IMPORTANCE INSECT NUTRITION AND NUTRITION IN BENEFICIAL INSECTS

INSECTS are the example of a successful class of animals which, owing to their adaptive evolution survived the onslaught of the changing environment through geological era. So severe were the changes that even the kingdom of the glorified reptiles which once ruled this planet, withered away with an astonishingly rapidity. The insects because of their ability to seek food of different types, to modify their organs to suit different ecological requirements, to make use of microclimate, to their small size and to develop true wings to disperse themselves to new regions, could have the largest number of species in the animal kingdom. Insects inflict damage to human health and economy in their efforts to obtain food. They associate with our crops with the main aim to secure nutrition for themselves or for their progeny. The extent and nature of damage is determined by the type of relationship between insects and their hosts. A knowledge of their nutritional requirements is therefore of great importance to an economic entomologist. Nutrition also influences the phenomenon of host selection. It investigates into the process by which insects feed and utilize food substances. It therefore concerns an important sphere of insect activity which directly or indirectly determines their economic status. A thorough and deep knowledge of nutrition in its wide sense can explain how one crop plant or its varieties are differentially damaged. In this way insect-plant relationship offers the bases for the susceptibility or resistance of different plants to insects and can help in identifying plant varieties capable of resisting insect attack.

The significance of insect's ability to develop on different food plants has been realised by the earlier entomologists. The literature is full of such valuable data where a pest, though serious in a particular crop, has a number of alternate host plants. This can be regarded as an earlier attempt to see the effect of different foods all insect development, growth, survival amd fecundity. Uvarov (1929) and Brues (1946) have reviewed the earlier work on the subject. Owing to the lack of knowledge about the effect of different nutrients on insects, it was not possible to interpret these data in physiological terms. These types of investigations remained within the purview of biological notes and lacked in proper interpretations because of the unknown and complex chemical nature of the plant and animal tissues.

The work carried out on insect nutrition by Fraenkel and his associates during forties in Imperial College, London, made it possible to raise insects on diets of known chemical composition. This period was also marked by the tremendous advancements made 111 the field of biochemistry and Isolation and synthesis of several compounds present in living tissues. Because of the availability of various vitamins of B complex in pure form, synthetic diets for several insects could be evolved. The vitamins like pantothenic acid, nicotinic acid and biotin were identified or synthesized only in 1940. For a very long time the test insects for nutritional studies were stored product pests which feed on dry diets. Now, it is possible to grow several species of phytophagous insects on chemically defined diets: To mention some are: *Chilo zonellus*, *Pectinophora, Anthonomnus grandis*, locusts, aphids, silkworm etc. Limited success has been achieved in case of parasites and predators.

Nutritional studies and resistance to insects in plants: One of the methods of insect control is to utilize plant varieties resistant to insect. Painter published a book in 1951 entitled *Insect resistance in crop plants* where he has discussed this phenomenon of resistance in several crop plant varieties. He had little information at that time on the causes of resistance. If this type 6f insect control is to be exploited successfully we must have a thorough knowledge of the factors responsible for resistance. In tropical countries like India each crop suffers from the attack of several species of insects and a caution is necessary not to declare a variety resistant unless true nature of resistance is studied. The physiological and biochemical bases of host plant relationship therefore have to be identified. Plants have several unidentified factors which govern the insect establishment. These could be nutrients or secondary plant substances like alkaloids, essential oils acting as attractants or repellents. . Isolation and identification bf these classes of chemicals in plants can help the plant breeders to select proper plant types for evolving resistant varieties. The nutritional status of different biotypes of the same species of the pest must also be known to decide whether a variety will be able to maintain its resistance in a new locality or not.

Nutrition of beneficial insects: There is a great scope of utilizing nutritional data for proper exploitation of beneficial insects like honey bee, lac insect, silkworm, parasites and predators. The significance of nutritional data of these forms is self-evident. It is of the same importance to these insects as animal nutrition to livestock. Nutrition directly influences quality and quantity of the product produced by these insects. Honey, lac or silk-yields can be greatly increased and their quality improved by proper dietary management. Efficiency of a parasite or a predator can be enhanced by providing proper nutrition. Japan has made phenomenal progress in the nutrition of silkworm. It is now possible to grow silkworm in an artificial diet and the time is not far away when silk industry will no longer depend upon the availability of mulberry plant. During winter months mulberry leaves are not available and insects undergo diapause. Methods are now known to break the diapause. Silkworm rearing can be a continuous process once an artificial diet is perfected. Unfortunately no attention has been paid to lac insect nutrition with the result the lac production in the country is becoming costlier and scanty. If this industry has to compete with several synthetic lac substitutes' scientific principles must be applied to lac production. It is well known that quantity and quality of lac are dependent upon the type of trees on which lac insects feed. What makes one species of host more suitable than other? What are the factors which affect the metabolism leading to lac secretion? These and other related questions though vital, have never been answered owing probably to lack of interest on this type of fundamental approach to the lac cultivation. Lac insect is a glaring example which bears the testimony to the fact that unless fundamental principles are worked out, suitable technology cannot be evolved for applying it to human welfare. This important product is a monopoly of India and can be a very important item of export in a big way if basic data on lac insect physiology especially nutrition, insect-host relationship and ecology are collected and utilized for increasing the production. Nutrition of biological control agents is another field awaiting attention of scientists. Success of biological control also partly depends upon the ease with which parasites or predators can be .reared in large numbers for releasing them in the field at proper time. To achieve this, main or alternative host should be available. The parasites which have high degree of

specificity, do not readily accept alternate hosts. Only in certain cases mass-breeding of parasites has been possible on different host insects. *Trichogramma*, an egg parasite of several lepidopterous insects associated with sugarcane, can be mass bred on the eggs of *Corcyra cephalonica*. This problem of alternate host insect can be solved if methods could be worked out for evolving suitable artificial diets for parasites. With the available data on insect nutrition, one can visualize that the nutritional requirement of parasites should not differ much from other insects. Some degree of success has been achieved in rearing *Pseudosarcophaga affinis* (a dipterous. parasite) on a chemically defined diet (House, 1958). Parasites because of their obligatory nature have special feeding requirements which must be fulfilled to enable the parasite to establish on artificial diets. An analysis of these factors is therefore as vital as the nutritional requirement of this class of insects.

Insect nutrittion as a tool in other scientific researches: Insects have been used for basic and fundamental researches pertaining the medical and genetic sciences. Indeed it was the use of Drosophila in fundamental genetics that ultimately led to the necessity of devising chemically defined diets to eliminate errors due to variation in food of test cultures. Similarly synthetic diets are now preferred for rearing test insects for bioassay of insecticides and for precision physiological and biochemical experimentations.

Working with *Tenebrio molitor*, Fraenkel and his associates discovered a new vitamin of B complex which was named as vitamin BT. This Tenebrio-factor was later identified ascarnitine.