CHAPTER - IV

SUMMARY AND CONCLUSIONS

The Madagascan periwinkle has been designated as Catharanthus roseus (L.) G.Don. and Lochnera rosea (L.) Reichb. It is widely distributed throughout the tropical and subtropical regions and is much cultivated as an ornamental as well as medicinal plant. The plant Vinca rosea L. was first scientifically investigated by Canadian workers to find out the active principle embodied in it and they found that, the active principle was the "alkaloids", which exhibited anticancerous activities. Almost all parts of Vinca rosea L. contain alkaloids. More than 100 alkaloids are present in the plant. The use of Vinca has been known since B.C. 50 in folk medicine literature of Europe as diuretic, anti-dysenteric, antihemorrhagic, wound healing, in the treatment of diabetis and toothache. The leaf, stem, root and flower extract of this plant is antibacterial and antifungal. Vinca alkaloids inhibit mitosis in metaphase and causes different chromosome abnormalities and disturbances of cellular division. At much higher doses vincaleukoblastine and vincristine partially inhibit DNA and RNA synthesis. Medicinally the Vinca alkaloids are used on relaxation from muscle pain, depression by central nervous system and in the treatments of circulatory disorders as a hypotensive agent. Vinblastine and vincristine are used in the treatments of various types of cancers in human beings. Presently it is a highly demanded plant species in the world of medicine.

Soil salinity is becoming a highly serious problem in modern agriculture. Area of saline soils is increasing day by day. Some of the productive soils are also being converted into saline soils as a result of overirrigation and fertilization. There are two possible approaches to this problem. Soil salinity can be reclaimed or minimised by engineering techniques, but it is very costly. Another approach is a biological one in which salt tolerant crop varieties are screened or breed for salt tolerance. Such species can be successfully grown in problem soils. The biological approach seems to be practicable in Indian conditions.

Salinity affects many aspects of plant growth and metabolism and induces the changes in their morphology as well anatomy. These changes are often considered as the adaptations which increase the chances of plants to endure the stress imposed on them by salinity. The most common effect of salinity is stunted growth which results into a poor yield in number of crops. Salinity affects the plants at all stages of development. It also affects several metabolic activities like mineral nutrition, photosynthesis, respiration, carbohydrate metabolism, nitrogen metabolism etc. There are quite a few number of crop species, which grow successfully in saline soils. However, the degree of salt tolerance in these plants differs from species to species. These plants can be categorised as salt sensitive, moderately salt tolerant and salt tolerant plants.

It is highly essential to screen some important medicinal plants for their salinity tolerance so that, such plants can be tried for their growth in such problem soils, which have become rather useless for most of the food crops. To understand the mechanism underlying this phenomenon, so as to make an attempt to introduce such important medicinal plants to problem soils, it is necessary to study the physiology of salt tolerance along with some cytological aspects of Catharanthus roseus (L.) G. Don., in the view of its medicinal importance.

Keeping this view in mind, in the present investigation an attempt has been made to study the influence of NaCl salinity on growth and development of plant through different parameters like biomass (fresh and dry matter) production, shoot and root length, number of leaves, leaf area, number of buds, flowers and pods per plant, uptake and distribution of mineral elements, organic constituents like chlorophylls, carbohydrates, total nitrogen, proline, leaf juice acidity, secondary metabolites like polyphenols and alkaloids and some photosynthetic characteristic along with meiotic studies. In the present study, the most recent and advanced techniques have been employed in designing the experiments and plant analysis which includes pot soil cultures, use of double beam spectrophotometer, thin layer chromatography, autoporometry, flame photometry and atomic absorption spectrophotometry.

Some of the Important Findings of the Present Investigations are as follows :

1. NaCl salinity has reduced overall growth of C. roseus as revealed by length of shoot, root, biomass production, number of buds, flowers and pods. However, this adverse effect of salinity is more significant at higher salinity levels (100 and 200 mM NaCl). From present results it appears that C. roseus gets slightly adjusted to lower salinity regimes (upto 50 mM NaCl).

