INTRODUCTION

Nutritional study of insect has been receiving increasing attention of several workers during the past few decades, has revealed a number of feeding processes, which enable an insect to survive, grow and breed on one and not on another type of food. Such nutritional processes are concerned with the ingestion of adequate quantity of food by the insect, proper utilization of the ingested food, efficiency of the utilized food to supply all the nutrients essential for the insect's metabolism, toxicity (if any) of the utilized food constituents and oviposition.

Of these, the first three i.e. the physiological processes governing the ingestion, utilization and nutritional efficiency of different types of food, are most important in determining the susceptibility or resistance to insect attack.

The usefulness of the knowledge of these aspects for protecting standing crops against various insect pests is

being increasingly realized by many entomologists.

Trichoplusia ni (Cabbage looper) belongs to the order Lepidoptera which recognized by the scales on the wings, which come off like dust on one's fingers when the insects are handled, its members are to be found almost every where often in considerable number.

Trichoplusia ni of the order lepidoptera belonging to the family noctuidae, has been found to defoliage the *Brassica oleracea* var capitata, *Brassica oleracea* var *botrytis*, collard, broccoli vegetables, which are commercially grown as' leafy vegetables in India. Some times tomato and cucumber are also damaged by *Trichoplusia ni.*

Trichoplusia ni being protected in this manner as it passes the day resting with folded wings on tree trunk in to a large extent concealed from its enemies. In the larvae of *Trichoplusia ni* primery setae are present. Its larvae feed upon foliage, they are often polyphagous and are nocturnal.

Trichoplusia ni (Hubner) is a serious pest of

Brassica oleracea var *capitata* (cabbage). The adults are dark brown with a wing spread of about 1.5 inches and have a small alongate silvery spot in the middle of each front wing. The under wings are relatively large and strikingly coloured. The hind wings are usually brightly coloured.

The larvae are called cut worms because they feed on herbaceous plants. The cut worms are nocturnal in habit. The larvae have a pair of tympanal auditory organ located at the base of abdomen.

Cabbage (*Brassica oleracea* var capitata) is an important vegetable crop, commercially grown as leafy vegetable in India. It occupies an area of about 2,30,000 hectare with a production of about 42 lakh tonnes.

Cabbage is prone to pest ravages from the time of sowing till the harvest. Amongst various pests attacking cabbage in Uttar Pradesh, *Trichoplusia ni* is most important of them.

Farmers apply huge amount of pesticides for the control of such pests. This increased reliance on

pesticides for the control of insect pests may not be sustained in future.

Some important field crops like cotton and soyabean are also attacked by *Trichoplusia ni* (Cabbage looper), because they preffer as host for egg laying, so *Trichoplusia ni* is one of the most destructive insect pest of crops.

The rapid increase density *Trichoplusia ni*, later in decision is thought to be due to increase fecundity.

Several workers Ripley *et al.* (1923), Crumb (1934), Rangaraian *et al.* (1975), Nayar *et al.* (1976), Goel and Kumar (1982), Benerjee and Haque (1983), Bhumannavar (2000), P. Das *et al.* (2002), reported 57 insect pests attacking to cabbage.

However, Browning *et al.* (1982) found out the presence of disease in the larval population of *Trichoplusia ni.*

According to Hinton (1946) the first instar larvae of lepidoptera soon after hatching consume its egg shell

and then start feeding on leaves.

Cabbage looper adults do not damage directly to the host plants yet caterpillar larvae defoliate the crop. The caterpillars just after hatching start feeding on the chlorophyll tissue of the leafy vegetables but fully grown larvae feed extensively on the leaves, thus the caterpillars of *Trichoplusia ni* are cause of damaging the factory of food manufacturing and consequently retarding the setting of seed and the growth of the plant to a great extent.

As the country's population is growing at a rate of 1.8 per cent per annum, we have to give emphasis not only on the productivity but also on the management of insect pests which cause a tremendous loss to the production of some important crops. The pests can be managed well if appropriate management techniques are applied at the right time. For this pest management strategy has to be formulated and one should know about the pests. Thus, efforts should be made so that a well planned management strategy can be made

(Tripathi, 2000). In spite of the use of all available means of plant protection, about one third of the yearly harvest of the world is destroyed by pests.

