

*INTRODUCTION AND REVIEW OF
LITERATURE*



I - INTRODUCTION

Chenopodium album L. is an annual herb, generally grown in garden, in fields and on bare waste grounds. It is a dicot belonging to family *chenopodiaceae*. It is a common weed known as 'Fat hen', 'Goose foot', 'Dirt weed' & 'Lamb's quarters'. In Hindi it is known as 'Battu sag' in Marathi 'Chakavata' and in sanskrit 'Vastuk'. *C. album* L. is world wide in distribution. It occurs upto latitude of 14000 ft. It is very common in the Deccan and also in western Himalayas.

C. album is a common weed mainly used as leafy vegetable, it is collected in winter-spring. It flowers from July to October. Flowers are small, ball like clusters arranged in spike inflorescence. Fruits are enclosed by tepals. Seeds are small edible. It is mainly cultivated for consumption in India and South America. It prefers all types of soils like sandy, loamy, very acidic, very alkaline and neutral; but it can't grow in shade. It is grown to indicate the presence of magnesium in soil.

C. album leaves are rich source of proteins, fats, vitamins, carbohydrates and essential nutrients like Ca, Fe and Mg. So they are used as leafy vegetable but in small quantity. *C. album* contains high percentage of calcium which is almost 3 times more than the Ca in whole fluid milk. Leaves are antihelmintic, laxative, antiphlogistic, antirheumatic, contraceptive and odontalgic. The leaves are applied as a wash or poultice to bug bite, sunstroke, rheumatic joints and swollen feet. Stem juice is applied to freckles and sunburn.

Many species of *Chenopodium* contain saponins which are toxic. However they are broken down in the cooking process and they are poorly absorbed by the body. The plant also contains oxalic acid which in large quantities can lock up some nutrients in food. There are reports that the people with the tendency to rheumatism, arthritis, gout, kidney stone or hyperacidity should take special precaution if it is used in their diet. Large quantities and raw leaves only can cause problems. It can disturb the nervous system, gastric pain and also cause photosensitivity in some people.

Seeds are small, edible and raw or baked into bread. They are also used in salad as they contain high amount of carbohydrates and proteins. They also contain

saponin which is very harmful to health. Hence before use they are soaked in water to remove saponin. The plant *C. album* is medicinally important and also useful in the preparation of green dye and soap.

Today the world face the problems of soil salinity, ecological imbalance and disposal problems of different waste products. All these problems arise due to excess use of chemical fertilizers to increase the yield. Due to excess and continuous use of chemical fertilizers soil becomes saline and soil fertility decreases.

In the present investigation we mainly focus on the application of some treatments and their effects in *C. album* which are very essential for today's industrialized and polluted world. In the present investigation *C. album*, a nutrient rich leafy vegetable is selected and treated with salt (NaCl) to observe its salt tolerance. It also treated with distillery effluent as it contains more organic matter. The treatment of vermiwash, a good nutrient is also given to *C. album* and treated plants are analysed to see the effects on organic and inorganic status of plants. The organic matter like chlorophylls, carbohydrates, polyphenols, oxalic acid contents etc. was investigated. The effects on mineral elements like Na, K, Ca, Mg, etc are also investigated in treated plants. Aging or senescence is an important phenomenon in all the plants. The changes that take place during senescence were also investigated. Some of the enzymes were also studied in the present investigation.

The present investigation is represented is four chapters. The chapter-I includes morphological nature of *C. album* and "Review of the literature" to understand the present status of plant *C. album*.

The chapter-II is of Material and Methods that we employed in the present investigation.

The main part of investigation is chapter-III of "Results and discussions". It includes the important findings of the present investigation.

Chapter-IV of "Summary and Conclusion" gives the brief idea of the main findings in the present investigation.

REVIEW OF LITERATURE

A) *Chenopodium album*:

Chenopodium album L. a common weed belonging to the family *chenopodiaceae* is a very wholesome medicine as well as a pleasant leafy vegetable and an excellent substitute for spinach. According Theodore Cooke it is a small odourless, annual herb mealy or reddish green in colour, stem often, striped leaves very variable in size and shape, magenta coloured, sometimes 6 inches long but the lower leaves are ablong rhombic, lanceolate, acute, entire, toothed, lobulate, petioles long and slender.

