ECRONICON OPEN ACCESS

EC VETERINARY SCIENCE
Short Communication

Larval Instars of Black Soldier Fly for Converting Food Waste into Livestock Feed

Vitthalrao B Khyade[1,2,3]*

[1]*Sericulture Unit, Malegaon Sheti Farm, Agricultural Development Trust Baramati, Baramati, Pune, Maharashtra, India*

[2]*Head, Department of Zoology, Shardabai Pawar Mahila Mahavidyalaya, Pune, Maharashtra, India*

[3]*Dr. APIS", Shrikrupa Residence, Teachers Society, Pune, Maharashtra, India*

***Corresponding Author:** Vitthalrao B Khyade, Sericulture Unit, Malegaon Sheti Farm, Agricultural Development Trust Baramati, Baramati and Head, Department of Zoology, Shardabai Pawar Mahila Mahavidyalaya and Dr. APIS", Shrikrupa Residence, Teachers Society, Pune, Maharashtra, India.

Received: April 15, 2021; **Published:** May 29, 2021

Black soldier fly meal is a food product, prepared through drying and pulverizing the larval instars of this insects (*Hermetia illucens* L.). Black soldier fly insect meal is proven to promote the assimilation of food material and animal growth. This insect meal is rich in animal protein and the vitamins. It can be used as a substitute for the costly components of fish-meals, soy-meals, and grain-meals used for the addition into the feed of livestock. The larval instars of the insect black soldier fly, *Hermetia illucens* (L) are the best sample species for the preparation of insect meals. The larval instars of the insect black soldier fly, *Hermetia illucens* (L) deserve efficient ability of transformation of the waste material into the products rich in the proteins. The challenge on the line of use of the larval instars of the insect black soldier fly, *Hermetia illucens* (L) for protein rich food products lies in the human abilities in harvesting in a sustainable way to meet global demand. Until now, edible insects have been collected from nature and their potential future use as feed meal will require large-scale production. Therefore, methods to produce insect meal should be developed in a way to meet the rising demands sustainably. In addition, legislation on their production and development of food safety matters as if prime concerns.

The human population at global level is rising rapidly (with the rate of seventy-five million per year). This is further paired with increase in the standard of living. Population size and the demand of food material goes hand in hand. It is speculated that, there may be seventy percent demand of animal proteins in future by the year: 2050. Presently, there is expansion in the production of livestock at a constant rate. The demand of animal proteins by ever increasing human population appears to be challenge. This is because, the present methods of cultivation is resulting into the over-exploitation of fertile lands, water resource scarcity, and cutting down of forests.

According to the reports of Food and Agriculture Organization (FAO) (2015), one billion population of South Asia and sub-Saharan Africa is depending on livestock production alone for food and livelihoods [1]. The largest share of land of agriculture belongs to the livestock animals for grazing (or growing feed crops). The enteric fermentation by the livestock animals, which is responsible for emission of the highest amounts of green-house gases (GHG) through enteric fermentation and manure production. The green-house gases (GHG) through the livestock animals are contributing for significant climate change. There is a negative effect of production of livestock animals on the natural resources (land, water, and biodiversity). It is therefore, there is a prime concern to find alternative methods for the qualitative methods of production through agricultural practices. It is not impossible for finding a effective solution for the production of feed for livestock animals (instead of investment of cultivable land of agriculture for growing feed crops).

The poor infrastructure, non-efficient facilities of crop harvest, and available transportation systems are exerting negative effects on the food production per year (at both pre- and post-consumption stages). The post-harvest loss in agricultural crops for pre-consumption

accounts about forty percent in the developing world. On the contrary, nearly half of food losses in the developed world occur at retail and consumer levels due to quality standards that overemphasize appearance [2].

There is application of traditional methods for the production of compost feed from waste food material for livestock animals. The results of this attempt depend exclusively on: the slow thermodynamic processes of either composting or depending on farm animals that are capable of feeding on food wastes and reprocessing them into manure. Insect meal production is bioconversion, the process of conversion of food wastes into insect larval biomass and the residue of organic nature. This process of bioconversion may be an alternative method for inefficient traditional practices [3].

There are various advantages of bioconversion in comparison with traditional waste management processes. The very first advantage of bioconversion is reduction in the amount (in the volume) of organic materials through the agents of biological process (in the form of microorganisms or enzymes that transfer organic material into usable products or energy sources thus providing greater spatial potential for landfills and waste containers). The second advantage of bioconversion is the limitation of the odours associated with landfills and waste sites, preventing the accumulation of unwanted material on solid surfaces that are associated with recyclables and the blockage of sewer pipelines by solid wastes. There is limitation for the production of methane gas through the bioconversion. This may be due to the anaerobic degradation of organic materials in landfills and waste sites [4]. Furthermore, the process of bioconversion is a natural process. Therefore, bioconversion process can be used and adapted within households, bringing down the costs related to the transport and recycling of waste.

The body of insect contain proteins of high quality, vitamins and amino acids. The insects deserve efficient rate of utilization of consumed food material. The rate of conversion in the insects requires up to six times less feed than livestock for the production of the same amounts of proteins. In comparison with the livestock animals, the emission of green-house gases (GHG) and ammonia is very less. Insects are thus forming potentially and efficient source for direct consumption by human being as food. The insects may also be used as a source of high-quality proteins.

The research work of the author is with a group of researchers, exploring various insects for food and feed and targeting small farmers who not only can decompose their organic waste in an environmentally friendly way, but can also invest in crop production for direct human consumption, rather than livestock feed. Author's research is looking at the utilization of larval stages and the pupae of black soldier flies (*Hermetia illucens*) (BSF) for feed production and as the best laboratory animals (and the field animals too) for the bioconversion of organic waste material. The larval stages of black soldier flies (*Hermetia illucens*) (BSF) are particularly interesting, as they efficiently convert various organic wastes into high-profile protein through decomposition, have global distribution, including moist tropic and subtropical regions, and can tolerate extreme temperatures [5-8,16].

