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**Estimation of chlorophyll content of some medicinal plants of genus  
*Terminalia* of Marathwada region in Maharashtra**

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**Abstract**

The seasonal variation (summer, Monsoon and winter) of chlorophyll a, chlorophyll b and carotenoid have been investigated in leaves of *Terminalia cuneata* Roth. *Terminalia bellirica* Roxb, *Terminalia chebula* Retz. and *Terminalia catappa* Linn. are important medicinal plants of family Combretaceae of Marathwada region in Maharashtra. Comparative account of chlorophyll a, chlorophyll b and carotenoid content of leaves of four medicinal plants revealed that, the highest amount of chlorophyll a, chlorophyll b and carotenoid content in the leaves of *Terminalia cuneata* (4.97 mg/g fresh wt.), (3.51 mg/g fresh wt.) and (1.83 mg/g fresh wt.) in summer seasons and comparative lower amount of chlorophyll a, chlorophyll b and carotenoid content in the leaves of *Terminalia catappa* (3.46 mg/g fresh wt.), ( 2.43 mg/g fresh wt.) and (1.27 mg/g fresh wt.) in monsoon seasons.

**Keywords:** Medicinal plant, Chlorophyll, Carotenoid and genus *Terminalia*

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**1. Introduction**

The pigments which are involved in the process of photosynthesis are called photosynthetic pigments. The pigments are the coloured organic compounds that have capacity to absorb certain wavelength of light and reflect to others. Chlorophyll is a green pigment found in cyanobacteria and the chloroplasts of algae and plants. Chlorophyll is an extremely important biomolecule, critical in photosynthesis, which allows plants to absorb energy from light. Chlorophyll absorbs light most strongly in the blue portion of the electromagnetic spectrum. Several kinds of chlorophyll have been discovered in plants. The formation of chlorophyll is physiological process that occurs only in living cells. The essential conditions for chlorophyll formation is the presence of genetic factors Anonymous (1969).

Traditionally plants have been well exploited by man for the treatment of human diseases. Indian sub-continent is a rich source of plant and animal wealth, which is due to its varied geographical and agro-climatic regions. Besides its varied biodiversity, it has a diverse cultural heritage too. Though at present Indian health care delivery consists of both traditional and modern systems of medicines. These two systems of medicine use plants, minerals, metals and animals as source of drugs, plants being the major source. *Terminalia cuneata* Roth. *Terminalia bellerica* Roxb, *Terminalia chebula* Retz. and *Terminalia catappa* Linn. are most important plants from the family Combretaceae. All these plants contain chemical ingredients of a great importance in medical care, in agriculture and they have their great importance in physiology, biochemistry and even in taxonomy also (Salve and Kadam, 2011).

The plant world comprises a rich store house of biochemical that could be trapped for the welfare of mankind. India is a rich source of plant wealth, which is due to its varied geographical and climatic conditions. India contains a great wealth of biological diversity in its forests (Botanical survey of India, 1983). The forest in India is the principal repository of large number of medicinal and aromatic plants which are largely collected as raw materials for manufacture of drugs and perfumery products. According to Patil, and Gaikawad, (2011), the bark of *Terminalia arjuna* is potent cardio tonic in the Ayurveda. The bark was analyzed with respect to reducing sugars, total sugars, amylose, amylopectin, starch, crude fibers and crude protein, total ash value, total flavonoids, total alkaloids, nitrates and total oxalate. Rajeev Nema et.al. (2012) did preliminary phytochemical evaluation and flavonoids quantification of *Terminalia arjuna* leaves extracts. Stem, bark and leaves possess glycosides, large quantities of flavonoids have been found to possess antioxidant, anti-inflammatory and lipid lowering effects to them where as glycosides are cardio tonic.

Shanmugasundaram et.al. (2011), scientifically validated the purification method of *Terminalia chebula* in Siddha medical practice in India. Gyawali and Kyong-su-kim, (2011) were isolated volatile organic compounds from *Terminalia chebula*. Manikandan and Rejula, (2008), identified the leaf extract contains more quantity of hydro Quinone, trans-cinnamic acid, gentistic acid, vanillic acid, syringic acid and transfernic acid known as allelochemical and they says that *Terminalia chebula* will be extremely useful in future to control the weed growth in agro ecosystem. The fruits of the tree *Terminalia bellirica* are traditionally useful in the cure of Bronchitis, sore throat and inflammation of eyes.

## 2. Materials and Methods

Chlorophyll a, Chlorophyll b, and Carotenoids were extracted from the freshly plucked third leaf from the top using 80% acetone. Optical densities were recorded at 480, 510, 645 and 663nm. The amount of Chl .a, Chl b, and Carotenoid were calculated. (Duxbury and Yestsch, 1956, Maclachalam and Zalik, 1963.)