The flowers in ball like cluster forming spike inflorescence. Flowers bisexual, 5- merous, parianth green ciliate at base. Stamens slightly longer than tepals, stigma- 2. Fruit entirely enclosed by tepals. Seeds 1.5mm in diameter, orbicular compressed with an acute margin, smooth shining embryo completely annular.

The plant is cultivated as a crop for consumption due to its high nutritional value. It prefers all types of soils. Riotte (1978) and Hatfield (1977) states that *C. album* is a good companion for potatoes, corn and cucurbits. According to Chakravarty the plant can be cultivated to indicate the presence of magnesium in soil. *C. album* and other species of *Chenopodium* were first harvested, cultivated and consumed their leaves and seeds by European farmers. It was observed in archeogonial deposits from Hascherkeller (Bovaria) dated from approximately 3000 years ago, (Wells, 1984). Today many authors consider these species as edible for human consumption [Sourly (1984), Font Quer (1990), Grau *et.al.* (1990)].

According to Reid (1977) the leaves contain about 3.9% proteins, 0.76% fats, 8.93% carbohydrates, 3% ash. Due to presence of proteins and ash (minerals) young leaves of this plant have good taste indicated by the popular habit of consumption among Nuxalk people native Indians of North America by Jose Luis, Gail Guerrero and Maria Esperanza Torija Isasa. According to Gupta and Wagle (1988) the main constraint to their nutritional exploitation is the presence of several antinutritional and toxic principles such as nitrates, oxalates and saponins. Brown (1995) proved that the people with the tendency to Rheumatism, Arthritis, Gout, Kidney stone should taken special caution if used in their diet since it can aggravate their

conditions. If they are eaten in large quantities can disturb the nervous system, gastric pain and also cause photosensitivity in some people (Kormarov, 1968)

According to Chakravarty and Reid (1977) the seeds contain about 49% carbohydrates 16% proteins, 7% ash. Facciola (1990) reported that seeds are eaten raw or baked into bread. The seeds also contain saponin which is harmful to health. The plant yields 8% saponin which shows α haemolysis against buffalo and sheep, Blood and γ haemolysis against human blood (Wealth of India).

Murdoch (1982), Watanabe (1978), Williams and Harper (1965) reported that the four most important factors in the promotion of germination of dormant seed of *Chenopodium* spp. are light, (potassium) nitrate, alternating temperatures and pre chill. Pre chill treatment is more effective in absence of other three. Khan (2004) studied the effect of plant growth regulators and salinity on seed germination.

The breakdown of chlorophylls in crude extracts of *C. album* in dark was examined by Shioi, Tatsumi and Shimakawa (1991). Kurashige and Agrawal (2005) studied phenotypic plasticity to light competition and herbivory in *C. album*. They observed that the stem elongation response of this plant to light competition. Plants were largely able to express phenotypic plasticity. Hirabayashi *et.al.* (2006) analysed the photo-oxidized pigments in water soluble chlorophylls, proteins complex isolated from *C. album*.

Singh (1974) observed decrease in oxalic acid content with increasing NaCl salinity in *C. album* and suggested that Cl^- or other anions if available compete for cations and depress the oxalate synthesis. Shekhawat and Kumar Neumann (2006) studied that shoot water content of *Suaeda nudiflora* and *C. album* is increased significantly in response to salinity. Salt tolerant bacteria which could tolerate 2-2.5 M NaCl were isolated from the histoplane and rhizoplane of *C. album* (Yasmin and Hasnain, 1997). Effect of Salinity on biomass production, water content and ion accumulation in *C. album* was reported by Shekhawat (2006). Shevyakova (1998) studied the effect of NaCl on the accumulation of proline in *C. album* L..