The larval stages of black soldier flies (Hermetia illucens) (BSF) have been used for waste management within the context of bioconversion, and they can also make use of various nutrients abundant in waste streams [9]. In particular, the larval stages of black soldier flies (Hermetia illucens) (BSF) can reduce significant amounts of wastes (food wastes, animal wastes, and sewage wastes). Furthermore, the life stages of black soldier flies (Hermetia illucens) (BSF) are not pests and actually deter the common houseflies that are normally linked to waste and low hygiene and health standards [10-12]. BSF are not known to be vectors of any disease linked to animal or human health, unlike other insects such as the common housefly or mosquitoes. In addition, larval stages and pupae of black soldier flies (Hermetia illucens) (BSF) can be used as a food protein source. In comparison with livestock products, larval stages and pupae of black soldier flies (Hermetia illucens) (BSF) exhibit some advantages. One is that, black soldier flies (Hermetia illucens) (BSF) are cold-blooded and thus can convert feed much more efficiently into edible product. In addition, they produce less ammonia and green-house gases (GHG) than traditional livestock and occupy less space physically [13].

Although the field of research in black soldier flies (Hermetia illucens) (BSF) is still in its infancy, studies have indicated that, black soldier flies (Hermetia illucens) (BSF) have the ability to inactivate and reduce harmful microbial contaminants present in waste samples by modifying waste's microflora [14-16].

BSF also showed some potential in reducing heavy metal traces by incorporating and concentrating nutrients from waste samples into livestock feed. This reduces the nutrients in the waste material. It is leading to the reduction in pollution potential by 50 to 60 percent or more.

The remaining BSF-decomposed waste can be used as a bio-compost that can be readily applied to agricultural lands. This can also act as a solution to replace the use of chemical fertilizers, which can deplete soil if applied in excessive amounts and are costly.

Insect meal is a food product prepared by drying and pulverizing insects and is proven to promote food assimilation and growth in animals. It is also rich in animal protein and vitamins. It can substitute for the costly components of fishmeal, soymeal, and grains that are added to livestock feed in order to promote food assimilation and growth in animals [15]. Insects like BSF are good candidates because of their ability to efficiently transform waste into high protein products. Yet, there are many challenges to be addressed regarding their use, such as the ability to harvest these insects in a sustainable way while also meeting global demand. The very first step on this line is collection of edible insects. The next step is large scale production through the efficient methods of rearing. It is therefore, methods of production of insect meal should be developed for meeting the sustainable and rising demands. The legislation on the production of insect meals and efficient utilization requires to be established and food safety matters are prime concerns to be addressed.

Ultimately, edible insects provide a promising future source for animal protein. In particular, the BSF show a great potential in providing us with livestock feed by utilizing organic waste in an environmentally sustainable fashion.

Bibliography

1. Food and Agriculture Organization of the United Nations. Livestock and the environment (2015).
2. Lyons K., et al. "Produced but never eaten: a visual guide to food waste". The Guardian (2015).
3. Barry T. "Evaluation of the economic, social and biological feasibility of bio converting food wastes with the black soldier fly (*Hermetia illucens*)". UNT Digital Library (2004).
4. Goudie A. "The Human Impact on the Natural Environment". MIT Press, Cambridge MA (2000).
5. James MT. "The genus *Hermetia* in the United States (Diptera, Stratiomyidae)". *Bulletin of the Brooklyn Entomological Society* 30 (1935): 165-170.
6. McCallan E. "*Hermetia Illucens* (L.) (Dipt, Stratiomyidae), a cosmopolitan American species long established in Australia and New Zealand". *Entomologist's Monthly Magazine* 109 (1974): 232-234.
7. Gullan PJ and Cranston PS. "The Insects: An Outline of Entomology". Blackwell Science, London (2000).
8. Kovac D and Rozkosny R. "Stratiomyidae (Insecta: Diptera) of Temengor Forest Reserve, Hulu Perak, Malaysia". *Malayan Nature Journal* 48 (1995): 281-285.
9. Sheppard C. "House fly lesser fly control utilizing the black soldier fly in manure management for caged layer hens". *Environmental Entomology* 12.5 (1983): 1439-1442.

10. Sheppard C., et al. "A value added manure management system using the black soldier fly". *Bio Resource Technology* 50.3 (1995): 275-279.

11. Furman DP., et al. "*Hermetia illucens* (Linnaeus) as a factor in the natural control of *Musca domestica*". *Journal of Economic Entomology* 52.5 (1959): 917.

12. Tingle FC., et al. "The soldier fly, *Hermetia illucens*, in poultry houses in north central Florida". *Journal of Georgia Entomology Society* 10.2 (1975): 179-183.

13. Food & Agriculture Organization of the United Nations. Assessing the potential of insects as food and feed in assuring food security (Summary Report). Food & Agriculture Organization of the United Nations (2012).

14. Erickson MC., et al. "Reduction of *Escherichia coli* O157:H7 and *Salmonella enterica* serovar Enteritidis in chicken manure by larvae of the black soldier fly". *Journal of Food Protection* 67.4 (2004): 685-690.

15. Feed meal. The Great Soviet Encyclopedia 3rd edition (1979).

16. Vitthalrao B Khyade. "Rearing the Black Soldier Fly, *Hermetia illucens* (Linnaeus) (Diptera: Stratiomyidae) in local environmental conditions of Baramati (India)". *Uttar Pradesh Journal of Zoology* 42.5 (2021): 64-72.

Volume 6 Issue 6 June 2021