Phytopathologists try to reduce the crop losses by Integrated Pest Management. In 1957, FAG defined the term Pest with respect to plants as any form of plant or animal life, or any pathogenic agent, injurious or potentially injurious to plants and plant products (Arya, 2002).

The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro (1992) prepared Agenda, to which stresses the need to increase the use of integrated pest, disease and crop management techniques to eliminate over dependence on agrochemical thereby encouraging environmentally sustainable agricultural practices.

Synthetic pesticides have of course, played very significant role in controlling many pest problems. Extensive and indiscriminate use of chemicals has its own limitation, as it has created several ecological and

medical problems like environmental problems as pollution, development of resistance in pests, insects and their resurgence, adverse effect on parasitoids and non target organisms. Toxic residue in food stuffs health hazards and high cost of pesticides. On the other hand, the number of effective pesticides available is dwindling day by day. These ill effects of synthetic pesticides have aroused interest in alternate methods of plant protection. The environmental problems caused by these xenobiotic have been recognized from time to time as these chemicals lace-the food with residues (Gonzalez *et al.*, 1977; Parmar and Devkumar, 1993). It has been estimated that hardly 0.1 per cent of the agrochemicals used in crop protection reach the target pest leaving 99.9 per cent enter into the environment, cause hazards to non target organisms including human (David Pimentil and Lois Levitan, 1986). Effective pest control is no longer a matter of heavy application of pesticides, partly because of rising cost of petroleum derived products but largely because excessive use of pesticides promotes faster evolution of resistant forms of pests, destroys

natural enemies, turns formerly innocuous species into pests, harms other non target species and contaminates food (Marini-Bettolo, 1977; Parmar and Devkumar, 1993).

All pesticides are classified according to the type of organisms which are intended to control, e.g. insecticide to control insects; acaricides to control mites; nematicides to control nematodes; fumigants to control soil born pathogens; rodenticides to control rats; herbicides to control weeds; molluscicides to control snail, slugs, etc.

Some pesticides, especially metal based ones (arsenic, copper and mercury) are well recognized agents of chemically induced auto immunity, i.e., human body can produce antibodies directed against itself. Thus, pesticides which can be immunosuppressive on one hand, can also led to reach including inflammatory responses (allergic contact demerits). Several pesticides are known to be extreme skin sensitizers. Allergic rhinitis and asthma are also result of acute

hypersensitivity on the part of the immune system in which abnormally high level of an antibody called IgE is produced. The water of Yamuna on which an estimated 57 million people depends, contains many pesticides (DDT, aldrin, dieldrin. heptachlor, BHC and endosulphan, etc.) at levels which far exceeds limits considered fit for human consumption (Trivedi, 2002).

These disadvantages can be overcome only by persistent search for new and safer insecticides accompanied by wide use of nonchemical insect pest control. Development of alternative pest control measures involving biological control methods and non-hazardous extracts of plant origin can help to reduce the harmful effect of pesticides. The continuous use of these conventional synthetic pesticides led to many problems.

Recent awareness about the hazards of persistent synthetic pesticides to the environment and their high cost have generated great interest and intensified research on pesticides of plant origin, free from these limitations to large extent. Neem has been receiving

global attention for the last three decades as a wonder tree of Indian origin for its tremendous pesticidal action. Following the discovery of neem kernel as a locust feeding deterrent, chemical investigations on neem has grown enormously that establish the tree a store house of several chemical constituents exhibiting a wide range of biological activity. As regards to pesticidal action neem and its products have been tested for their pesticidal properties against more than 300 species of insects belonging to different orders throughout the world. Most of the insecticides used today are organophosphorous compound used during World War II for mass destruction of human beings by Germany. These synthetic pesticides are non-degradable and pass on the poison to the next in food chain. Hence, the urgency of using safe material as biodegradable after doing its job, is greatly stressed. Unlike synthetic pesticides that harm both pest and predators, cause development of resistance by pests, resurgence of pest, leave toxic residues in food, water, air and soil thereby causing disruption of ecosystem balance, plant products are

selective, biodegradable, relatively safe, economical and beneficial to non-target organism and man (Tripathi, 2000).

