Correlation studies on floral behavior of Chironji populations (*Buchananialanzan* Spreng) from natural forest northern India

ABSTRACT

The research investigation"Correlation studies on floral behavior ofchironji populations (*Buchananialanzan* Spreng) from natural forests in northern India" was conducted during 2022-23 and 2023-24. Survey was carried out across various districts in Uttar Pradesh, Madhya Pradesh, Bihar, and Gujarat, recording latitude and longitude for data collection and identification. Data were collected using minimal descriptors for characterization and evaluation of agri-horticultural crops, following PPV & FRA guidelines.Floral characteristics were recorded in 74 chironji accessions. The colour of fully bloom flower was recorded, 59 accessions noted creamy white with pink tinge, while 15 had creamy white flowers. The average number of flowers per inflorescence ranged from 1,954 to 3,650, with mean of 2,732. The average inflorescence length varied from 14.23 cm to 28.50 cm with mean of 20.23 cm and the average inflorescence width ranged from 15 cm to 34.55 cm with mean of inflorescence with 26.47 cm. The average number of peduncles per inflorescence ranged from 5.50 to 13.50, with mean of 10.00.Significant positive correlations were found among the floral characteristics. The average number of flowers per inflorescence strongly correlated with average inflorescence width ($r = 0.809$, $p < 0.01$) and moderately with the average number of peduncles per inflorescence ($r = 0.543$, $p < 0.01$) and average inflorescence length ($r = 0.476$, $p < 0.01$). The average inflorescence length showed a moderate correlation with average inflorescence width ($r = 0.540$, $p < 0.01$) and a weak correlation with the average number of peduncles ($r = 0.233$, $p < 0.05$). The average inflorescence width had a strong correlation with the average number of flowers per inflorescence and a moderate correlation with the average number of peduncles ($r = 0.453$, $p < 0.01$). The average number of peduncles per inflorescence noted significant positive correlations with other attributes, the strongest being with the average number of flowers per inflorescence ($r = 0.543$, $p < 0.01$).

Comment [MI1]: In the abstract, it is necessary to add the benefits of the flowers to be researched

Keywords- Chironji, flower, peduncles, inflorescenceand correlation

INTRODUCTION

The Chironji (*Buchanania lanzan* Spreng.), belongs to the family Anacardiaceae. It is commonly known as 'Chironji or Char' (Srivastava *et al.,* 2024; Banerjee & Bandyopadhyay, 2015).This plant is wildand mostly found in the tropical deciduous forests, northern,western and central India (Siddiqui *et al.,* 2016).In India, trees are distributed in the states of Madhya Pradesh, Bihar, Orissa, Andhra Pradesh, Chhattisgarh, Jharkhand, Gujarat, Rajasthan, Maharashtra and Uttar Pradesh (Malik *et al.,* 2012, Pandey, 1985).Chironji tree is a hardy plant and better thrives well on rocky, gravelly red laterite soils but does not survive under water logged situation(Hemavathy and Prabhankar, 1988).

A tree is a medium-sized deciduous tree that can reach a height of roughly 50 feet(Pandey, 1985).*Buchanania lanzan* flowers from January-March and their colour is greenish-white and the fruits ripen in April and May and remain on the tree for a considerable amount of time(Troup, 1986).It produces fruits that are each filled with a single seed known as chironji, an edible nut. Chironji fruits are collected by hand during April and May after they reach maturity, which takes 4 to 5 months. Before shelling, the greenish-colored skins of the collected chironji fruits must be removed because they turn black during storage(Kumar *et al.,* 2012).Chironji fruit is under uncultivation/underutilized but it has lots culinary and medicinalproperties. Kumar *et al.,* 2012 reported that chironji is a excellent source of oil (52%) and seedsconsists of moisture (3.0%), fat (59.0%), protein (19.0-21.6%), carbohydrate (12.1%), fibre(3.8%), calcium (279.0 mg), phosphorus (528.0 mg), iron (8.5 mg), thiamine (0.69 mg),ascorbic acid (5.0 mg), riboflavin (0.53 mg), niacin (1.50 mg) and also contain 34-47% fattyoil and 650 kcal/100g of kernel as caloric value(Siddiqui *et al.,* 2014).A single tree gives 15-20 kg of fresh fruits without any maintenance, which yields 1-1.5 kg of kernels, which cost roughly 1500–1800 rupees/Kg. The chironji nut has grown to be a significant crop due to its high demand in international markets. As a result, as a means to generate foreign money, the government and industry have shown a strong desire to grow this business through expanding its capabilities for processing and production. (Kumar *et al.,* 2012).

