CHAPTER - 2

OBJECTIVES OF THE STUDY
To boost primary production and simultaneously prevent and protect crop loss before and after harvest, pesticides are essential. They are first manufactured as technical grade products having high chemical purity. Consumable pesticides are then produced by conversion of these products into approved formulations which are tailor-made for application on diverse insect pest spectra and plant disease. The pesticide industries in India comprises of basic manufacturers, formulators, importers, distributors and dealers in the public and private sectors. There are large scale multinational and Indian companies of medium scale and small scale units. In India, the total current investment for the production of pesticides is about Rs. 1500 crores with a turnover of around Rs. 2,500 crores (Mathur, 1998). The green revolution has resulted in increased food grain production from 644kg/ha in 1966 to 1000kg/ha in 1975 and about 1500kg/ha in 1989 in India (Meherotra, 1991).

Modern agricultural practices led to the use of high yielding variety of seeds, plants, chemical fertilizers along with a number of synthetic pesticides. The indiscriminate use of these pesticides created several problems in the ecosystem resulting in environmental pollution, pest resistance, pest resurgence, residual toxicity and health hazards. It is therefore necessary to use only such preparations which are safe, selective, cheap and fit into integrated pest management strategy.

The main target of the pesticide is the nervous system of the pest organism. Out of the three groups of pesticides, carbamates are moderately acting agents and used against a variety of pests. Further, they are the new-comers to
The family of insecticides and hence, studies on effect of carbamates on nontarget organisms are scanty. The mechanism of the action of a pesticide lies in the fact that it interferes in the synaptic transmission and thus the conduction of nerve impulse (Fig. 1.1) there by paralysing the pest and finally causing the death with the appearance of some neurotoxic symptoms. Carbamate insecticides are highly cholinergic and create a lot of neuromuscular disorders. They penetrate rapidly into the body of the insects. Carbaryl, the most commonly used carbamate insecticide has structural resemblances with acetylcholine which may have some point to point effect on the latter.

The fate of a pesticide in the soil is determined considering the environment in which it is applied. There are several general consensus regarding the use, restrictions and alternatives to various kinds of pesticides. Besides, the recommendations like the use of less persistant, biodegradable, environmentally safe pesticides; it is equally important to study their effect in the locality and the practices of their use. The effects and degradation of a pesticide depends on environmental condition in which it is applied. Therefore, simply going through the literature a conclusion cannot be drawn whether a pesticide will be restricted or banned. A pesticide showing its performance in a temperate environment and soil may have a different action in a tropical condition. In this work a study on the effect of a carbamate insecticide was undertaken in the tropical condition of India.

In most parts of the world earthworms constitute a major component of the biomass of the soil animals. Because of their relatively larger
size and characteristic feeding behaviour, they have some impact on soil
structure, soil fertility, plant growth and crop yield. (Edwards and Lofty 1972,
1973,1978). They also play a major role in the soil fauna accounting for 80% of
the invertebrate biomass in agroecosystems of tropical and subtropical regions
on earthworm biology and works of Mishra and Dash (1980a,b), Mishra and
Shaoo (1997) on the activity and metabolism of earthworms reflect the
diversified role played by them in soil subsystems of different regions. Dash and
Patra (1977), Senapati and Dash ( 1981) reported that, in tropical pasture
ecosystems 13-16 % of energy input utilized for earthworms alone prove their
importance in the system. Further, their role in soil fertility organic matter
decomposition and nutrient recycling in soil sub-system can not be over looked
(Senapati and Dash ,1984; Lee, 1985; Spiers et al, 1986) for which they are
called as friend of farmers. Some species of earthworms are also utilized in
organic waste management and vermicomposting (Dash et al 1986). There is
also a growing consciousness throughout the world for development of
vermitechnology.

Agricultural dose of different pesticides have been tested in
animals mostly on rat based on which the manufacturers label the toxicity of
their product on the container as warning. Probably in no case, the toxic effect
of the pesticide on non-target soil organisms is mentioned. Therefore, it is
essential to study the effect of any agrochemical on nontarget organisms.
Soil metabolism is an important factor for soil fertility. The agrochemicals added to the soil on account of their broad spectrum use interfere in the metabolic activities of the soil organisms. The microbial biomass mostly regulates the soil metabolism. Some of the agrochemicals enhance their activities temporarily and/or become detrimental. The microbes which degrade and utilize the pesticide as a source of their nutrient increase the soil metabolic rate. The other groups, which are not able to survive, contribute to the temporary increase of the extracellular fraction of soil enzymes. Moreover, their dead tissues and cells are utilized by other soil organisms. If the non-target organisms survive despite the application of the pesticide, its effect on the activity and metabolism of the former becomes a point of attraction for researchers.

Precisely, the authentication of taking earthworms as experimental animal can be evidenced from the following facts.

(i) Earthworms constitute a major component of the biomass of the soil animals in many parts of the world.

(ii) Owing to their fossorial behaviour, they impart a good crumb structure to the soil. As a result aeration, water infiltration and drainage are well established. Their burrows also provide channels for root growth.

(iii) They play important roles in litter disappearance, decomposition, break down of organic matter and incorporate them into the soil.

(iv) They are also helpful in land restoration from which top soil is removed.

(v) Earthworms play a significant role in phosphorous and nitrogen metabolism.
(vi) Surface feeding behaviour of earthworm has increased their importance in organic waste management.

(vii) They are good source of protein and often used as food in certain parts of the globe.

(viii) Recently, they are used in vermicomposting the product of which surpasses the chemical fertilizers and organic manure (Goswami and Kalita, 2000).

(ix) Earthworm has opened an era being used as an electrode as a living animal in the field of electro-bioluminescence (Santhanam, 1986).

(x) They play a crucial role in conversion of micropollutants.

(xi) They are also used as bioindicators of pollutants.

(xii) Earthworms are abundantly available and easily culturable.

Based on these facts the present investigation was undertaken to study the following parameters with respect to carbaryl:

1. The number, biomass and population dynamics of earthworms in field conditions.

2. The metabolism of earthworms and soil in field conditions.


4. The arginase and acetylcholinesterase activity in earthworms in laboratory conditions.