II REVIEW OF LITERATURE

A. Effect of pesticides on germination and growth :

Pesticides play an important role in protecting plants from diseases, pests and weeds. From ancient time different chemicals are used by man for their protection. Among these vast number of chemicals used, some exhibit favourable effects such as better fruits, seed set, stimulation of growth. But some pesticides have shown to cause toxic effects on plants in various ways (Casida and Lykken, 1969; Prasad *et al*. 1980). Some of the work carried out about the pesticidal effect on seed germination is reviewed below.

Gupta *et al*. (1986) studied the effect of BHC dust on germination of *Arachis hypogaea* and *Vigna aconitifolia*. Their study revealed that the BHC applied to the soil had an adverse effect on germination in both plants, but at lower doses there was no marked effect on the germination. Prasad and Mathur (1983) observed effect of Metasystox and Cuman - L on seed germination in *V. mungo*. They observed that Metasystox affected seed germination at all the doses studied. However Cuman - L had little or no effect on seed germination . Effect of various concentrations of sevin on growth parameters of mungbean seedlings was observed by Pathak and Mukherji (1986). They found that at lower concentrations root and shoot growth increases, but at higher concentrations it inhibits root and shoot growth. According to them pesticide had no detrimental effects at concentration of 100-200 ppm. Sengupta et al. (1988) have studied the carbaryl toxicity in germinating seeds of V. sinensis. They reported that gibberellic acid, on simultaneous application with toxic doses of carbaryl, overcomes growth inhibition caused by low concentration of carbaryl.

Effect of Kitazin on Dolichos biflorus was studied by Reddy and Vidyavati (1983) where a gradual decrease in germination percentage was observed with increasing concentration of fungicide. Krishnamurthy and Rao (1980) have reported the effect of Antracol and Kitazin on Brassica nigra. They found that increasing concentrations of these pesticides inhibit germination, seedling growth and plant height.

Huffman et al. (1984) have studied effect of 3 herbicides (2, 4, 5-T, chlopyralid, Picloram and Triclopyr) on 3 grasses (buffalograss, blue grama and sideoots gama). They observed that Picloram and Triclopyr affected the germination. The effect of Isoproturon (herbicide) on germination and early seedling growth of canary grass was studied by Jaiprakash and Singh (1984). They reported that varying concentrations of Isoproturon inhibit the germination percentage and root shoot length. Radicle and plumule growth was found to be adversly affected by 1% thiodan in pea (Agrawal and Soam, 1988).

The loss of 60% viability in the pollen of egg plant (Solanum melongena) was observed as a result of pesticide treatment (Dubey et al. 1984). Gupta and Beg (1991) have also exhibited the phytotoxic effects of pesticides on pollen germination.

The percentage of seed germination and hypocotyl growth were closely related to the concentrations of fungicide in coffee seeds (Venkatasubbaiah and safeeulla, 1987). A decrease in seed germination and seeding growth was observed in plants treated with Benlate (Somashekhar and Sreenath, 1987). Benjamini (1986) Studied the effect of carbofuran on germination of wheat, sugarbeet, sunflower, vetch, chickpea and caraway fenugreck. Inhibitory effects on seed germination are reported in Allium fistulosum by Amirova (1984) and in Vigna radiata and V. mungo by Josephine and Janardhanan (1990).

Seed germination is also affected by the action of metalic ions. Many workers have studied the effect of different metals on seed germination and growth metabolism. The effect of fluoride toxicity in chickpea (Reddy, 1986); nickel, cadmium, zink in Hordeum vulgare (Kumar, 1989); cadmium and zink in Cicer arietinum and T. aestivum (Kumar, 1987), nickel and zink in Phaseolus aureus (Veer, 1989); cadmium and mercury in Abelmascunus esculantus (Ganesan and Manoharam, 1983) and groundnut (Baby and Janardhanan, 1989), chromium in pea (Dua and Sawhney, 1991), molybdenum in pigeon pea (Khan, 1989) are reported. In all above cases adverse effects of metals on seed germination and seeding growth are observed.

Sahai and Srivastava (1988) studied the effect of fertilizer factory waste on two varieties of Brassica oleracea. Their study revealed that germination is affected adversely with increase in concentration of effluent. However Neelam and Sahai (1988) noticed in Sesamum indicum that fertilizer factory effluent have no adverse effect on seed germination, pigment content and seeding biomass. Raza and Vijayakumari (1989) confirmed that liquor factory effluent affects adversely the germination and growth of paddy seedlings.

