of feed products with high nutritional value. In particular, it was determined that *Tenebrio molitor* of various edible insects retains 44-64% protein, 17-43% fat, *Alphitobius diaperinus*- protein 58-65%, fat 22-29%, *Acheta domestica*- protein 58-74%, fat 14-23%, *Gryllodes sigillatus*- protein 70%, fat-18%, *Locusta migratoria*- protein 56-65%, fat 13-30%, *Hermetia illucens*- protein 32-52%, fat 12-42% [Rumpold & Schlüter, 2013].

Thus, edible insects can be considered as an alternative source of providing the livestock, poultry, and fishing industries with a continuous nutritious food base [Khujamshukurov., 2011]. It is known that *Tenebrio molitor* is one of the most widely used edible insects in the world practice [Khujamshukurov et al., 2016]. In addition, the amino acids in their protein [Akhtar et al., 2018] and the fatty acid content of their fat are also interpreted differently [Jeon et al., 2016]. This may be due to the area of distribution of these insects, living conditions, type of feeding under controlled conditions, nutritional value of the feed base.

The purpose of the work. Growing in the conditions of Uzbekistan consists in determining the stock of protein *Tenebrio molitor* (*Coleoptera: Tenebrionidae*).

Research methods. Object of study. The sixth generation (F_6) *Tenebrio molitor* (*Coleoptera: Tenebrionidae*) was used, collected from the southern foothills of Uzbekistan and propagated under controlled conditions. During the study, from larvae and beetles collected by nature and numbered *Tenebrio molitor* (128: larvae 108, 20 beetles), 2 larvae (TMO-2: 5.36 cm, TMO-6: 4.83 cm) were selected (F_1 variant), which were the largest in size compared to others, upon visual observation, a *Tenebrio molitor* colony was formed on their basis. Growing conditions: used dry biomass of wheat bran with a standard content (protein 14-15%, fat - 0.8-1.0%), as well as from macrophytes *Lemna minor* (protein 16.1%, fat-2.8-3,1%) and *Azolla carolina* (protein -27.6%, fat-2.8-3.2%). Temperature is 20-22°C. The duration of cultivation in all samples was 28 days. Determination of proteins. Method R. Scoups (1985) was used in protein purification. The amount of protein in the supernatant was determined by the standard Lowry method. The statistical significance of the results was determined using Student's t-test.

Results and their discussion. When studying the direct storage of protein of *Tenebrio molitor (T.molitor)* larvae (3-4 cm long), variant F_1 collected from the Angren mountain ranges, Republic of Uzbekistan, Tashkent region, the average protein content was 43.09% (Fig.1). It was noted that the average protein content in the variants of F_1 larvae 1-3 cm long collected from nature is 42.74% (Fig.2). The average protein content in both variants was summed up and averaged 43.0%. This indicator (43.0%) was used as a control for moderate growth of *T.molitor* larvae and selection of culture media with different protein contents for storage. During the study, from larvae and beetles collected by nature and numbered *Tenebrio molitor*, 2 larvae (TMO-2: 5.36 cm, TMO-6: 4.83 cm) were selected (F_1 variant), which were the largest in size compared to others, upon visual observation, a *T.molitor* colony was formed on their basis.

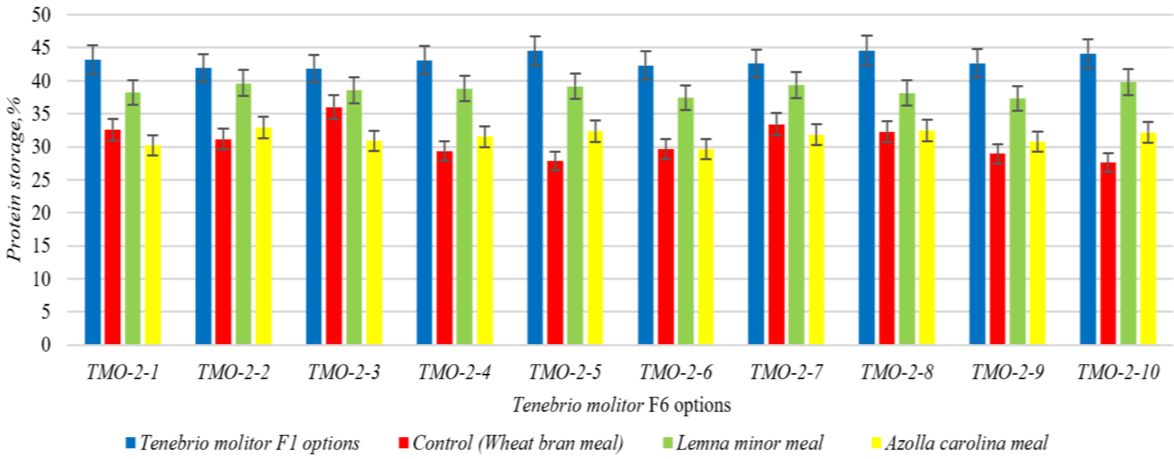

Fig. 1. **Storage of protein larvae of *Tenebrio molitor* (TMO-2) in various nutrient media (in% of dry matter)**

