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Variation in Water Relation Properties and Photosynthetic Pigments in Four Different *Ficus* Species

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Abstract

This study was intended to assess some of the basic physiological processes in four different *Ficus* species of ecosystem. The investigation revealed that a substantial variation exists in respect of chlorophyll and carotenoid contents amongst the species. These species also registered a wide variation in chlorophyll stability index percentage. Assessment of water relation status of these species envisaged that a subtle variation lied among the three *Ficus* species with *Ficus infectoria* as exception which had lower water potential. The moisture content, RWC and RWD varied among them without any definite trend.
Key words : Water relation properties, Photosynthetic pigments, *Ficus*.

The importance of water in living organisms results from its unique physical and chemical properties. These unusual properties were recognized in nineteenth century and their importance was discussed carly in the 20th century. Even today there is some uncertainty about the structure of water and some of its properties, there is no doubt that water has the largest collection of anomalous properties of generally known substance. The ecological importance of water is the results of its physiological importance. The only way in which environmental factor such as water can affect plant growth is by influencing physiological process and conditions directly or indirectly (1). Plants contain a variety of pigments that are prominent visual features and important physiological components of virtually all plants. All the photo-biological phenomena require the participation of these pigments with the absorption of photochemical radiation of these pigments, chlorophylls and carotenes are of paramount importance with regard various physiochemical processes (2). The present experiment aims assess some of the these aspects in different *Ficus* species used mostly as medicinal purposes. From the time immemorial these plants have been utilized, praised and worshiped by man . Moreover, these plants, generally considered pious by the great people of this country, dealing with cultural heritage, festivals and religious ceremonies, starting from birth till death. From the physiological point of view, in the *Ficus* species, the absorption of incident light is 80—90% and reflection is 10—20% (3), whereas in other species the absorption of light is in the order of 20—60%. This implies that the *Ficus* species are enriched with chlorophyll pigments enabling the plant to absorb more indicident light and reflect less. Consequent upon more light absorption of photolysis of water the environment of *Ficus* species are enriched in oxygen with concomitant reduction in carbon dioxide (3). All these reasons prompted us to take up a preliminary study on different *Ficus* species in the context of its water relations and pigment composition with special reference to oxygen rich environment.

Methods

Uniform leaf samples collected from matured trees were subjected to analysis of various parameters like chlorophyll fractions (4), carotenoids (5), water status (5) and a comparative study was made among the four *Ficus* species. Chlorophyll stability index (CSI) was calculated following the methods of Kar et al. (6).

Results and Discussion

Analysis of pigment fractions in leaves of four

Table 1. Variability in chlorophylls and carotenoids (mg g FW) in four different *Ficus* species.

Species	Chl-*a*	Chl-*b*	Total chloro-phyll	CSI (%)	Caro-ten-oids
1. *Ficus benghalensis*	2.87	0.78	3.66	62	1.82
2. *Ficus religiosa*	6.19	1.47	7.66	87	2.68
3. *Ficus infectoria*	6.70	1.68	8.40	77	2.42
4. *Ficus racemosa*	3.84	0.81	4.65	84	1.76

Table 2. Variability in water relation parameters in four different *Ficus* species.

Species	Water potential (Ψw) (–MPa)	RWC (%)	RWD (%)	Moisture content (%)
1. *Ficus benghalensis*	5.3	71	29	68.7
2. *Ficus religiosa*	5.2	65	35	62.4
3. *Ficus infectoria*	8.6	68	32	47.1
4. *Ficus racemosa*	6.1	62	38	61.5

different *Ficus* species revealed that total chlorophyll content was significantly higher in *Ficus infectoria* (8.4 mg) followed by *Ficus religiosa* (7.66 mg) (Table 1). The other two species like *Ficus benghalensis* and *Ficus racemosa* maintained nearly half of the above plants. In general, total chlorophyll content is attributed to higher chlorophyll fractions irrespective of species. On the other hand, chlorophyll stabilities index (CSI) was higher in *Ficus religiosa* (87%) followed by *Ficus racemosa* (84%). Of course, *Ficus infectoria* had a substantial value of CSI i.e. 77%. The lowest CSI value was recorded in *Ficus benghalensis* only to the tune of 62%. Higher CSI is an attributable character for thermal resistance which suggests that increase in environmental temperature has subtle effect on chlorophyl degradation (2). It is pertinent to mention here that reactions in the thylakoid membranes of higher plant chloroplasts are most sensitive to high temperature damage, with consequent effects on the efficiency of photosynthesis and oxygen evolution. High temperature limit for photosynthesis is generally marked by abrupt increase in chlorophyll fluorescence. Notwithstanding, prevalence of higher temperature in the ecosystem, except *Ficus benghalensis*, the other three species are expected to maintain consistant photosynthetic rate with concomitant release of oxygen to its environment.

Both *Ficus religiosa* and *Ficus infectoria* had higher caroteniod content than the other two species. Higher caroteniod in leaves is related to more scavenging action of of chlorophyll from photo-oxidation because this group of pigment strongly absorbs the blue light. Hence, in that way, the former two species are more resistant to UV-radiation and consequently resist chlorophyll degradation.

The study revealed that the water potential (Ψw) and moisture content of *Ficus infectoria* are significantly lower as compared to other three species of *ficus* group. (Table 2). The variability in Ψw among the *Ficus* species was within a margin of 0.1 to 3.4 MPa. On the other hand, RWC of the four species varied among themselves in the order of 3—9%. High water potential and RWC are related to the elasticity of cells and the turgor maintenance (7), probably the cells of *Ficus infectoria* being relatively low elastic in nature are unable to maintain water potentials at par with other three species. Thus to understand many basic physiological phenomena in these species, it is necessary to know the water relations of plants and plant cells (2) in relation to water potential, moisture content, RWC and RWD. It is definite that all these preliminary studies will provide a strong impetus and insight to the future researchers working in these areas to understand the basic physiological processes and functions.

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