

CHAPTER - IV

Summary
&
Conclusions

SUMMARY AND CONCLUSION

The Sansevieria is one of the important genus belonging to family Agavaceae (Liliaceae). Economically it is important as garden ornamental and indoor foliage plant. Sansevieria also offers the fibers which are not popular but are of good quality like jute fiber. It is perennial monocarpic succulent with dark green rosette leaves; some species possess ~~variegated~~ leaves with different morphology. The basic species Sansevieria trifasciata is smaller, less popular commonly known as mother - in - law's tongue plant. It is cultivated as garden succulent and indoor plant. Most well known "Bow - string - hemp - fibers are obtained from Sansevieria roxbourghiana. In India as well other warm and temperate countries several species are cultivated. In Maharashtra only few species are in cultivation as garden succulents.

Kluge and Ting (1978) have reported the physiological aspect in Sansevieria species, (Ramchandra and Das (1982)), Chen and Black (1983) have attempted this plant for crassulacean acid metabolism studies (CAM).

CAM is a special type of metabolism characterized by diurnal fluctuation in acid contents of their Chlorophylls parts. This metabolism is reported from the succulent belonging to Crassulacean, Liliaceae, Euphorbiaceae, Agavaceae, and several other families. The Sansevieria species are well known of accumulating for

large quantities of organic acids in dark which are metabolically consumed in subsequent light period.

The earlier works on CAM indicate that in these succulents CAM shows two aspects :-

I) Diurnal fluctuation in TAN, carbohydrates in chlorophylls part. Bharcha and Joshi (1957) reported that the magnitude of diurnal fluctuation in TAN values varies from season to season and it is highest in winter and lowest in monsoon. The Sansevieria species also follows the same behaviour like other CAM plants. However in India these species are not studied in detail with respect to their organic acid metabolism during different seasons.

Ramchandra and Das (1982) have reported the enzyme studies in relation to carbon fixation. Hence we thought it worthwhile to study monthly variations in the physiological aspect, related to CAM in Sansevieria trifasciata (cv.) Laurantii. These studies include the fate of different inorganic constituents as well as important organic constituents during the course of complete year. The climatic conditions in different seasons affect the growth, development, mineral nutrition and acid status in the plant.

The present work is in continuation of earlier work carried out in our laboratory on Aloe barbeandensis, Agave cantala, B. Pinnatum and some other succulents. In the present investigation, Sansevieria trifasciata (Cv.) Laurantii has been investigated for organic constituent and mineral nutrition. The

investigation^s are also extended to study monthly variations in the organic and inorganic constituents during the course of year. In order to study CAM in Sansevieria the diurnal fluctuation^s In TAN values, total carbohydrate and inorganic constituents are attempted, some of the present investigations can be briefly summarised as follows.

(A) Mineral nutrition study

1) SODIUM :-

The analysis of sodium content in mature leaves of Sansevieria trifasciata. (Cv.) during the year revealed that there is considerable variation in sodium contents during different months. A typical pattern is observed, maximum amount of sodium is recorded in months^{the} of June to Aug. then there is decrease in winter month and ~~sustend~~ increase in the summer months. Thus diurnal fluctuation in the sodium content during dark and light period show maximum levels at 6am. and 6 pm. while minimum at 12 noon and midnight. Sansevieria shows low level of sodium ranges from 0.18 to 0.28% of dry wt. This low level of sodium indicate the low affinity of Sansevieria to sodium probably due to the fact that sodium does not play any prominent role in the succulent metabolism.

2) POTASSIUM :-

The analysis of potassium content on mature ~~leaves~~ of Sansevieria trifasciata during the year revealed that there is considerable variation in potassium contents during different months. There are maximum potassium

levels recorded in winter month, moderate in rainy and summer months. As far as diurnal fluctuations are considering in the potassium level. The highest level of potassium is observed ^{at} 6 am. in Nov. while the minimum is at 6 pm. It appears that similar to higher plant in case of Sansevieria potassium balance changes from season to season and K⁺ level ranges from 2.4 to 2.34% of dry weight. 4.

3) CALCIUM :-

The analysis of calcium content in mature leaves of Sansevieria trifasciata. during the year reviewed that there is considerable variation in calcium content during different months of the year. The highest level of calcium are observed during summer months while the minimum levels are recorded in the winter month. In rainy season adequate amount of calcium is present. The range of calcium values in Sansevieria form 2.1 to 4.65% weight. Hence the plant can be classified as calcicolous plant. The diurnal fluctuation in calcium level does not show a specific pattern during the different months of the year.

4) MAGNESIUM :-

The monthly variation in Magnesium content in mature leaves of Sansevieria trifasciata during the year indicates rather low values than the calcium. The level of Magnesium is maximum in the winter and then declines as summer season progresses. The average values of magnesium range from 0.27 to 0.417% of dry weight. Thus

2.7 to 4.65%

in comparison to other plant Sansevieria leaves have capacity to leaves sufficient amount of mg. Magnesium is considered as one of the most important essential elements required for architecture of chlorophyll as well as activity of enzyme studies. The levels of organic acid and Magnesium contents in Sansevieria suggest that the Mg up take may be controlled by high acidity and PH values during the year.