In this study, variants of TMO-2 and TMO-6 larvae based on variant F_1 and based on F_6 were used to study the properties of protein formation in various nutrient sources. Variants of *T.molitor* TMO-2 and TMO-6 larvae were used as controls for each other in the analysis of protein formation in various nutrient sources. Although the larvae of the TMO-2 variant obtained on the basis of the F_6 variant synthesized

30.89% of the protein in wheat bran, it was found that they synthesize 12.2% less protein than in the control variant (F_1). The TMO-2 variant grown in duckweed-based nutrient medium showed an average of 38.65% protein synthesis, 4.44% less than the F_1 control, and 7.71% more protein synthesis than F_6 grown on wheat bran. Therefore, the fact that duckweed stores more protein than wheat bran from the point of view of protein storage, could serve as the basis for this. It was found that the larvae of the TMO-2 variant obtained on the basis of variant F_6 synthesize an average of 31.48% of the protein when grown on the basis of azole.

It was noted that the protein synthesized is 11.61% less compared to the F_1 protein variant. It was found that wheat bran produces an average of 0.59% more protein than the larvae of variant F_6, and 7.17% less protein synthesis than the larvae of variant F_6 grown in duckweed. The fact that less protein is synthesized in azole than in duckweed can be explained by the fact that splitting of the azole flour in the larval organism is more complicated than in duckweed flour.

The larvae of the TMO-6 *T.molitor* variant obtained on the basis of F_6 synthesized 31.15% of the protein in wheat bran, while protein synthesis was observed to be 11.59% less compared to the control variant (F_1) (Fig. 2). The TMO-6 variant grown in a nutrient medium based on *Lemna minor* synthesized an average of 37.60% protein, 5.14% less than the F_1 control, and 6.45% more protein synthesis than the F_6 variant grown on wheat bran. Therefore, the reason for this may be the fact that the aforementioned duckweed stores more protein than wheat bran. It was observed that the larvae of the TMO-6 variant obtained on the basis of the F_6 variant synthesized on average 30.26% of the protein when grown on the basis of azole and 12.48% less protein synthesis than on the F_1 control. Variant TMO-6 larvae grown on *Azolla carolina* flour synthesized 0.89% less protein than larvae of TMO-6 variant grown on wheat bran.

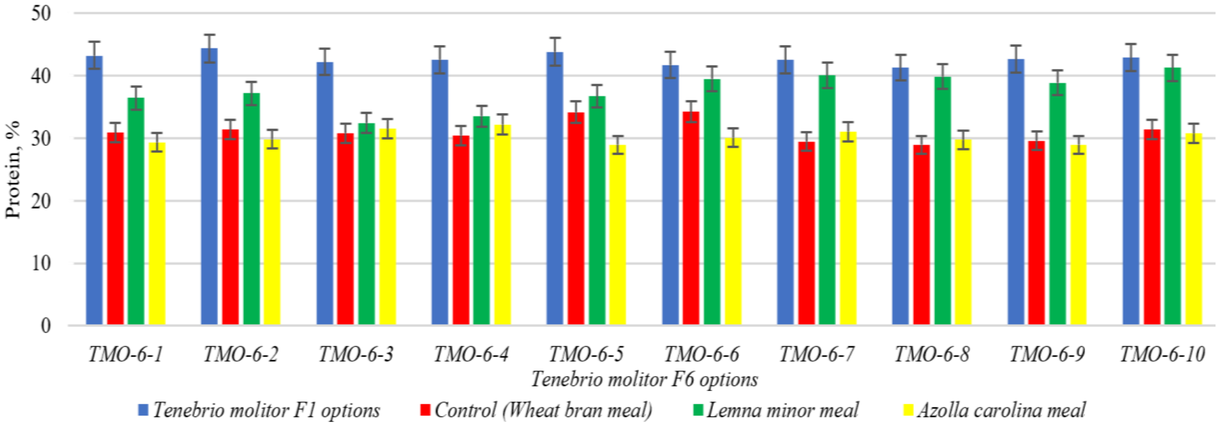

Fig. 2. **Storage of *Tenebrio molitor* larvae protein (TMO-6) in various nutrient media (% of dry matter)**

