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Evaluation of Candidate Plus Trees of *Cleistanthus collinus* (Roxb.) for Physico-Chemical Properties of Wood

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ABSTRACT

The variation in physico-chemical properties of wood within the candidates plus trees (CPT's) of Cleistanthus collinus (Roxb.) in Bhandara and Gondia District were studied. The maximum height and diameter was recorded in Murdoli-1 among 20 selected CTP's. Garada-1, Murpar-1 and Murdoli-2 had nearly straight grain. Murdoli-1 recorded maximum percentage of bark and highest specific gravity of wood was noticed in Sonegaon-2. The maximum fiber length was observed in Sonegaon-2. The cold water solubility content of wood was recorded highest in Murdoli-1. The hot water solubility content of wood was recorded highest in Sonegaon-2. The alcohol-benzene solubility and lignin content of wood were recorded highest in Murdoli-1 and maximum holocellulose percentage recorded in Sonegaon-2. Highly significant and positive correlation was found between fiber length and holocellulose percentage. Highly significant and negative correlation was recorded between lignin content and holocellulose percentage.

Key words: *CTP's, properties of wood*

INTRODUCTION

Cleistanthus collinus (Roxb.) is belonging to the family of Euphorbiaceae. It is naturally widespread in the drier areas of Africa and in Asia from Arabia Eastward to India, Burma and Sri Lanka. It is the species of Southern Tropical dry deciduous forest and Southern Tropical forest[13].It is distributed throughout the greater part of India in forest areas, farmland, bunds etc. It has been widely planted on farms throughout the plains of India Subcontinent.

Cleistanthus collinus (Roxb.) is a toxic plant. Extract of the various plant parts yielded a multitude of compounds of which the glycosides, anylnapthalene lignin, lactones which are toxic. Extract of leaves, roots and fruits of *Cleistanthus collinus* (Roxb.) are used to treat gastro intestinal disorder and anticancer activity. The plant also posses insecticidal properties against red flour bettle and larvae of Spodoptera Litura[5]. The bark, leaves, heartwood, fruit and other parts of *Cleistanthus collinus* (Roxb.) are rich in lignin and lignin lactones, which are structurally similar to the semi-synthetic podophyllotoxin anticancer drugs such as etopoide 5-10 and tinoposide.

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Cleistanthus collinus (Roxb.) has created a considerable amount of intrest because of its complex metabolic and their cytotoxic activities.

The wood of *Cleistanthus collinus* (Roxb.) is mostly used as agricultural implements, building, door frames, boats, firewood etc. Keeping he commercial importance of this species, the present investigation was carried out to evaluate the best performing CPT's (Candidate Plus Trees) species marked at different locations in Bhandara and Gondia District of Maharashtra State.

MATERIAL AND METHODS

The present investigation entitled "Evaluation of Candidate Plus Trees *Cleistanthus collinus* (Roxb.) for physico-chemical properties of wood" was carried out at different location in Bhandara and Gondia District of Maharashtra. The CTP's of *Cleistanthus collinus* (Roxb.) was marked at Bodalkasa (02), Garuda (02), Jambhadi (02), Kinhi Mokhe (02), Khamba (02), Murpar (02), Murdoli (02), Ramatola (02), Satalwada (02) and Sonegaon (02). The selection of CPT's of Cleistanthus collinus (Roxb.) was done as per the method suggested by Zobel and Talbert[18]. The experiment was laid in Randomized Block Design consisting 20 treatments replicated thrice. The wood samples were chipped at breast height with the help of manner and chisel from all the market trees. The wood samples were analyzed for cold water solubility (Tim-59-Anonymous, 1995a), hot water solubility (Tim-59-Anonymous, 1995a), alcohol-benzene extractives (T6m-59-Anonymous, 1959b), klason-lignin content (T12m-59-Anonymous, 1959c), and holocellulose (T9m-54-Anonymous, 1954) by following standard procedure. The statistical analysis was carried out by procedure of Panse and Sukhatme[12].