### Formula for Calculation:

$$\text{*Chl. a } \left( \frac{\text{Mg}}{\text{g}} \text{ fresh weight} \right) = \frac{12.3D_{663} - 0.86D_{645}}{d \times 1000 \times W} \times V$$

$$\text{*Chl. b } \left( \frac{\text{Mg}}{\text{g}} \text{ fresh weight} \right) = \frac{19.3D_{645} - 3.6D_{663}}{d \times 1000 \times W} \times V$$

$$\text{*Carotenoids } \left( \frac{\text{Mg}}{\text{g}} \text{ fresh weight} \right) = \frac{7.6D_{480} - 1.49D_{510}}{d \times 1000 \times W} \times V$$

Where,

V 'is the volume of chlorophyll solution, 'd' is the length (cm) of light path and 'W' is the fresh weight of leaves.

## 3. Results and Discussion

***Terminalia cuneata* Roth.** The chlorophyll-a content of leaves of *Terminalia cuneata* Roth. was recorded higher in the season of summer (4.97 mg/g fresh wt.) compared to other seasons i.e. winter (4.74 mg/g fresh wt.) and monsoon (4.53 mg/g fresh wt.). The chlorophyll-b content of leaves of the same plant was also higher, found in summer season (3.51mg/g fresh wt.) over to winter (3.35 mg/g fresh wt.) and monsoon (3.24 mg/g fresh wt.). The Carotenoids contain in leaves of the same plant were accumulated more in summer season (1.83 mg/g fresh wt.) over that of winter (1.67 mg/g fresh wt.) and monsoon (1.53mg/g fresh wt.). The range of chlorophyll-a, chlorophyll-b and carotenoids were found to be in the increasing order of monsoon < winter < summer (Table No.1 and graph No.1).

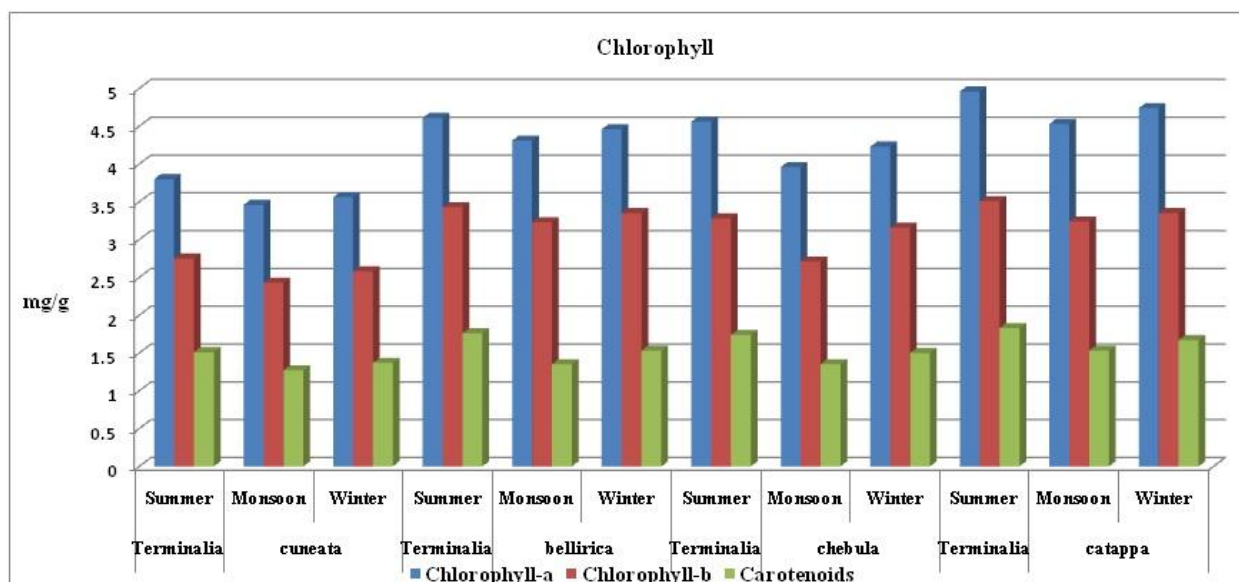
***Terminalia bellirica* Roxb.** In the leaves of *Terminalia bellirica* Roxb., the range of chlorophyll-a was noted from (4.31mg/g fresh wt. to 4.61mg/g fresh wt.) where, in the summer season, the leaves were rich with chlorophyll-a (4.61 mg/g fresh wt.) over that of the winter (4.46 mg/g fresh wt.) and monsoon (4.31 mg/g fresh wt.). The chlorophyll-b content of leaves in the same plant was found higher in summer season (3.43 mg/g fresh wt.) compared to winter (3.25 mg/g fresh wt.) and monsoon (3.23 mg/g fresh wt.). The carotenoids content of leaves was recorded in the range of (1.35 mg/g fresh wt. to 1.76 mg/ g fresh wt.) where, the highest accumulation of carotenoids was recorded in summer season (1.76 mg/g fresh wt.) as compared to winter (1.53 mg/g fresh wt.) and monsoon (1.35 mg/g fresh wt.). The range of chlorophyll-a, chlorophyll-b, and carotenoids were found to be in the increasing order of monsoon < winter < summer (Table No.1 and graph No.1).