2. Salinity causes decrease in photosynthetic leaf area and number of leaves produced by the plant.

3. C. roseus is successful in inducing succulence at lower salinity regimes while it is enable to do so at higher salinity levels. Thus this species can be placed somewhere in between salt sensitive and moderately salt tolerant plants.

4. With increase in NaCl salinity there is decrease in acidity status of C. roseus leaves, which indicates that this plant species has failed to develope the mechanism of salt tolerance when grown under saline conditions.

5. The accumulation of soluble sugars (total sugars) in the leaves of C. roseus at lower salinity levels and in stem and roots at all salinity levels in the medium, appears to be an adaptive feature of plant in an attempt to cope up with adverse saline conditions.

6. Polyphenol metabolism in C. roseus is less influenced by NaCl salinity. It seems that polyphenols have no major role to play either in the salinity tolerance or sensitivity of this plant.

7. Nitrogen metabolism in Vinca rosea is adversly influenced by NaCl salinity. Thus this plant seems to be rather salt sensitive as far as its nitrogen metabolism is concerned.

8. C. roseus has no capacity to accumulate proline under physiological drought conditions. Therefore, it appears that proline seems to be playing no role at all in the salt tolerance capacity of this species.

9. Under salinity stress, an increase in the total alkaloid content occurs which points towards the possibility of involvement of these compounds in the adaptibility to drought conditions. It can be suggested that a mild stress (water stress and salinity stress upto 100 mM NaCl) at the time of maturity of thee plant (completion of vegetative growth) can have a commercial application to obtain maximum amount of alkaloids from both root and leaves of C. roseus.

10. From the thin layer chromatography of alkaloids it can be suggested that, NaCl salinity induces qualitative as well as quantitative changes in the alkaloids of Vinca rosea.

11. Vinca rosea is able to develope a salt tolerance mechanism through retention of chlorophylls in young developing leaves, particularly under low salinity regimes upto 50 mM.

12. NaCl salinity reduces the stomatal index of upper and lower leaf surfaces of C. roseus. Thus salinity may be one of the major factors contributing to the lowered rate of transpiration.

13. A marked decrease in flow rate, particularly through lower leaf surface of C. roseus suggests an inhibitory effect of salinity on the rate of photosynthesis.

14. The increase in uptake and accumulation of sodium and chloride ions is observed in all parts of C. roseus which indicates the salt sensitive nature of the species.

15. C. roseus exhibited a significant increase in the K level in the leaves. The ability to maintain high level of K ion in tissues, under saline conditions appear to be the cause behind the moderate salt tolerance capacity of the plant; particularly at low salinity regimes.

16. Uptake of calcium is slightly affected, however, its translocation to the most active parts of plant, particularly the leaves has been affected.

17. C. roseus has an ability to absorb and translocate more phosphorus under low salinity regimes, but is affected at higher salinity levels. Thus it appears that this plant is able to develope a mechanism of salt tolerance at least at lower saliity level.

18. C. roseus has failed to maintain an adequate level of magnesium, particularly in the leaves under high salinity levels which indicates the disturbed mineral metabolism of the plant at higher salinity.

19. C. roseus has an ability to absorb iron, however its translocation from stem to leaf has been affected under saline conditions.

20. Mn content of the stem and roots of C. roseus is adversely affected due to NaCl salinity, which may be one of the reasons for reduced growth of this plant at higher salinity levels.

21. Accumulation of zinc takes place in all parts of C. roseus under saline conditions. However, the exact role of Zn in this plant under saline conditions, cannot be explained on the basis of present results.

22. In the present investigation the chromosome number of C. roseus was found to be 2n = 16. The chromosomes are arranged in a fairly regular bivalents during meiosis. This suggests that the species is genetically stable.