REVIEW OF LITERATURE

The work on allelopathy initiated long back by German scientist Molish (1937), is now well progressing in more than 85 different countries in the world. He coined the term **"Allelopathy"** which refers to stimulatory or inhibitory biochemical interactions between the plant species including microorganisms. For the first time, he studied in the effect of numerous plant species and their plant parts viz. roots, shoots, leaves, flowers and fruits leachates, extracts or residues on seed germination, seedling growth and maturity of fruits in several crop plants.

Recently Bansal (2003) also used the term allelopathy to describe the chemical interactions between plants and from plants to other organisms, influencing growth and development in biotic communities. He explained the significant role of allelopathy in crop productivity and emphasized on studying the mechanism and mode of action of allelopathic compounds on target organism, exudation and transformation of allelochemicals., incorporation of allelopathic substances in biodiversity and ecosystem functioning, incorporation of allelopathic traits into commercial crops, though biotechnology, evaluation of new purified compounds for further use in agriculture, synthesis of natural compounds or their analogues as novel agrochemicals, detoxifying the harmful plant products and stimulate the synthesis of useful metabolites for sustainable agriculture.

Fujii *et al.*, (2002) while taking the review of recent work in allelopathy during 3rd world congress on **"Allelopathy – challenge for the new millennium"** held at Japan explained that allelopathy now refers to any process involving secondary metabolites produced by plants, microorganisms, viruses and fungi that influences the growth and development of agricultural and biological systems. According to Bhat and Chauhan (2000) and Singh and Rao (2003) the secondary metabolites produced by plants (donors) when released in to environment, play a key role in ecology and physiology of other plants (recipient) in their vicinity. They further claimed that the released chemicals as well as the chemicals present in the extracts (aqueous or alcoholic) have stimulatory or inhibitory influence on seed germination, seedling growth, yield and physiology of subsequent crops. Many allelopathy workers all over the world are now working on the same aspect and due to the multidisciplinary nature of the subject it is now widely accepted throughout world. At present the researchers in agriculture; biological sciences (life science), biochemistry, physiology biotechnology and even genetic engineering are taking keen

interest in this newly emerging area of research.

A. Allelopathic effect on seed germination:

Allelopathy refers to any direct or indirect inhibitory or stimulatory effect by one plant on another through the production of chemical compounds that escape into the environment (Whittaker and Fenny, 1971). Allelopathy has impact on morphology, physiology and even genetic make up and gene expression of plants. Such influences (Positive or negatively) have many implications on crop yield.

The review of work done on various aspects of seed germination is briefly summarized below. The seed germination is one of the most significant and complicated phases in a plant life. It can be inhibited or stimulated by number of internal and external factor. Several workers had investigated the allelopathic impacts of weeds and other plant extracts, leachates and residues on seed germination and seedling growth.

Molina *et al.* (1991) reported that root exudates also release the allelochemicals i e. natural leachates of *Eucalaptus glabulus* may influence the germination and radicle growth of *Lactuca sativa*. Dias *et al.* (1995) also reported the maximum reduction in germination percentage in wheat seeds at highest concentration of weed *Calicotome villosa*.; Mandal and Tapaswi (1999) has been reported that concentration of *Chrozophora rottleri* leaf extract cause 100% inhibition of shoot radicle elongation in mustard similar effect has shown in Greengram, Groundnut and Maize by the leaf extract of Parthenium (Rao and Reddy, 2003);Mahadik and jadhav (2003) noted that leaf leachates of *Delonix regia* are not much harmful for the growth of Rice as well as Cowpea. Similarly leaf extracts of Cashewnut, Aonia, Kokum, Gulmohar, Jamun, Shivan, Bamboo, Australian babul and Suru inhibit the growth of field crops.(Jadhav,2003); Ghayal and Dhumal (2003) leaf and stem leachates of *Eupatorium odoratum* L at different concentrations were inhibited the seed germination, seedling vigour in onion. Similarly effect of *Sphaeranthus* sps reduced germination and seedling vigour of rice and wheat (Lodha, 2003).

Lee (2004) noted allelopathic potential of Rice germplasm against Barnyardgrass was tested using relay seedling method. Rice germplasm caused 5-80% inhibition in root growth of Barnyardgrass. Similar allelopathic effect of *cyperus rotundus* (Bartariya 2005). Aqueous extract of *Ageratum conyzoides, Borreria hispida*

and *Eleusine indica* also reduced the germination and seedling growth of Rice. (Boby Gogoi 2000).; Allelopathic influence *O. americanum* in seed germination and seedling growth was observed in *Parthenium hysterophorus* (Thaper and Singh 2005).; Das (2006) also reported the inhibition of seed germination and seedling growth of *Parthenium hysterophorus* by the leaf extracts of *Abutilon indicum, Eclipta alba, Chenopodium album, Argemone mexicana, Amaranthus viridis.* Similar inhibition has been noted in Cotton by the effect of *Prosopis chilensis.* (Punjani 2006)

Avchar (2007) noted the allelopathic influence of *Aristolochia bracteolata* was suppresses seed germination and seedling growth of *Cucumis sativus,* L similar inhibitory effect of Fenugreek shows on *Pisum sativum, Cicer arientum, Phseolus vulgaris, Triticum aestivum* and *Zea mays* (Haouala 2008)

The recent work on influence of allelopathic chemicals naturally released from various plant parts or in the form of leachates or present in the extrats, exudates and residues indicated same trend in many agricultural crops.