MATERIALS AND METHODS

The present investigation "Correlation studies on floral behavior of wild chironji populations (*Buchanania lanzan* Spreng) from natural forest northern India" was conducted

during 2022-23 &2023-24. A survey of chironji germplasm was done from the different geographical locations in Uttar Pradesh, Madhya Pradesh, Bihar and Gujrat particularly in the districts of Chitrakoot, Lalitpur,Satna, Katni, Burhanpur, West Champaran, Rohtas, Dahod and Panchmahal. Latitude and longitude was noted for the generation of passport data and further identification of the collection site.Floral characters were observed as flower colour, average number of flower per inflorescence, average inflorescence length, average inflorescence width and average number of peduncles per inflorescence.Morphological characterization was done using "minimal descriptors for characterization and evaluation of agri-horticultural crops (Part I), developed by National Bureau of Plant Genetic Resources, New Delhi **(Mahajan *et al.*, 2000)** and Guidelines for the Conduct of Test for Distinctiveness, Uniformity and Stability on chironji (*Buchanania lanzan* Spreng.) developed by PPV & FRA.

RESULTS AND DISCUSSION

The colour of fully bloom flower was recorded in 74 chironji accessions, 59 accessions were of creamy white with pink tinge and 15 accessions were of Creamy white (Table 1). Similarly, Chauhan *et al.* (2012) recorded small bisexual greenish white flowers of chironji. The number of flowers per inflorescence among the 74 chironji accessions varied from 1,954.06 to 3,650.10 with mean 2732.14 (Table 1). The maximum number of flowers per inflorescence (3650.10) was recorded in accession BUAT-C-35 followed by BUAT-C-45, BUAT-C-46, BUAT-C-54 and BUAT-C-56 while, the minimum number (1954.06) was recorded in accession BUAT-C 61.Bhantnagar and Kumari (2023) reported a single panicle bears about 3000 – 5000 flowers in chironji. The average inflorescence length of the 74 selected accessions ranged from 14.23 cm to 28.50 cm with mean of 20.23cm (Table 1). The longest inflorescence (28.50 cm) was recorded in accession BUAT-C 35, followed by BUAT-C-45, BUAT-C-46, BUAT-C-54 and BUAT-C-56 whereas; the shortest (14.23 cm) was noted in accession BUAT-C-16. Average inflorescence width data presented in Table 1 reveal that the 74 accessions ranged varied from 15cm to 34.55cmwith mean of inflorescence width 26.47cm.Maximum inflorescence width (34.55 cm) was recorded in accessions BUAT-C-35 followed byBUAT-C-45, BUAT-C-46, BUAT-C-54 and BUAT-C-56 while, the minimum width (15.0 cm) was noted in BUAT-C 11. The average number of peduncles per inflorescence in the 74 chironji accessions varied from 5.50 to 13.50 with mean 10.00cm (Table 1). The maximum number of peduncles per inflorescence (13.50) was recorded in accessions BUAT-C-35followed by BUAT-C-45, BUAT-C-46, BUAT-C-54 and

BUAT-C-56 whereas; the minimum (5.12) was noted in accession BUAT-C 8.Sushrut (2003) recordedthe highest panicle length recorded in KCS-43 (24.33 cm), followed by KCS-14 (22.07 cm) and KCS-49 (20.50 cm), with a mean panicle length of 14.64 cm. The lowest panicle length was in KCS-13 (9.17 cm). The highest panicle breadth was recorded in KCS-2 (29.67 cm), followed by KCS-25 (24.50 cm) and KCS-14 (24.50 cm), with a mean panicle breadth of 18.23 cm. The lowest panicle breadth was in KCS-8 (8.60 cm). The highest number of peduncles was recorded in KCS-1 (12.67), followed by KCS-1 and KCS-2 (11.33) with a mean of 5.34 peduncle. The lowest number of peduncle was in KCS-7 (3.33).