***Terminalia chebula* Retz.** The leaves of *Terminalia chebula* Retz. in the summer season found rich with chlorophyll-a, (3.80 mg/g fresh wt.) over that of winter (3.56 mg/g fresh wt.) and monsoon (3.46 mg/g fresh wt.). The range of accumulation of chlorophyll-b was (2.43 mg/g fresh wt. to 2.75 mg/g fresh wt.), where in summer season accumulation of chlorophyll-b was recorded more (2.7 mg/g fresh wt.) than that of other seasons i.e. winter showed (2.58 mg/g fresh wt.) and monsoon (2.43 mg/g fresh wt.). The accumulation of pigment carotenoids in the leaves of the same plant were more in summer season (1.51 mg/ g fresh wt.) over that of winter (1.37 mg/g fresh wt.) and monsoon (1.27 mg/g fresh wt.). The range of chlorophyll-a, chlorophyll-b and carotenoids in the leaves of *Terminalia chebula* Retz. were recorded increasing in order i.e. from monsoon < winter < summer (Table No1 and graph No.1).

***Terminalia catappa* Linn.** In the leaves of *Terminalia catappa* Linn., the pigments of chlorophyll-a was found highest in summer season (4.54 mg/g fresh wt.) as compared to winter (4.23 mg/g fresh wt.) and monsoon (3.96 mg/g fresh wt.). Chlorophyll-b was accumulated in the range of (2.71 mg/g fresh wt. to 3.28 mg/g fresh wt.) where, in summer season it was found highest (3.28 mg/g fresh wt.) compared to winter (3.16 mg/g fresh wt.) and monsoon (2.71 mg/g fresh wt.). The carotenoids content was also found highest in summer season (1.74 mg/g fresh wt.) in the leaves of *Terminalia catappa* Linn. Than that of other seasons i.e. in the winter season carotenoids were found, (1.50 mg/g fresh wt.) and in monsoon it was recorded (1.35 mg/g fresh wt.). The range of content of pigments chlorophyll-a, chlorophyll-b and carotenoids in the leaves of *Terminalia catappa* Linn.was found in the increasing order from the seasons monsoon < winter < summer (from Table No.1 and graph No.1)

**Table 1:** Determination of chlorophyll pigments from the leaves of *T. cuneata*, *T.bellerica* *T.chebula*. and *T.catappa*

S.No	Name of Plant	Season	Chlorophyll a Mg/g fresh wt.			Chlorophyll b Mg/g fresh wt.			Carotenoids Mg/g fresh wt.		
			1Year	2 Year	Mean	1Year	2Year	Mean	1Year	2Year	Mean
1.	<i>Terminalia cuneata</i> Roth.	Summer	4.92	5.02	4.97	3.47	3.55	3.51	1.80	1.86	1.83
		Monsoon	4.65	4.83	4.74	3.32	3.38	3.35	1.58	1.76	1.67
		Winter	4.48	4.58	4.53	3.18	3.30	3.24	1.50	1.56	1.53
2.	<i>Terminalia bellerica</i> Roxb.	Summer	4.55	4.67	4.61	3.34	3.52	3.43	1.77	1.76	1.76
		Monsoon	4.23	4.39	4.31	3.14	3.31	3.23	1.33	1.38	1.35
		Winter	4.44	4.49	4.46	3.23	3.27	3.25	1.58	1.49	1.53
3.	<i>Terminalia catappa</i> Linn.	Summer	4.45	4.62	4.56	3.25	3.31	3.28	1.76	1.73	1.74
		Monsoon	4.89	4.02	3.96	2.67	2.75	2.71	1.32	1.39	1.35
		Winter	4.11	4.32	4.23	3.11	3.21	3.16	1.53	1.47	1.50
4.	<i>Terminalia chebula</i> . Retz	Summer	3.85	3.75	3.80	2.82	2.69	2.75	1.54	1.48	1.51
		Monsoon	3.44	3.48	3.46	2.49	2.38	2.43	1.28	1.26	1.27
		Winter	3.53	3.59	3.56	2.62	2.54	2.58	1.37	1.38	1.37



Graph 1

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