Allelopathic influence of aqueous leachates extracts or residues and litter in various crop plants on dry weight of seedlings. Jeloder *et al.* (2002) reported significant reduction in dry weight of Rice and Cotton seedlings due to allelopathic influence of residues of Soybean and Sunflower respectively Similar observations are recorded in Rice seedlings due to treatment of aqueous leachates of *Andrographis paniculata* (Singh and Rao 2003) Nandal et al. (1992) reported maximum increase in shoot length and dry weight in different plants when treated with lower concentrations of aqueous leaf extracts of Poplar and *Eucalyptus.* Similarly in Cowpea seedling when treated with lower concentrations of teak leaf leachates noted increased dry weight. (Gayner 1991).

B. Allelopathic effect on Organic constituents:

The changes in carbohydrate and protein contents due to allelopathic treatments are indicative of photosynthetic rate, dry matter accumulation and productivity as well as yield level. Hence many allelopathy workers have studied this aspect in leachates or extract treated crop plants.

Tripathi *et al.* (1999) reported that severe reduction in carbohydrate contents in Soybean leaves due to treatment of root extract of *Tectona grandis.* Similarly, Singh and Rao (2003) noted decrease in total sugars in Rice due to treatment of aqueous leachates of *Andrographis sp.* Similar result observed in Elusine (Padhy et al.

2000); Tripathi et al. (2000) studied effects of leaf extracts of *Dalbergia sisoo* and *Eucalyptus* leaf litter on *Vigna radiata* they also noted decreased protein content; padhy et al. (2000) reported increase in protein content in seedling of fingermillet when treated with *Eucalyptus* leaf leachates. Similar effect noted in Mentha due to the treatment of Pterium and Aspidium leaf leachates (Bhalerao *el al.* 2001).

C. Allelopathic effect on Enzyme activities:

Many workers studied the stimulatory or inhibitory effects of plant extracts, leachates and residues on the activities of various enzymes. Tripathi *et al.* (1998) recorded significant increase in peroxidase activity in soybean leaves due to foliar application of *Dendrocalamus strictus* rhizome extract. Similarly Manikandan (1998) reported stimulation of NR activity in Cotton plants treated with *Wedelia* leaf extracts. Lin *et al.* (2001) noted significant stimulation in peroxidase activity in *Echinochloa crus-galli* when treated with aqueous leaf extracts of Rice. Similarly Vidyasagar and Rajasab (2001) noted stimulated activity of polyphenol oxidase in Mulberry due to foliar spraying of different concentration of leaf extracts of Neem, *Parthenium* and extracts of Garlic bulb. In seedlings of Kidneybeen the activity of protease enzyme was lowered in cotyledons due to aqueous extract of *Parthenium* (Sinha and Dube, 2000); Singh et al. (2002) noticed a decrease in activity of protease due to cineole in seedling of *Ageratum conyzoides* similar result shows in case of Sunflower seed due to treatment of sodiumdikegulac, ascorbic acid and eucalyptus oil. Prasad *et al.* (1994) indicated that in Rice the enzyme catalase activity was inhibited by mimosine isolated from allelopathic mimosa sp. Similarly in Fingermillet catalase activity was decreased due to leaf leachates of *Eucalyptus globules* (Padhy *et al.* 2000) embryo and endosperm of Rice seeds enzyme activity was increased due to extract of algae *Enteromorpha* and higher plant *Bryophyllum* (Mehta *et al.* 1999).

D. Allelopathic effect on Inorganic constituents:

The studies on changes in the mineral constituents of treated plants are essential to know the influence of allelochemicals, leachates, extracts and development

McClur *et al.* (1978) indicated that different allelochemicals such as ferulic acid, caffic acid, protocatechuic acid and syrringic acid had caused decrease in phosphorus uptake. Similar effect noted in *Chenopodium album* to accumulation of various mineral elements like N, P, K, Ca and Mg in shoots of Tomato (Quasem and

Hill1989); Baziramakenga el al. (1994) also noted that benzoic and cinnamic acid had induced decrease in Magnesium level in root tissue like wise leachates of *Moringa, Eucalyptus* and *Parthenium* cause decrease in potassium content (Pawar and Chavan, 1999). Newman and Miller (1977) had applied the root leachates of *Anthoxanthum odoratum, Lolium perenne, Plantago lanceolate* and *Trifolium repens* reprted that some of these leachates stimulated the uptake of phosphorus where as it was inhibited like wise residue of *Ambrosia artemisifolia* increase in potassium and phosphorus uptake (Bhowmik and Doli 1982).

E. Allelopathic effect on Photosynthetic pigments:

Allelochemicals present in the leachates or phytoextracts may change in chlorophyll pigments hence several workers had emphasized this aspects.

Bansal *et al.* (1978) reported enhanced chlorophyll contents in different plants like *Boerravia cenchrus*, Convolvulus and Seasamum due to allelopathic treatment; Padhy *et al.* (2000) noted enhanced chlorophyll content in seedlings of fingermillet similarly in Amaranthus low concentration of aqueous extract of root and shoot of *Plumbago zeylanica* stimulated the chlorophyll content (Venkata Raju 1999); Kalita (1999) noted that allelopathic effect of *Ageratum conyzoides, Borreria hispida, Cynadon dactylon* and *Cyperus rotundus* on Rice had reduced the chlorophyll content. Mohnot and Soni (1977) noted aqueous extract of *Celosia argentea* shows adverse effect on the contents of chl 'a' chl 'b' in Sorghum likewise in Rice similar reduction is occur due to *Andrographis paniculata* (Singh and Rao 2003).