Gupta and Sinha (2006) studied metal accumulation potential of *C. album* L. grown on soil amended with tannery sludge. They investigated that an increase in photosynthetic pigments, carotenoids and leaf protein content with increase in sludge amendments. They also proved that plants may be used for phytoextraction of

'Cr' from tannery waste contaminated soil. Gupta and Sinha (2007) also reported that *C. album* have high bioconcentration factor and low translocation factor values for toxic metals Pd, Cd and suitable for phytostabilization of these metals. David *et.al.* (2004) studied the effect of manure and compost on soil P^H and growth of *C. album* in a soil contaminated by pyritic mine waste.

According to Guerrero and Isasa (1997) vitamin-C, carotenoids, minerals, fiber and fatty acids were higher and oxalic acids were moderate in *C. album* as compared to other spp. of *Chenopodium*. Singh, *et. al.* (2007) reported that *C. album* leaves rich in micronutrients were selected for dehydration because their leaves were rich source of proteins, carbohydrates and ash. Iron (24.48 mg/100g) and carotene (148.26µg/100g) contents of dehydrated bathua leaves were 6-8 times higher than fresh leaves hence used as a nutritional food. The plant is also used in traditional medicine system due to its antihelmintic activity *in vivo* reported by Abdul Jabbar *et.al.* (2007).

Profilin and polcalcin are relevant panallergens in chenopod pollen and good candidates to be involved in IgE cross reactivity with other pollen sources, thus explaining the highly frequent polysensitization of patients allergic to chenopod reported by Barderas *et.al.* (2004). Cutillo *et.al.* (2003) isolated seven cinnamic acid amides from *C. album* which effects on germination and plant growth of other important crops.

As *C. album* is a common weed lot of work was carried to control it. According to Schamachera *et.al.* (2006) bromoxynil plus oxyfluorfen is used to control the weed *C. album* and *Amaranthus retroflexus*. Khokhar, Metamooda and Shakeela (2006) reported that oxadiazon is used to control weeds like *C. album* and *Lomium amplexicule*. Anjum and Bajwaa (2006) investigated that sunflower leaf extracts allelochemicals showed substantial potential to be used as natural herbicide for broadleaved weeds such as *C. album*.

B) Soil Salinity:

Soil salinity is one of the major problems which adversely affecting agricultural production world wide. Globally salinity constrains agricultural production on 45 million hectors irrigated land and this equated to annual losses of approximately US\$ 11.4 billion (Smedema, 1990). Salinity affects 100 million

hectares of arable lands worldwide and this area is expanding (Ghassemi 1995). In India 8.6 million hectares land is affected by salinity out of which 3.5 million hectares are in canal command and wet deserts. The soil salinity problems are being severe in states like U.P., Gujarat, W. Bengal, Rajasthan, Panjab and Maharashtra. In Maharashtra 1.4 million hectares black cotton soil becomes saline along with coastal saline soil. Soil becomes saline due to excess use of chemical fertilizers, poor irrigation management and industrial wastes. Salt affected soils are grouped into saline and alkali or sodic soils on the basis of soil management and crop response (Dr. Leather).

The U.S. salinity laboratory staff (1954) defined a saline soil as a soil having an electrical conductivity of the saturation extract greater than 4 ds/m on an exchangeable sodium percentage less than 13 and the pH is less than 8.5. The soluble salts mainly consist of chlorides and sulphates of sodium calcium and magnesium.

In order to manage the problem in highly fertile irrigated areas the Indian Council of Agricultural Research made provision to invest on research resources on priority basis. Botany Department of Shivaji University Kolhapur has been actively working on saline soils and salt tolerance for last 40 years.

The soil salinity problems can be minimised by the proper irrigation system, use of biofertilizers and salt tolerant high yielding varieties of crop plants. According to Mass and Hoffman (1977) only few crops like cotton, barley, sugar beet, and date palm are highly salt tolerant. According to Sharma (1982) many members of *chenopodiaceae* are highly salt tolerant and they can survive at soil osmotic potentials below 1.5 m.pa. *C. album* is one of the salt tolerant spp. (Dood *et.al.* 1964 and Lilley, 1982). The salt tolerance of *C. album* is studied in the present investigation.

