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Effect of seasonal variation in photosynthetic pigments of few medicinal plants species of Jhansi

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SUMMARY

Photosynthesis is fundamental basis of competitive success in green plants and the principal organ of photosynthesis in higher plants in leaf. It is the most important metabolic activity performed by green plants. In present investigation, an attempt has been made to study the seasonal variation in photosynthetic pigments chlorophyll a, chlorophyll b and total chlorophyll of few medicinal plants species of Jhansi. In present study out of Nine medicinal plants, *Acacia nelotica Azardirachta indica*, and *Jatropha curcas*, are potential medicinal plant followed by, *Vinca rosea, Adhatoda vasica, Calotropis procera, Syzygium cumini, Ocimum sanctum* and *Eucalyptus globules*.

Key words : Seasonal variation, Photosynthetic pigments, Medicinal plants

Plant biomass and productivity depends on efficiency of photosynthetic activity. Photosynthesis is most important metabolic activity performed by green plants. It not only builds up food for plant by harvesting solar energy, but also sustains its flow of energy in the biosphere. Presence of chlorophyll in green plants makes them unique in living world for they only can capture the solar energy and convert it into chemical energy. It is a phenomenon of utmost significance for the existence of the entire life on this plant (Tiwari and Rai, 2002). Chlorophyll is the molecule that absorbs sunlight and uses its energy to synthesize carbohydrates from CO_2 and water. This process is known as photosynthesis and is the basis for sustaining the life processes of all plants. Since animals and humans obtain their food supply by eating plants, so photosynthesis can be said to be the source of our life also. Role of chlorophyll as the main triggering molecule in photosynthesis is known for over two hundred years now. In higher plants (Angiosperms) synthesis of chlorophyll is light dependent reaction while is lower vascular plants and some algae it is an enzyme coupled dark relation (Devilin, 1983). In order to absorb light efficiently a typical leaf presents a large surface area at approximately right angle to the incoming sunlight. From this perspective, the leaf may be viewed as a photosynthetic machine, superbly engineered to carry out photosynthesis efficiently in an externally hostile environment. (Hopkins *et al.,* 2003). Chlorophyll content in leaf tissue varies with species, age of plants and growing season. Among the climatic factor light and temperature during the growth season. Among the climatic factor light and temperature during the growth period have more pronounced effect on chlorophyll content, the high chlorophyll a: b ratio represents the high efficiency of photosynthesis (Bhatt and Sinha, 1990)

Study site:

Jhansi is the headquarters of Bundelkhand region of Uttar Pradesh. Geographically it is situated between 25^0 -27', North of latitude and 78^0 35' East of longitude with 271m above mean sea level in semiarid of central India. The topography of region lies within 271m above mean sea level in general and exceeds over 431 in some cases. The hypsometric curve of the region show that about 28.7% of the area is under 271m and 67.7% less between 300 and 400m with small area (3.6%) above 431m.. The climate of Jhansi is relatively moderate and dry except in the monsoon season. This region is tropical sub humid and distinct seasonally. It is characterized by 3 season viz. summer, Rains and winter. The average annual rainfall is 903mm. with about 42% precipitation following during the monsoon months of June to September On an average there are 30 rainy days in an year in the district.

MATERIALS AND METHODS

The present investigation was conducted to study seasonal variation in photosynthetic pigments of few medicinal plant species of Jhansi region (Year, 2007). The amount of chlorophyll a, chlorophyll b, and total chlorophyll

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in terms of mg/ g. fr. wt. were calculated by using the following formula given by Goodwin (1965) and AOAC (1965).

$$\text{(a) Chl. a} = 12.7\,(A_{663}) - 2.69\,(A_{645}) \times \frac{V}{100 \times W}\ \text{mg/g fr. wt.}$$

$$\text{(b) Chl. b} = 22.9\,(A_{645}) - 4.68\,(A_{663}) \times \frac{V}{100 \times W}\ \text{mg/g fr. wt.}$$

$$\text{(c) Total Chl.} = 22.2\,(A_{645}) + 8.02\,(A_{663}) \times \frac{V}{100 \times W}\ \text{mg/g fr. wt.}$$

where, V = volume of chlorophyll extract
W = Fresh wt. of leaf sample
A_{663} = Absorbance in nm at 663 m wave length
A_{645} =Absorbance in nm at 645nm wave length

RESULTS AND DISCUSSION

Productivity of green plants depends on efficiency of photosynthesis activity. Photosynthetic pigment in different plant under various environmental conditions might be one of the important parameter for the adaptive potential of plant. Different medicinal plant species exhibited different trends in their seasonal variation in photosynthetic pigments. The effect of seasonal factors, specially rainfall and temperature on chlorophyll synthesis appears to be an individual character of species. In general chlorophyll a contents were more than chlorophyll b contents. According to Shiyk *et al.* (1963) and Bogorad (1967) chlorophyll b is derived from chlorophyll a and it is expected that amount of chlorophyll a is always higher in comparison to chlorophyll b.