Vijaykumari and Kumudha (1990) have reported that distillary effluents are benéficial for over all growth of plants and can be used as liquid fertilizer in diluted form. Germination percentage in gram, mung and maiz decreased when treated with oxalic acid manufacturing plant waste water (Shukla and Pandey, (1991).

B. Effect of pesticides on biochemical activities

Pesticides play a major role in the production and storage of our food, feed and fibre supply, being important agents for the control of the large number of variety of pests that attack the crop and agriculture commodities. The use of pesticides has increased extensively in developing countries and the adverse effects produced by these chemicals is the subject of growing concern today (Abbott*et al*. 1965, Tatekar *et al*. 1965). Although there are several reports on the effect of pesticides on the seedling growth, biochemical studies regarding pesticide mediated changes in germinating seeds are relatively scanty (Guha *et al*. 1987).

Mathur *et al*. (1983) .have studied the effect of Rogor (30E) on the germination and amylase activity in *Vigna mungo* and observed that activity of amylase increases with increasing concentrations of Rogor Inhibition of amylase activity has been reported in the same seeds due to Metasystox with little or no effect due to Cuman-L treatment (Prasad and Mathur, 1983).

Reddy and Vidyavati (1983) investigated effect of Kitazin on the hydrolytic enzymes in *Dolichos biflorus*. Amylase, protease and catalase activities decreased at higher concentrations but stimulated slightly at lower concentrations of Kitazin. On the contrary peroxidase activity was reported to be less at lower concentrations and more at higher concentrations. Peroxidase activity and isozyme pattern in cotyledon cell suspension culture of bushbean (*Phaseolus vulgaris*) in presence of 2, 4-D and kinetin was observed by Arnison and Boll (1976).

Sengupta *et al.* (1988) have shown that activities of amylase, phytase decreased due to carbaryl toxicity in germinating seeds of *V. sinensis*. But ATpase extracted from seedling showed stimulation followed by carbaryl application. Sengpta *et al.* (1986a) also studied toxic effects of carbaryl on *V. sinensis* during germination. A decline in nucleic acid content due to increase in nuclease activity and accumulation of protein due to inhibition of protease was observed.

The effects of carbaryl on the activity of enzyme amylase, protease, RNase in germinating seeds of *V. radiata* are reported by Pathak and Mukherji (1986). According to them carbaryl can be used at a concentration of 100-200 ppm with no detrimental effects. The influence of Dimethoate on deoxyribonuclease and ribonuclease in *V. sinensis* seeds during germination has been reported by Guha *et al.* (1987). According to them Dimethoate presumably increases the activation and/or *denovo* synthesis of DNase in the cotyledons but inhibits the process in the seedings. On the other hand it stimulates the RNase activity both in cotyledons and seedlings. Reports are also available on the stimulation of the activities of plasma membrane bound ATpase and some hydrolytic enzymes like DNase, in *V. sinensis* by organophosphorus pesticides (Chakrabarti *et al.* 1979, 1981). Hydrolytic enzymes in germinating wheat seeds, treated with Malathion are studied by sengupta *et. al.* (1986).

Agarwal *et. al.* (1984) have shown complete inhibition of α - amylase and protease in *Cicer arietinum* treated with systemic nematicides. Cervells and Perna (1985) observed phytase inhibition by insecticides and herbicides. Reddy and Venkaiah (1988) have shown an increase in superoxide dismutase activity in bajra seedlings treated with herbicide paraquat. Manoharan *et al.* (1981) have investigated the effect of fluchoralin, a pre - emergent herbicide on some of the metabolic processes of *V. uniculata* seedlings. According to them the herbicide affects the activity of hydrolytic enzymes and alters the rate of respiration and permeability of cell membrane. Apart from these, studies on the effect of herbicides (Namdeo and Dube, 1973) and fungicides (Karanth *et al.* 1975) on soil enzymes are also carried out.

The effect of foliar application of fungicides on physiology of plant has been carried out by a number of workers. Karadge and Karne (1985) have studied the influence of systemic fungicides Bavistin and Calixin on *Lycopersicon esculentum* leaves. Their data revealed that both the fungicides cause an increase in free organic acids, polyphenols and chlorophylls in the leaves. Total nitrogen and proline contents were decreased and the activities of the enzymes catalase, IAA oxidase were elevated while those of peroxidase and acid phosphatase were decreased down.

Safina *et al.* (1984) observed the effects of systemic fungicides Vitavax, Plantavax and Bayleton on root respiration in wheat seedlings and found that the fungicides inhibit the respiration in roots. While studying effects of Trifluralin soil metabolites on growth and yield of *Glycine max* Koskinen *et al*. (1986) observed that no individual metabolite had significant adverse effect on growth and yield but three of them decreased seed oil content and two increased seed protein content.

