Iowa Science Teachers Journal

Volume 16 | Number 3 Article 16

1979

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The world food deficit has resulted in an expanded effort to find new sources of protein. With significant research efforts directed toward development of oilseed, leaf, fish and single cell concentrates, it is surprising that insects have been almost totally overlooked. They are a natural food for many kinds of animals and they are used widely as food by some human populations, especially in the tropics where they help compensate for the general deficiency in animal proteins, fats and calories. The few biochemical studies done to date indicate that insect protein is of high quality.

It is well known that some insect species have a tremendous reproductive capacity. A medium sized swarm of the migratory desert locust, *Schistocerca gregaria*, may cover about 25 square miles and contain up to 5 billion insects weighing a total of approximately 10,000 tons. A really large swarm may cover an area of 200 square miles. This insect breeds in an area of more than 5 million square miles and ranges over 11 million square miles in Africa and southwestern Asia. About 20-25 percent of the wet weight of a locust is good protein (calculated on the basis of protein nitrogen only). If the daily human need for protein is assumed to be 50 grams, a medium sized swarm of the desert locust contains enough protein to meet the yearly needs of 100,000 to 125,000 people.

It should not be too difficult to devise methods for harvesting part of this locust crop. In years when migrations of winged adults will form due to crowded conditions in the vicinity of the breeding grounds, the young hoppers, which are wingless, become gregarious and form marching bands composed of hundreds of millions of individuals. In connection with chemical control programs much knowledge has been accumulated about the location of breeding grounds and the direction that migrations will move.

While some species, such as locusts may be harvestable as wild populations, with others it may be possible to develop mass-production technology such as has been done with a number of species for use in biological control programs. In societies where there is a cultural aversion to eating insects, the main potential may lie in developing mass production systems in which insects recycle waste materials into protein-rich feeds for animals such as poultry and fish that are more acceptable for direct human consumption.

House fly larvae, *Musca domestica* normally develop in various kinds of animal excreta. Two research groups, one in the U.S, Department of Agriculture, the other at Colorado State University have worked with the

objective of determining whether larvae grown in such media (poultry manure) contain sufficient nutritive value to be substituted for soybean meal in the ration of growing chicks, while at the same time biodegrading the manure and thereby reducing the pollution problem posed by its disposal. The fly pupae were found to contain slightly more than 60% protein, based on total N The metabolizable energy value of pupae was higher than that of soybean meal and only slightly lower than that of fish meal. Analyses of amino acids showed the pupae to be comparable to bone and fish meal and superior to soybean oil meal. The pupae were also a good source of fat and of minerals. When the dried fly pupae were substituted for the soybean oil meal in the diet of chicks to the 4th week of age, there was no significant difference in weight gain, food consumption or food conversion between chicks fed pupae and chicks fed a fully balanced ration. Finally, there was no adverse effect on carcass quality or taste of birds fed the pupal diet.

The above work also demonstrated the potential value of insects in recycling waste materials. It was found that poultry manure, after digestion by fly larvae, was reduced to about half its original weight. It was granular in texture, readily dried, had much less odor, and with additional drying and pelleting, was suitable as a soil conditioner. Simple equipment was devised whereby it was estimated 500 to 1,000 lbs. of pupae could be harvested daily from the excreta of 100,000 hens.

The above are but two examples worldwide, there are nearly one million described species of insects. There are few substances of either plant or animal origin that are not utilized as food by one or more species. It will take imaginative research to determine whether specific systems can be developed that are economically and nutritionally feasible to utilize insects as food. The development of mass production methods will not be easy, especially if based upon utilization of waste materials or other low-cost substrates. Insects are subject to many diseases in captivity and they are extremely sensitive to environmental conditions such as temperature, humidity, light and crowding. Much additional research will be needed on nutritional factors such as digestibility. Research will also be needed to insure again the presence of toxic factors such as allergens, amino acid antagonists and organolytic factors such as taste and texture. Nevertheless, the food potential of insects appear to warrant exploratory research on these problems.

References

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