

DARKLING BEETLE LARVA: THE ALTERNATIVE OF SOYBEAN MEAL AS PROTEIN SOURCE IN CHICKEN FEED

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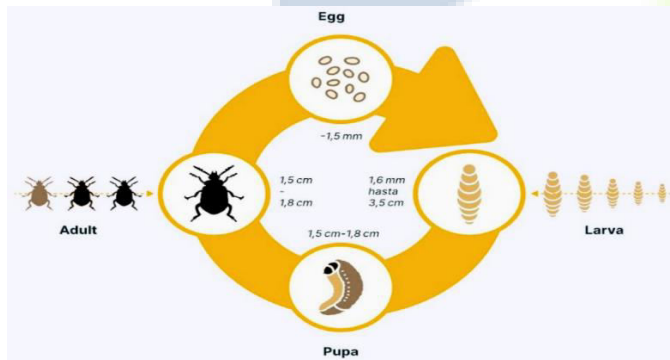
ABSTRACT

Poultry meat and eggs are animal protein sources. To produce this protein poultry needs high protein diets. In traditional poultry feed formulation, farmers use soya beans, which contain a high level of protein, but their cost is very high. Darkling beetle (*Tenebrio molitor*) larva are a good source of protein and are easy to grow in sense of cost and low production areas.

Introduction:

The share of Pakistan in the investment of poultry sector is about 1981.63 billion PKR according to a survey of the financial year 2022-2023 [9]. Insects are the organic source of protein for birds and animals [2]. It is a common practice that poultry birds eat insects for ages. Also, the life span of insects is very short, and fast they attain the required size in a few days [3]. Insects are a good protein diet having some minerals and vitamins also contain highly unsaturated fat linoleic acid and linolenic acid [4]. Mealworms or yellow worms, the larva of Darkling beetles (*Tenebrio molitor*) are rich in protein, on feeding these worms broiler shows better growth than the broiler feeding on soya beans [4]. Yellow worms are found in grain storage areas as pests of grains but in many countries, they are grown on a commercial scale to use as pet feed [1, 5]. As compared to soya beans and fish meal, mealworm has high nutritional value with low production areas, breeding is not too difficult and possess a short life cycle [5].

Life cycle:



Life stages of Yellow Worms [8].

Tenebrio molitor needs almost 60 days (about 2 months) to become an adult beetle, eggs hatch in about 5-7 days at 25°C-35. The number of days is inversely proportional to temperature, eggs of adult beetles also affect the number of days of egg hatching [5]. After egg hatching larval stage starts, which passes through 17 instars to and changes into a pupa [6]. The length of the larva varies between 12-32mm (about 1.26 in) and decreases near pupa stage [5]. The pupal stage lasts for about 5-6 days, pupae cannot eat due to the absence of a mouth and anus, insect completes their body in this stage [5]. At the end of pupation, a white beetle comes out, which gradually changes its color and becomes black in color, about 400-600 eggs are laid by an adult female beetle, and male and female beetles are attracted by each other through pheromones [5].

Feed and housing of mealworms:

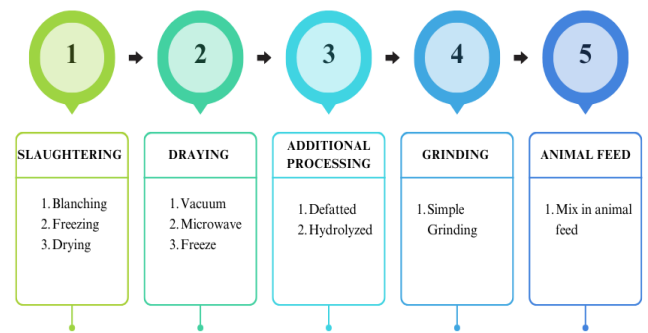
A major part of the mealworm diet is carbohydrates, which are about 80%-85% and high levels of humidity and temperature help the worm to gain more weight [5]. Larva simply feeds on wheat bran [5]. 35°C is the most suitable temperature for all the stages of mealworms to complete as early as possible [6].

Processing and storage of mealworm:

1. Slaughtering 2. Drying 3. Defatted or Hydrolyzed 4. Grinding 5. Animal Feed

Slaughtering includes blanching, freezing and chilling, this is necessary for long-term storage and transportation. The Blanching process inhibits microbial reproduction when store it for long time [6]. For the removal of moisture content from the mealworm drying is done because worms have 68% moisture that can destroy the quality of worms. Vacuum and Oven

drying is done [7]. It contains a high fat content of 30%-35%. Defatting and hydrolysis are carried out to prevent the oxidation of lipids, increase digestibility and reduce the anti-nutritional factor [7]. Finally, grind and mix it with feed.



Processing of mealworms for animal feed

Nutritional Values of Mealworm:

The mealworms are rich in sources of protein fat, amino acids, and mineral vitamins. It also contains higher amounts of lysine and threonine. Owing to the low calcium content in mealworms, the poultry may face calcium deficiency and bone disease issues [5]. To overcome calcium deficiency, mealworm usage provides another calcium source. The mealworm is a good source of nitrogen in the form of D-acetylglucosamine. According to FAO and WHO amino acid content of larva are not only useful for animals but also human beings [4]. *Tenebrio Molitor* larvae contain 46.44% protein, and its adult protein is 63.34% [4].

Table: 1. Essential amino acids present in meal worms

Amino acid	Quantity Per 100 Grams
Isoleucine	4.5 gram
Leucine	5.3 gram
Lysine	4.5 gram
Methionine	1.3 gram
Phenylalanine	1.5 gram
Threonine	1.6 gram
Valine	4.4 gram

Conclusion:

It is concluded that the mealworm is a good source of protein and can replace soybean meal as an alternative source. Mealworms enhance the immune response and prevent birds from diseases and also show a positive increase in the feed conversion ratio. Soybean imports are a burden on the economy of the county so adopting this alternative helps to lessen the import deficit. Wheat bran is the only diet of worms so growing mealworms is cost-effective, so by using mealworm meals we can save millions of rupees. In many countries of the world, farmers adopt the practice of feeding mealworm larvae as a protein source in poultry. In our country, this practice is also being adopted on a small scale. We should promote the farming and feeding of mealworms.

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