Effects of Bavistin on nitrogen utilizing enzymes was analysed by Chandra and Mathur (1986). Their study revealed that their is no effect on activities of nitrate reductase (NR) and nitrite reductase (NIR), however incubation of leaves in the fungicide solution showed a dose dependent fall in NR activity.

Clark *et al*. (1987) showed that Maneb fungicide applied to oat foliage over 3 years period, increased seed yield and seed protein content of some cultivars. Prakash and Swami (1989) found in case of rice seedlings treated with Benthiocarb (a thiocarbamate herbicide), an increase in δ- aminolevulinic acid levels, total chlorophyll content and δ- aminolevulinic acid dehydrogenase activity. In contrast to this in barn yard seedlings all the above parameters were inhibited by Benthiocarb.

Recently Singh and Tripathi (1991) observed an increase in menthol content in Japnese mint (Mentha arrvensis L.) treated with Dimethoate and phosphomidon.

C. Pesticides and microorganisms

The effect of pesticides on soil microflora are reviewed by many workers (Agnihotri, 1973; Tui, 1981; Malkomes and Wohler, 1984). Reports on the effect of pesticides on nitrogen fixing blue green algae are also given by many workers (Singh and Vaishampayan, 1978; Pandey et al. 1985; Tiwari et al. 1985; Goulding et al. 1984). Inhibition of nitrogenase activity in Anabaena by Trichlorfon has been observed by Orus and Marco (1991).

Toxic effect of organophosphorus insecticide on marine dinoflagellate are reported by Prevot et al. (1986). In addition to this, pesticides also affected nodulation in V. mungo (Chandra et al. 1983), Pisum sativum (Reddy et al. 1986), Coronilla varia (Cardina et al. 1986) and in Arachis hypogaea (Anusuya, 1986).

Kulkarni et al. (1974) have studied the symbiosis of Rhizobium species with A. hypogaea under the influence of soil applied pesticide. Growth and metabolism of Azatobactor chrococcum as influenced by pesticide is worked out by Balsubramanian and Narayanan (1980) and rhizosphere microflora of cow pea has been investigated by Palaniappan and Balsubramanian (1986).

D. Effect of pesticides on anatomy and pollen germination.

Anatomical details of oniбn leaf-tips treated with Monocrotophos and Dimethoate (Srinivasan et al. 1985) and leaf variations in Phaseolus vulgaris in presence of sumathion (Krishnamurthy and Rao, 1980) have been studied. A beneficial effect, accounting for more protein bodies per individual cell of palisade layer was observed in the former case while in the later, plant metabolism was altered resulting in changes in leaf morphogenesis.

A reduction in net photosynthetic rate was observed in greening pea seedlings treated with a photodynamic herbicide but ultrastructure was not affected (Mostowska et al. 1991).

Certain unusual features like multiple pollen tubes, branching of pollen tubes due to pesticide application have also been reported by Philomena and David (1985). Pollen tube deformities and pollenicidic action brought in by herbicides like 2, 4-D, 2, 4, 5-T and Triazine have been investigated by Salgare (1983). Dubey et al. (1984) observed that due to toxicity of pesticide, viability of pollens of egg plant is lost. Church et al. (1983) also found that high volume sprays of captain and dinocarp formulations are more toxic to pollen on apple anther and stigmas and more often reduced fruit set. Similarly Gupta and Beg (1991) also reported the phytotoxic effects of pesticides on pollen.

E. Scope of Present Investigation :

Pesticides no doubt are considerd as important means for the protection of crops, friut trees and other plants from various pathogenic organisms. However the nonselective and liberal use of these chemicals is becoming problematic now a days with respect to the health of human beings and animals. Especially organochlorine compounds are very stable and a wide spread use of insecticides containing these compounds leaves a persistent residue in air, water and soil. Thus insecticides though are recommended and used for controlling insect pests attacking mostly the mature crop or above-ground parts of plants, an appreciable amount soon returns to the soil and remains in the form of residues. These residues if not leached away, can affect the germinatin and growth of the seeds sown in the next season.

In the present investigation an attempt has been made to analyse the biochemical effects of Endosulfan and Methylparathion as evident during germination and growth of jowar seeds. Endosulfan and Methylparathion are widely used insecticides on cereals, vegetables, pulses and fruit trees etc.

Information regarding the biochemical studies of these insecticides during germination is scanty. Therefore in the present study it was planned to observe the seedling growth, behaviour and activities of some important enzymes in jowar seeds germinated in different concentrations of Endosulfan and Methylparathion. Such type of study may not have much agronomical importance but it may be helpful in knowing the mode and extent of action of the said insecticides.