The results obtained compared the synthesis of F_6 protein of the larva variant of TMO-2 and the variant TMO-6 in food sources with an average protein synthesis of 31.02% in standard wheat bran, 38.13% in duckweed and 30.87% in azole. It was found that the larvae of variant F_6 grown on wheat bran synthesized protein on average 4.79% less than variant F_1. F_6 larvae grown in duckweed synthesized 7.11% more protein than larvae grown in wheat bran and 0.15% less protein synthesis than larvae grown in azole. It was found that F_6 larvae grown in duckweed produce 7.26% more protein than larvae grown in azole. This means that although the source of the nutrients of the naturally harvested (F_1) larvae is unclear, they may have had high protein synthesis because they naturally fed on the most convenient and nutritious food source. The high protein synthesis of F_6 larvae in wheat bran compared to duckweed can be explained by its high protein content and its easy digestion in the larval organism. However, the high protein content in azole can be explained by the fact that the larvae synthesize less protein than duckweed, which complicates the breakdown and digestion of azole in the larval organism.

However, studies have shown significant differences in the overall development and mortality of larvae feeding on duckweed and azole. In particular, the laying of eggs of larvae based on azole was 38.14%, and in duckweed - 58.38%. It was noted that the percentage of egg laying in larvae grown on wheat bran was 68.85%. The mortality rate of larvae feeding on wheat bran was only 18.22%, on duckweed - 44.63%, and on azole - 62.27%. This situation is explained by the fact that in duckweed and azole there is not enough moisture (average humidity 3.4–4.2%), the content of wheat bran is relatively high (average humidity 9.58–10.12%). Summing up these indicators, we believe that the lack of nutrients in the body eating macrophyte larvae, the low moisture content in the feed led to their death, egg laying and larvae of variant F_6 produced significantly less protein than variant F_1. Therefore, when feeding macrophytes, it is advisable to take into account its moisture content or add flour based on them to other food sources. Then the larvae can die, lay eggs and achieve maximum protein synthesis.

Conclusion. Typically, agricultural products such as soybean meal, wheat bran, corn bran and cornmeal, which are expensive and inconvenient to grow, are used in the production of *T.molitor* under controlled conditions and in the production of feed products based on it. This suggests the need for alternative food sources to organize industrial production based on edible insects. As such alternative nutrient sources, macrophytes can be considered as one of the most viable options. In particular, based on our scientific studies, it was proved that in Uzbekistan, on the basis of the small *Lemna*, it is possible to obtain 154 t/ha/year of wet biomass or 27.34 tons of dry mass [Khujamshukurov et al., 2011].

This will allow to establish production based on edible insects in Uzbekistan and provide its food base based on macrophytes. From scientific sources it is known that when obtaining protein based on *T.molitor*, very few land areas, feed and water are required in comparison with the land plots necessary for raising chickens, pigs or cattle. In addition to its low environmental impact, this production is characterized by a very high level of productivity and the ability to organize the production process regardless of the time of year. In particular, cattle or pigs cannot feed on any plant matter, and very large plants, including macrophytes, can be used for insects.

The production of feed based on feed insects will provide the fast-growing fish industry in Uzbekistan with a source of continuous, full nutritional value. The cultivation of these species of insects using macrophytes of duckweed and azole, which are easy to breed, will reduce their cost and increase their nutritional value.

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THE USE OF ENERGY FEED SUPPLEMENT «КАУДЖОЙ» IN THE DIETS OF HIGHLY PRODUCTIVE COWS

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Abstract: *in the system of complete feeding of dairy cows, the energy supply of animals is of paramount importance. The basis of the diet of ruminants is voluminous feed. However, they cannot fully provide highly productive cows with sufficient nutrients and energy. A particularly busy lactation period is a new lactation period, when the high energy costs of milk production cannot be fully covered by the nutrients from the feed. Therefore, as a rule, in the new body period, highly productive cows use a concentrated type of feeding in order to increase the level of metabolic energy in the dry matter of the diet.*

Keywords: *Кауджой , cows, energy, feed supplement, highly productive*

Relevance of the topic general description of work. It is known that an excess of concentrated feed in the diet leads to metabolic disturbances in animals, the occurrence of various diseases, a decrease in productivity and an increase in the cost of milk [3].

Therefore, along with factors such as improving the quality of feed and rations, various feed additives, which are metabolic regulators and additional energy sources for animals, are widely used. The effectiveness of feed additives is due to the regulatory influence on the intensity of the processes of digestion and use of nutrients, which has a positive effect on the productivity and health of animals [5].