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E: ISSN NO.: 2455-0817 *Remarking An Analisation*

Estimation of Leaf Pigments and Chlorophyll Stability Index in Three Populations of *Christella dentata* (Forssk) Brownsey & Jermy

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Abstract

Christella dentata is restricted in its distribution. Any disturbance or imbalance in their ecosystem or habitats could lead to its extermination. The micro-morphological and eco-physiological studies of *C. dentata* have comparatively received little attention.

Various primary metabolites viz. sugar, proteins, starch, etc. were studied for different populations of *C.dentata.* The behavior of chlorophyll, carotenoids and phenols in drought resistance in ferns and fern allies from Rajasthan has been studied by Bohra et al. (1979), Vyas et al. (1989), Rathore & Sharma (1991) and Sharma et al. (1992).

Keywords: Christella dentata, Total Chlorophyll, Carotenoid, Chlorophyll Stability Index, Adaptation.

Introduction

As the first true land plants pteridophytes offer very favourable material for the study of various adaptations that have made the colonization of the land possible for the plants.

Pteridophytes are shade loving plants and grow luxuriantly in moist tropical and temperate forests in varied eco-geographical regions. *C. dentata* has been reported for the first time in Rajasthan by Bir & Verma (1963) from Mount Abu. Subsequently this species was reported by Sharma et al. (1998) from Haroti plateau and later on by Vyas (2000, unpublished) from Mewar region.

C. dentata is a thinly populated and rare taxon of Rajasthan and is reported only from a few localities of Rajasthan like Mt. Abu, Kota, Baran, Chittorgarh etc. This species of *Christella* in particular is known to exhibit polymorphism.

Review of Literature

Ferns dominated Earth's landscape before the emergence of seed plants (Spermatophyta), including the gymnosperms that appeared during the Permian 290 Ma and the angiosperms which appeared at the onset of the Mesozoic Jurassic period 200 Ma (Haworth et al., 2011 Flexas & Keeley, 2012). They are the most diverse group of vascular plant after seed plant. They are the second largest group of vascular plant, with more than 10,000 species that reproduce via spore and have neither seed nor flower. They have differed from mosses by being vascular (i.e. having water-conducting vessel) (Jim, 2013).

Ferns are unique amongst land plants in that they have 2 separate living structures in their reproductive cycle –the sporophyte and the gametophyte. No other land plant has these 2 separate independent living stages. This is a unique characteristic of ferns (Vasco et al., 2013). The sporophyte in ferns has 3 major parts – the rhizome, the fronds and the reproductive structures called sporangia. The characteristics of each of these 3 parts of the fern plant are used for classification and identification. A vertical rhizome can grow into a short or a tall trunk. The trunk of the ponga (silver fern) is a vertical rhizome (Link, 2015).

Ferns are distributed across all over world. For example: America, Europe and Asia etc. In India different type of species are found. Central India includes 10 species of Fern allies and 68 species of Ferns (Dudani et al., 2014).

Ferns are not as important economically as seed plants but have considerable importance in some societies. Some ferns are used for food, including the fiddleheads of bracken, ostrich fern. Ferns are generally not

known to be poisonous to humans (Pelton and Robert, 2012). Ferns of the genus *Azolla* are very small, floating plants that do not resemble ferns. Called mosquito fern, they are used as a biological fertilizer in the rice paddies of Southeast Asia, taking advantage of their ability to fix nitrogen from the air into compounds that can then be used by other plants (Vu, 2016).

C. dentata is regarded as a facultative wetland plant. Both in its native and introduced ranges forested wetlands, damp woods and disturbed or open wet areas are typical habitats (Viane, 1985). In general it grows well in disturbed, wet sites. It often co-occurs with another widespread adventive fern, *C. parasitica* (=*Cyclosorus parasiticus*). It is tolerant of a range of soil conditions, although it has been suggested as an indicator of calcareous conditions in South Carolina (Hill, 1992) and has been found on limestone substrates in the Bahamas (Correll, 1976).