The plant word comprises a rich store house of biochemicals that could be trapped for use as pesticides. The toxic constituents present in the plant, represent secondary metabolites and have only an insignificant role in primary physiological process in plant that synthesize them (Cooper and Johnson, 1984). Recently, there has been a new interest in botanical pesticides because of several distinct advantages: (i) Pesticidal plants are generally much safer than conventionally used synthetic pesticides. Pesticidal plants have been in nature as its component for millions of years without any ill or adverse effect on the ecosystem, (ii) Plant based pesticides will be renewal in nature and would be cheaper, (iii) Some plants have more than one chemical as an active principle responsible for their biological properties. These chemicals may be having either one particular biological effect or diverse biological effects. The changes of developing quick resistance to different

chemicals are highly unlike (Singh, 1993). Therefore, alternative choice may be use botanical or herbal fungicides or herbal insecticides that are easily biodegradable (Faweett and Spencer, 1970; Mahadevan, 1982) and selective in their toxicity. This necessitated the need to identify and determine the relative efficiency of some potent and safer plant products. A high potential of botanicals for the development of cheap and harmful biocides useful for the management of plant pathogens has been reported (Rajeswari and Mariappan, 1992; Vimala *et al.*, 1993; Ganguly and Das, 1993). It is unfortunate that a variety of our plant diversity is getting eroded every year and one of the main reason is the lack of knowledge and appreciation for their potential or actual use in daily life. Hence, there is a great urgency to use plant extracts as the substitutes for many of these synthetic chemical pesticides and fungicides.

Till very recently the public was hardly concerned about the crop pest's infestation except in cases of very severe epidemic and that also used to forget as soon as the epidemic subsided. It is well known that insects

affect human interest both for good and evil but their destructive nature is better known to us than their beneficial role. Considering the role of insects in agriculture they can be classified into three groups viz. harmless, injurious and beneficial insects. The damage caused by insects to agriculture may broadly be grouped into two viz. direct and indirect losses. A wide range of side effects have been manifested owing to the abuse of synthetic pesticides. This has necessitated the search for alternative novel techniques of pest management. Increasing emphasis is being laid to exploit of manipulate the exocrinological and endocrinological environments of insects. Moreover, the advances in biotechnology, particularly in tissue culture and molecular biology have opened new vistas for pest management.

In the last few decades several reports have appeared on the growth inhibitory, toxic and hormonal effect of plants on insects (Williams, 1970; Gujar and Mehrotra, 1983; Schimutterer, 1981; Grainage *et al.*, 1985). This has been possible because the plant kingdom

is a vast store house of diversified chemicals which has evolved in the course of evolution (Fraeknel, 1959; Fenny, 1975; Maxwell and Jennings, 1980). Therefore, a successful and environmentally acceptable pest management can be developed of these biochemicals are identified and exploited as insect control agents. Deshmukh *et al.* (1976, 1977, 1979) revealed that Spilosoma oblique Walker can develop on a wide variety of plant species but it failed to develop on neem, fern, bougainvillea and sacred basil. This insect also does not feed on parthenium (*Parthenium hysterophorus* L.) and make test bites on sweet neem (*Murraya koenigii* L. Spreng) under choice condition.

The main objective of this study is to overview the role of synthetic pesticides and bio-pesticides (plant extracts) in insect pest control in various important crops. Also, the efficacy of synthetic pesticides is compared with bio-pesticides (plant extracts) against insect pest management.

Keeping above facts the present investigation has

been undertaken to evaluate the insecticidal properties of synthetic pesticides (endosulphan) and botanical (plant extract – *Parthenium hysterophorus*) against the insect pests *Trichoplusia ni* in order to exploit them as a possible source of pest management.

So the present work entitled "Nutritional studies of *Trichoplusia ni* with special emphasis to consumption, growth and utilization of food material and its control by synthetic pesticide and plant extract" has been under taken, so that it may help in evolving the suitable management practices for farmers so as to increase the yield of leafy vegetables by sustainable pest management practices.