5) IRON :-

The Fe contents in mature leaves of Sansevieria trifasciata does not show variation the level in the during different month of the year. The Iron level range from 6500 to 8060 ppm. There is no specific pattern in the Iron level is observed during diurnal fluctuation studies.

6) COPPER :-

The monthly variation in copper contents in mature leaves of Sansevieria trifasciata indicates considerable variation in its level. Maximum copper up take is recorded in rainy months than in the winter and summer months. Diurnal fluctuation studies during dark and light period show maximum levels at 12 noon and minimum at 12 night. It is possible that copper levels show response to water stress and organic acid accumulation in the plant.

7) PHOSPHATE :-

The analysis of phosphate content in mature leaves of Sansevieria trifasciata show variation through

out the year Maximum phosphate up take is recorded in rainy months than in winter and summer month. The light and dark period affect the phosphate balance as maximum amount is recorded at 6 pm. while minimum at 6 am. phosphorous has important role in organic acid metabolism. It appears from the result that phosphate may accelerate activity of enzymes of CAM.

B) Organic Constituents

1) Moisture Percentage :-

The leaf moisture percentage of Sansevieria trifasciata show considerable, Variation during different months of year. The highest values are recorded (83%) in the summer months and minimum values in the post monsoon months. (73.8%). The Sansevieria show xerophytic nature and it is able to maintain proper water balance in different season. It reviewed that the succulent possess high drought resistance capacity.

2) TAN :-

The estimation of titratable acid number (TAN) in Sansevieria leaves indicated that TAN value range from 36 to 105 ml. 100⁻¹ fresh tissue. A typical pattern is observed to the max. values of TAN are recorded in the winter months of minimum at summer months rainy season slight increase is observed as far as in the diurnal fluctuation during dark and light period are considered. The Sansevieria show a typical CAM behaviour. maximum TAN contents are recorded at 6. am. and minimum at 6 pm. At

mid night and 12 noon intermediate values are observed. It is clear from data that more vigorous acid metabolism is present in this succulent.

3) Carbohydrate :-

The analysis of total carbohydrates in mature leaves of Sansevieria trifasciata during different months of year suggest that there is marked variation in the levels of carbohydrate in response to climatic condition. The value range from 0.15% to 0.35% fresh tissue. Highest levels recorded in summer season, while lowest level in winter season. Intermediate values are observed in rainy season. As for as the diurnal fluctuation concern it is observed that maximum carbohydrate contents are recorded at 6 pm. then slightly level is decrease at 12 night and again there is increase in carbohydrate at 6 am. and 12 noon. It appears from the result large amount of carbohydrates are synthesised during photosynthesis and they may be utilised for organic acid synthesis in night hours.

4) Chlorophylls :-

The analysis of total chlorophyll in mature leaves of Sansevieria trifasciata during different months of year ranges from 23 to 24 mg. 100^{-1} fresh tissue. These values are low as compared to other CAM plant. The amount of total chlorophyll is highest in winter season while lowest in rainy season. The diurnal fluctuation in total chlorophyll contents show significant pattern with relation to CAM at 6 pm. maximum cal. contents are

recorded. Similarly total carbohydrates are also at maximum level at 12 night minimum values are recorded while at 6 am and 12 noon gradual increase is observed.

In the CAM total carbohydrate level is in response with organic acid accumulation. The photosynthetic rates are higher when total chlorophylls are higher in the leaves. The night CO_2 fixation and dark CO_2 fixation in carbohydrate and organic acids respectively balance both these pool. .pa

C) CAM Studies

1) TAN :-

Diurnal Fluctuation in TAN : The diurnal fluctuation in titratable acidity in leaves of Sansevieria trifasciata leaves in different season indicate FULL CAM nature of the succulents. The fluctuation are more significant like those observed in case of total carbohydrates. It is observed that the magnitude of diurnal fluctuation in TAN is high during the winter season as compared to summer season. The titratable acidity is highest at 6 am. While the lowest TAN values are recorded at 6 pm. Intermediate values are obtained at 12 noon and 12 night. The present observation clearly indicate that the S. trifasciata operates typical CAM through out the year. Seasonal changes may affect the magnitude of TAN but the behaviour remain same.

Study of Diurnal Fluctuation in Carbohydrates :-

The total carbohydrate contents show fluctuations during different hours of day. This is consistence with the CAM behaviour in Sansevieria trifasciata. The maximum fluctuation recorded in summer season then in the other. The TAN studies also supports that less organic acid synthesis increased total carbohydrate contents in the species. In the evening the maximum level of carbohydrates are recorded while minimum at 6 am. or early in the morning. Through out the dark period organic acid accumulation may declines the rate of carbohydrate synthesis. The earliest study of Chen and Black (1983), and Barry and Koehler (1986) also support the present investigation.