RESULTS AND DISCUSSION

Physical parameters

The perusal of data (Table 1) revealed that there is significant variation in plant height, diameter and grain angle. The maximum height 23.11 m was recorded in Murdoli-1 and minimum 16.11 m in Sonegaon-2. Regarding the diameter, the maximum value 29.82 cm and minimum value 19.12 cm diameter was recorded in the Garuda-1 and Sonegaon-2, respectively. The minimum deviation of 1.30^0 (88.67^0 against 90^0) with vertical axis was recorded in Garada-1, Murpar-1 and Murdoli-2, however, the maximum deviation of 4.70^0 (85.30^0 against 90^0) was recorded in Jambali-2. The mean value regarding height and diameter of plant was recorded from 16.11 – 23.11 m and 19.12 – 30.58 cm, respectively. Toky *et. al.*[15], while working on *Albizia rebbak* and Townsend[16]. in *Acer rubrum* have also reported significant variation in the height and diameter of different provenance.

The maximum bark value of 6.45 per cent was found in Murdoli-1 and minimum of 4.20 per cent in Sonegaon-2. Toda *et. al.*[14], also reported variation in bark thickness with tree age.

Physico-chemical characteristics

From the data in table 2, it was revealed that the maximum and minimum specific gravity of 0.6751 and 0.6018 recorded in Sonegaon-2 and Murdoli-1, respectively. Extractives mainly located in cell lumen, so they fill the vacant space in the wood, decreasing the porosity and thereby increasing the specific gravity. The significant variation in specific gravity of *Populous deltoids* has also been noticed by Gupta[8].

The longest fibers were noticed in Sonegaon-2 (1.85 mm) and smallest fibers in Murdoli-1 (1.40 mm). Environment in combination with genetic variability plays an important role in the alternation of fiber length. Jiang Xiamoi *et. al.*[9], observed significant variation in fiber length of *Populous deltoids.*

Regarding cold water soluble extractives of wood (Table 2), the highest value of 6.33 per cent (2.58) in Murdoli-1 and the lowest value of 3.05 per cent (1.93) was recorded in Sonegaon-2. However, the maximum hot water soluble extractives of 9.01 per cent (3.04) were recorded in Sonegaon-2 and minimum in Murdoli-1 i.e. 3.67 per cent (2.03). The significant variation among the

cold and hot water soluble extractives of wood recorded due to the varied level of accumulation of extractives in different candidate plus trees (CTP's). Karnik *et. al.*[10], recorded maximum per cent of hot water solubility of wood of Khair (*Acasia catechue*) more than cold water solubility.

The maximum alcohol-benzene soluble extractives of wood and klason lignin content in wood was recorded in Murdoli-1 8.71 (2.93) and 31.09 (5.59) per cent, respectively. Whereas, the lowest content was observed in Sonegaon-2 i.e. 4.66 (2.31) and 21.3 (4.69) per cent, respectively. The alcohol-benzene solubility of wood is an important character representing extractives present in wood which affect the pulping quality with maximum extractives. The present results are in conformity with the results of Khurana *et. al.*[11], in *Populous ciliate*, Beleam and Harkin[6], in Eucalyptus spp.

The maximum holocellulose of 72.40 per cent was recorded in Sonegaon-2 and minimum in Murdali-1 i.e. 58.74 per cent (Table 2).

Regarding correlation coefficient (Table 3), the significant positive correlation was observed between fiber length & hallocellulose (0.917**), hot water soluble extractives percentage and holocellulose percentage (0.890**), cold water extractives percentage & lignin percentage of wood (0.876**), bark percentage and lignin percentage of wood (0.777**). Whereas, the significant negative correlation values of (-0.934**) was recorded between lignin content & holocellulose percentage, cold water soluble extractives and holocellulose (-0.900**). Similar relationship have found by way Kesheng et. al.[17], in *Popular clones* & Campbell et. al.[7], in *lodgeople pine*.