In all three seasons the average value of chlorophyll a varied between 2.58 to 0.18 mg/g. fr.wt. In summer season the average chlorophyll a was observed maximum in *Azadirachta indica* 1.38 mg/g. fr. wt. while minimum in *Adhatoda vasica* 0.45 mg/g. fr.wt. In rainy season the average chlorophyll a was observed maximum in *Jatropha curcas* and in *Acacia nilotica* 1.40 mg/g. fr.wt while minimum in *Calotropis procera* 0.36 mg/g. fr. wt. In winter season the average chlorophyll a was observed maximum in *Acacia nilotica* 2.58 mg/g. fr. wt. and minimum in *Calotropis procera* 0.58 mg/g. fr. wt. In summer season *Azadirachta indica* appeared to be a potential productive plant while in rainy season *Jatropha curcas* and *Acacia nilotica* seemed to a potential productive plants. In rainy season *Calotropis procera* showed low potential productive plant. In winter season *Acacia nilotica* seemed to be a potential productive plant. Average result on *Acacia nilotica* reveled that chlorophyll a content was higher in winter season as compared to

Table 1 : Effect of seasonal variation in Photosynthetic Pigments (unit- mg/g fr.wt) of few medicinal plant species of Jhansi

St. No.	Name of plant	Chl a		Chl a		Chlb	Chl b		Total Chl	Total Chl	Total Chl
		S	R	W	S	R	W	S	R	W
1.	*Acacia nilotica* (Benth.Brenan)	1.18±0.05	1.40±0.27	2.58±0.06	0.81±0.06	0.74±0.24	1.96±0.06	0.91±0.06	0.85±0.24	2.16±0.06
2.	*Adhatoda indica* (Nees)	0.45±0.05	1.05±0.28	0.93±0.0	0.37±0.0	0.70±0.18	0.62±0.05	0.41±0.05	0.79±0.2	0.60±0.0
3.	*Azadirachta indica* (A.Juss)	1.38±0.0	1.92±0.1	2.31±0.20	1.00±0.0	1.25±0.1	1.69±0.17	1.11±0.05	1.40±0.08	1.81±0.12
4.	*Calotropis procera*(L)R.Br.	0.54±0.0	0.36±0.0	0.58±0.0	0.38±0.0	0.18±0.0	0.40±0.0	0.43±0.05	0.21±0.0	0.45±0.0
5.	*Eucalyptus globules* (Labill)	0.72+0.15	0.84+0.0	0.65-0.11	1.14+0.1	0.69+0.0	0.46+0.1	0.84+0.0	0.75+0.0	0.62+0.21
6.	*Jatropha curcus* (Linn.)	1.32±0.05	1.40±0.19	1.54±0.1	0.69±0.0	1.13±0.08	1.36±0.24	1.26±0.11	1.26±0.08	1.49±0.27
7.	*Ocimum santum* (L.)	1.19±0.08	1.03±0.08	0.75±0.05	0.69±0.0	0.60±0.05	0.35±0.1	0.68±0.0	0.68±0.0	0.50±0.0
8.	*Syzygium cumini* (Linn.)	0.92±0.12	0.59±0.1	0.91±0.05	0.66±0.08	0.51±0.11	0.71±0.05	0.73±0.1	0.56±0.11	0.75±0.0
9.	*Vinca rosea* (L) G.Don	1.19±0.11	0.47±0.05	1.47±0.19	0.68±0.05	0.25±0.05	0.89±0.11	0.30±0.0	0.78±0.05	1.01±0.1

S-summer W-winter R-rain

rainy season but were less in summer season.

General range of chlorophyll b content was recorded between 1.96mg./g.fr. wt to 0.18 mg/g. fr. wt. Among different seasons chlorophyll b content was found maximum during winter season and minimum in summer season. In summer season average chlorophyll b was observed maximum in *Eucalyptus globules* (Labill) 1.14 mg/g fr. wt while *Adhatoda vasica* showed the minimum chlorophyll b content 0.37 mg/g fr. wt. In rainy season the average chlorophyll b was observed maximum in *Azadirachta indica* 1.25 mg/g. fr.wt while minimum in *Calotropis procera* 0.18 mg/g. fr. wt. In winter season average chlorophyll b was observed maximum in *Acacia nilotica* 1.96 mg/g fr. wt. while minimum in *Ocimum sanctum* 0.35 mg/g fr. wt.

The total chlorophyll content varied between 2.16 mg/g. fr.wt to 0.21 mg/g. fr. wt. In summer season average total chlorophyll was recorded maximum in *Jatropha curcas* 1.26 mg/g. fr. wt and minimum in *Vinca rosea* 0.30 mg/g fr. wt In rainy season *Azadirachta indica* showed maximum (1.40mg/g fr. wt.) total chlorophyll while *Calotropis procera* showed minimum (0.21mg/g. fr. wt.) total chlorophyll. In winter season average total chlorophyll was observed maximum in *Acacia nilotica* 2.16 mg/g.fr. wt and minimum in *Calotropis procera* 0.45 mg/g. fr. wt.

By comparing the values of total chlorophyll among nine plants the higher total chlorophyll content was observed by *Jatropha curcus , Eucalyptus globules* and *Azadirachta indica* in summer season, while in rainy season *Azadirachta indica Jatropha curcus* and *Acacia nilotica* where as in winter season *Acacia nilotica*. Studies on estimation of photosynthetic pigments indicate that there was wide variation in their contents and they also exhibit seasonal alteration. So it was concluded from present investigation that out of nine medicinal plants, *Acacia nilotica, Azardirachta indica, Eucatyptus glopules* and *Jatropha curcas* potential productive medicinal plant followed by, *Vinca rosea, Adhatoda vasica, Calotropis procera, Syzygium cumini,* and *Ocimum sanctum*.

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