C) Distillery Effluent:

The molasses, waste product of sugar industries is the raw material for distilleries. The distillery effluent and its disposal is another problem of sugar factories in India. Total distillery effluent (Spent wash) generated in India by distilleries amount to nearly 40 billion litres, which can provides 4,80,000 tons of potassium 52,000 tons of nitrogen and 8000 tons of phosphorus regularly. Thus one

year spent wash can provide N.P.K. requirement of 0.25, 0.2 and 3 million hectores land respectively. The water pollution by industrial effluent and herbicides also exert adverse effect on crop establishment (Wang, 1976 and Segura *et.al.*, 1977). Spent wash contains unfermented sugars, soluble starch, volatile fatty acids, inorganic salts, solids like spent grains and waste yeast.

In recent years distillery effluents are used as fertilizers in agricultures for recycling the effluent in constructive way (Smith and Whichers 1981, Vaismon *et. al.*, 1981, Hegde and Patil 1983). According to Pathak *et.al.* (1998), Ramana *et.al.* (2001) distillery effluent contains organic and inorganic nutrients which show beneficial effect on crop yields. Spent wash is wastes which can be recycled and used as fertilizer for crop. It did not affect soil P^H or acidity but increased exchangeable potassium. Mostly it is used as organic fertilizer for improving crop yields and soil fertility (Jocelyn, Torre and Ofella, Domingo, 2008). According to Subraman *et.al.* (1999) the distillery effluent is mixture of organic and inorganic nutrients which have beneficial effect on seed germination but Raman (2002) states that sensitivity of plants varies from spp. to spp. to effluent salinity. In the present investigation an attempt has been made to study the effect of distillery effluent on growth of *C. album*.

D) Vermiwash :

Vermicompost is a welcoming trend that the farmers and scientist of late have understood the importance of earthworm. Vermicompost is a nutrient rich biofertilizer which is prepared from biodegradable wastes, such as farm wastes, kitchen wastes, market wastes, biowastes of agro based industries. In recent times the vermiculturists produce a new growth promoting product vermiwash. Vermiwash is the honey brown coloured liquid fertilizer with pH of 8.5 and N, P_{205} and K_2O content 20,70 & 1000 ppm. respectively.

For large scale collection of vermiwash a cement tank of size $80 \times 80 \times 80$ cm. is constructed. A layer of small brick pieces or gravels is placed at the bottom of the tank, above which a layer of fibre of 3-4 cm. thickness is placed. Then 4 Kg biowaste and 2 Kg earthworm are added. After two weeks the entire mass of biowaste will turn to brownish black compost. Then add 2 liters of water and vermiwash is collected through a side tap after 24 hours. It is a collection of

excretory products of earthworms along with some essential macro and micro nutrients in plant available forms, enzymes, vitamins and plant growth hormones. Vermiwash is the best tonic for plants which is very useful in foliar spray. According to Sivasubramanian and Ganesh Kumar (2004) vermiwash is increasing the production of ornamentals like marigold. Springett and Syers (1979) observed that the earthworms alter nutrients availability which altered the plants ability to take up the nutrients or affected the growth mechanisms of plants. Lee (1985) reported that *L. rubellus* casts probably contain an auxin like substance that modified the effects of the plant auxins. In the present investigation the effect of vermiwash on *C. album* is studied with respect to plant growth, and study is extended to organic and inorganic contents.

E) Senescence :

Senescence is the natural phenomenon in which deterioration of organ or entire plant leads to its death. Tollenar and Daynard (1982) stated leaf senescence as a series of events of deterioration and changes which leads to the death of leaf. The colour change is due to both, degradation of chlorophylls compared with carotenoids and the synthesis of new compound such as anthocyanins and phenolics (Matile 1992). According to Woolhouse (1967) the term aging or senescence is usually related to accumulation of somatic structure and increase in metabolic failures.

In the present investigation the changes in organic and inorganic contents and changes in the enzyme activities have been undertaken in the young to senescent leaves of *C. album*.