Table 1. Physical parameters of candidate plus trees of Cleistanthus collinus (Roxb.) in different locations at Bhandara and Gondia District

Sr. No.	Locality	Tree No.	Plant Height (m)	Diameter (cm)	Grain angle (deviation) in degrees	Bark percentage (%)	Specific Gravity	Fiber length(mm)
1	Bodalkasa	B-1	19.91	25.26	87.67(2.33)	5.11(2.40)	0.6326	1.64
2	Bodalkasa	B-2	20.34	26.26	88.34(1.66)	5.23(2.43)	0.6309	1.62
3	Garada	G-1	22.08	29.89	88.67(1.33)	6.23(2.51)	0.6029	1.46
4	Garada	G-2	21.44	28.56	87.67(2.33)	6.23(2.64)	0.6032	1.47
5	Jambhadi	J-1	19.75	24.81	87.34(2.66)	5.04(2.36)	0.6367	1.66
6	Jambhadi	J-2	20.41	26.59	85.30(4.70)	5.26(2.46)	0.6278	1.60
7	Kinhi	K-1	19.33	23.81	86.34(3.66)	4.95(2.31)	0.6445	1.67
8	Kinhi	K-2	18.38	22.18	85.34(4.66)	4.66(2.25)	0.6643	1.80
9	Khamba	KH-1	19.08	23.48	86.34(3.66)	4.92(2.39)	0.6496	1.72
10	Khamba	KH-2	18.52	22.44	85.34(4.66)	4.68(2.25)	0.6542	1.79
11	Murpar	M-1	21.00	26.92	88.67(1.33)	5.99(2.55)	0.6100	1.55
12	Murpar	M-2	20.00	25.69	88.33(1.67)	5.20(2.37)	0.6317	1.64
13	Murdoli	MU-1	23.11	30.58	86.67(1.33)	6.45(3.60)	0.6018	1.40
14	Murdoli	MU-2	21.20	28.22	88.67(1.33)	6.09(2.57)	0.6093	1.50
15	Ramatola	R-1	20.49	26.92	88.34(1.66)	5.26(2.39)	0.6214	1.55
16	Ramatola	R-2	20.22	25.71	88.30(1.70)	5.20(2.29)	0.6317	1.63
17	Satalwada	S-1	19.67	24.25	87.34(2.66)	4.96(2.34)	0.6429	1.66
18	Satalwada	S-2	18.22	20.33	85.34(4.66)	4.50(2.26)	0.6686	1.83
19	Sonegaon	SO-1	18.75	22.78	88.34(1.66)	4.75(2.24)	0.6540	1.72
20	Sonegaon	SO-2	16.11	19.12	85.34(4.66)	4.20(2.10)	0.6751	1.85
		Mean	19.90	25.19	87.34(2.66)	5.25(2.38)	0.6347	1.64
		SE (m) ±	1.251	2.242	0.267	0.309	0.016	0.030
		CD at 5%	--	--	0.764	0.874	0.046	0.084

Figures in parenthesis are square root transformed value

Table 2. Chemical parameters of candidate plus trees of Cleistanthus collinus (Roxb.) in different locations at Bhandara and Gondia District