Aim of the Study

The present investigation was done to understand the adaptive parameters in three populations of *C. dentata.* For this various parameters of the three populations were studied which includes micro-morphology, eco-physiology and experimental biology. A comparative analysis of these studies of the three populations was done to reach the conclusion.

Material and Methods

Present investigation is based on the fresh plants collected from the three sites during the months of December (winter season), May (summer season) and August (rainy season) for two consecutive seasons. Some plant material was preserved in formo-aceto-alcohol, the universal fixative for eco-physiological and micro-morphological studies.

Three sites were chosen for collection of different populations of *C. dentata* for present study-

Site I- Nakki lake area, Mt. Abu

Site II- Sitabari, Kelwara, Baran

Site III- Sitamata, Pratapgarh

Fresh leaves were analysed for estimation of leaf pigments and chlorophyll stability index.

Leaf pigments (mg/g/f.wt.):

Leaf pigments were estimated according to method suggested by Arnon (1949). Fresh leaf samples were extracted in 80% acetone and O.D. of the clear solution thus obtained was read at 470, 645 and 663 nm on spectrophotometer.

Different pigment contents i.e. chlorophyll a, chlorophyll b and carotenoids were calculated using the following formulae:

Chlorophyll a = 12.7 A_{663} – 2.69 A_{645} x V/1000xw

Chlorophyll b = 22.9 A_{663} – 4.68 A_{645} x V/1000xw

Total Chlorophyll = 20.2 A_{663} – 8.02 A_{645} x V/1000xw

Where A = absorbance at specific wavelength

V = final volume of chlorophyll extract in 80% acetone

W = fresh weight of tissue extracted

Carotenoids = D.V.F x 10/2500

Where D = absorbance at 470 nm

V = volume of original extract

F = dilution factor (F = mass/volume)

2500 = mean extinction coefficient

Chlorophyll Stability Index (CSI)

Fresh leaf samples were collected and kept in warm water at 60°C for 40 min., thereafter pigments extracted in 80% acetone and the clear solution thus obtained was read at 640nm on spectrophotometer. Difference between the colorimetric readings of chlorophyll extracts from heated and unheated leaf samples were calculated as CSI (Kaloyears,1958; Majumdar,1970; Chawan et al.,1979).

Results and Discussion

In the present investigation the maximum values of Total chlorophyll were observed during the winter season. The ratio of chlorophyll a and chlorophyll b was greatest in rainy season in populations collected from Vindhyan scarpland sites while in the Mt. Abu population it was maximum in the month of December. Carotenoids reached their maximum during the summer season at all the three sites.

The Total chlorophyll was found to be more or less same in populations at site I and III while at site II, the Total chlorophyll content was lesser. Presence of more chlorophyll in sciophytes and less in heliophytes is earlier reported by Ludlow and Wolf (1975) and Patric Raja et al. (1992).

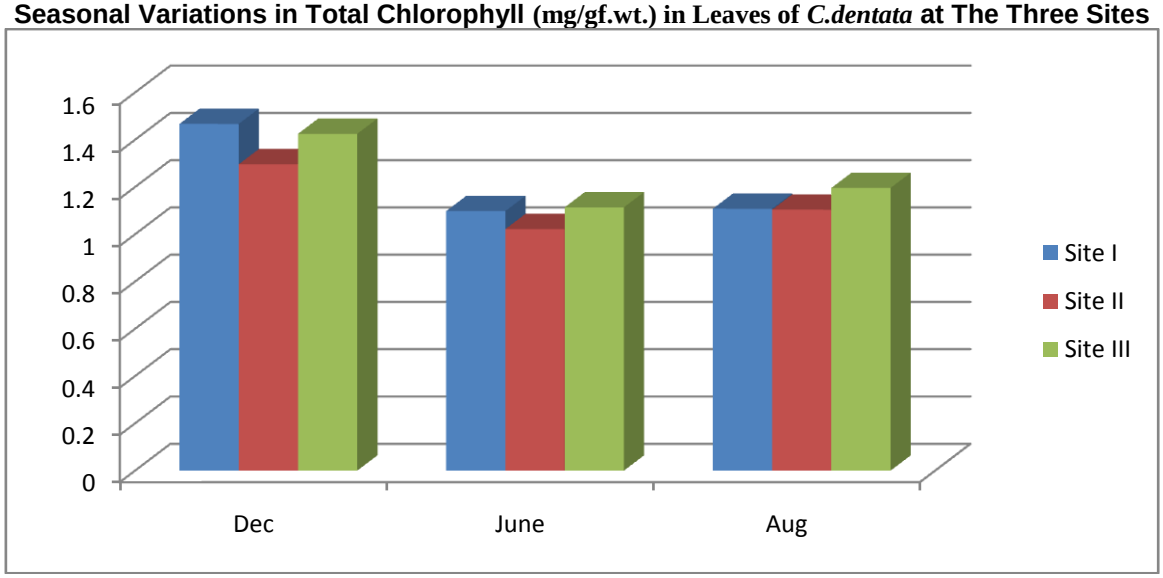
Carotenoid content is more during summers than winter and rainy season. Populations with more chlorophyll content also have more of carotenoid.

The leaves of *C. dentata* showed maximum values of leaf pigments during winters and minimum in summers. The lower values of pigments in summers may be due to water stress conditions.

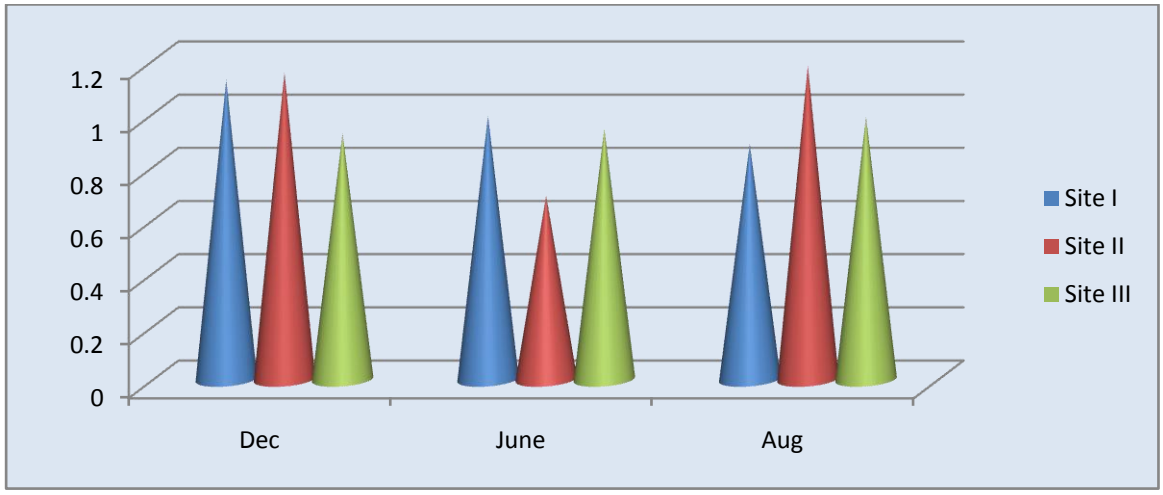
CSI depends on the resistance of the chloroplast membrane to heat and consequently, it is helpful in indicating adaptations in plants. Increase in CSI is indicative of high efficiency of photosynthetic apparatus under extreme conditions.

In *C. dentata* values of CSI were highest during winter and lowest in summer. Sharma et al. (1977) established the importance of CSI as an important factor for heat and drought resistance in plants. A higher CSI indicates higher capacity for heat and drought resistance. In this respect the population of *C. dentata* at site III have been found to posses high CSI.

Seasonal Variations in Total Chlorophyll (mg/gf.wt.) in Leaves of *C.dentata* at The Three Sites



Seasonal Variations in Chlorophyll a/b Ratio in Leaves of *C.dentata* at The Three Sites



Conclusion

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