Sr. No.	Locality	Tree No.	Cold water soluble extractives (%)	Hot water soluble extractives (%)	Alcohol – benzene soluble extractives (%)	Lignin (%)	Holocellulose (%)
1	Bodalkasa	B-1	4.28 (2.18)	6.54 (2.59)	7.31 (2.78)	25.47 (5.05)	66.49
2	Bodalkasa	B-2	4.54 (2.19)	5.88 (2.51)	7.55 (2.91)	26.69 (5.23)	64.56
3	Garada	G-1	6.21 (2.48)	4.56 (2.23)	8.55 (2.97)	30.36 (5.53)	60.66
4	Garada	G-2	5.34 (2.42)	4.97 (2.26)	8.34 (2.05)	29.98 (5.52)	61.15
5	Jambhadi	J-1	4.22 (2.18)	6.75 (2.77)	7.31 (2.78)	24.43 (5.01)	67.41
6	Jambhadi	J-2	4.66 (2.25)	5.47 (2.34)	7.67 (2.86)	27.55 (5.30)	63.34
7	Kinhi	K-1	4.08 (2.20)	7.12 (2.80)	6.76 (2.58)	24.24 (4.99)	67.63
8	Kinhi	K-2	3.23 (1.92)	8.65 (2.92)	6.57 (2.69)	22.51 (4.80)	69.57
9	Khamba	KH-1	3.61 (1.98)	7.34 (2.80)	6.76 (2.63)	23.86 (4.91)	67.73
10	Khamba	KH-2	3.54 (1.99)	8.51 (2.96)	6.58 (2.70)	23.30 (4.88)	69.48
11	Murpar	M-1	5.11 (2.41)	5.34 (2.36)	7.81 (2.85)	28.32 (5.39)	62.72
12	Murpar	M-2	4.39 (2.12)	6.54 (2.69)	7.33 (2.71)	26.56 (5.13)	65.70
13	Murdoli	MU-1	6.33 (2.58)	3.67 (2.03)	8.71 (2.93)	31.09 (5.59)	58.74
14	Murdoli	MU-2	5.34 (2.34)	4.98 (2.38)	7.89 (2.86)	29.88 (5.53)	62.59
15	Ramatola	R-1	5.11 (2.41)	5.41 (2.43)	7.76 (2.76)	27.77 (5.13)	63.01
16	Ramatola	R-2	4.45 (2.21)	6.23 (2.57)	7.45 (2.82)	26.61 (5.16)	65.17
17	Satalwada	S-1	4.11 (2.18)	6.76 (2.58)	6.77 (2.67)	24.41 (4.99)	67.63
18	Satalwada	S-2	3.17 (1.94)	8.67 (3.11)	5.87 (2.55)	21.74 (4.70)	71.82
19	Sonegaon	SO-1	3.56 (1.98)	7.44 (2.85)	6.76 (2.63)	23.85 (4.91)	68.71
20	Sonegaon	SO-2	3.05 (1.93)	9.01 (3.04)	4.66 (2.31)	21.38 (4.69)	72.40
		Mean	4.42 (2.19)	6.49 (2.61)	7.22 (2.75)	26.00 (5.12)	65.83
		SE (m) ±	0.280	0.414	0.456	0.535	0.490
		CD at 5%	0.800	1.183	1.305	1.529	1.402

Figures in parenthesis are square root transformed value

Table 3. Simple correlation coefficient between physico-chemical characteristics of wood of CTP's of Cleistanthus collinus (Roxb.)

	Plant height	Diameter of plant	Grain angle	Bark %	Specific gravity	Fiber length	Cold water	Hot water	Alcohol-benzene	Lignin	Holo cellulose
Plant height	1										
Diameter of plant	0.329	1									
Grain angle	0.517	0.629	1								
Bark %	0.528	0.572	0.628	1							
Specific gravity	-0.292	-0.439	-0.609	-0.539	1						
Fiber length	-0.638	-0.561	-0.813	-0.798	0.703	1					
Cold water	0.614	0.598	0.793	0.743	-0.624	-0.872	1				
Hot water	-0.532	-0.643	-0.819	-0.705	0.585	0.874**	-0.833	1			
Alcohol-benzene	0.517	0.533	0.680	0.691	-0.506	-0.718	0.734	-0.725	1		
Lignin	0.578	0.675	0.856**	0.777**	-0.624	-0.885	0.876**	-0.874	0.808	1	
Holocellulose	-0.600	-0.670	-0.847	-0.751	0.719	0.917**	-0.900**	0.890**	-0.746	-0.934**	1

** significant at 5% level

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