Table: 1. Floral characters of chironji genotypes

S. No	Accession No.	Long./Lat	District	Flower colour	A.F./I.	A.I.L.	A.I.W.	A.P/I
1	BUAT- C -1	N 25*05.81'/E081*10.30	Chitrakoot	Creamy white with pink tinge	2900.20	19.21	27.12	12.00
2	BUAT- C-2	N 25*05.81'/E081*10.30	Chitrakoot	Creamy white with pink tinge	2900.50	23.25	31.75	12.22
3	BUAT- C-3	N 25*05.81'/E081*10.30	Chitrakoot	Creamy white	2300.25	22.42	30.50	8.45
4	BUAT- C-4	N 25*05.81'/E081*10.30	Chitrakoot	Creamy white with pink tinge	3280.23	18.30	27.50	12.21
5	BUAT- C-5	N 25*05.81'/E081*10.30	Chitrakoot	Creamy white	3040.70	14.50	23.18	10.50
6	BUAT- C-6	N 25*05.81'/E081*10.30	Chitrakoot	Creamy white with pink tinge	3300.34	23.25	30.10	11.35
7	BUAT- C-7	N 25*17.57'/E080*37.86	Chitrakoot	Creamy white with pink tinge	2433.04	16.24	21.75	11.25
8	BUAT- C-8	N 25*17.57'/E080*37.86	Chitrakoot	Creamy white with pink tinge	2100.15	19.75	20.71	5.12
9	BUAT- C-9	N 25*17.57'/E080*37.86	Chitrakoot	Creamy white with pink tinge	2800.22	14.46	30.53	9.43
10	BUAT- C-10	N 25*17.57'/E080*37.86	Chitrakoot	Creamy white with pink tinge	2633.08	17.12	18.57	11.71
11	BUAT- C-11	N 25*05.81'/E081*10.30	Chitrakoot	Creamy white	2266.14	16.51	15.00	9.53
12	BUAT- C-12	N24*54.53'/E080*56.01	Satna	Creamy white	2433.50	16.00	21.25	7.58
13	BUAT- C-13	N23*38.01'/E080*19.68	Chitrakoot	Creamy white with pink tinge	2593.50	17.50	21.14	12.65
14	BUAT- C-14	N24*54.53'/E080*56.01	Satna	Creamy white with pink tinge	2943.18	14.51	26.54	9.44
15	BUAT- C-15	N24*54.53'/E080*56.01	Satna	Creamy white with pink tinge	2623.06	18.11	23.34	11.21
16	BUAT- C-16	N24*36.52'/E083*49.21	West Champaran	Creamy white with pink tinge	2963.14	14.23	27.50	10.70
17	BUAT- C-17	N 24*64.433'/E078*36.162'	Lalitpur	Creamy white with pink tinge	2236.30	18.52	23.23	10.26
18	BUAT -C-18	N 24*64.433'/E078*36.162'	Lalitpur	Creamy white	2297.16	19.13	25.75	8.50
19	BUAT -C-19	N 24*64.433'/E078*36.160'	Lalitpur	Creamy white with pink tinge	2800.41	20.43	27.32	7.54
20	BUAT- C-20	N 24*64.430'/E078*36.155'	Lalitpur	Creamy white with pink tinge	2553.75	20.50	23.25	9.74
21	BUAT -C-21	N 24*64.424'/E078*36.150'	Lalitpur	Creamy white with pink tinge	2633.88	17.60	23.52	9.56
22	BUAT- C-22	N 24*64.431'/ E078*36.162'	Lalitpur	Creamy white with pink tinge	3330.15	26.12	33.66	11.56
23	BUAT- C-23	N 24*64.428'/E078*36.174'	Lalitpur	Creamy white with pink tinge	3200.90	23.55	31.52	8.73
24	BUAT- C-24	N 24*64.429'/ E078*36.160'	Lalitpur	Creamy white with pink tinge	2320.23	17.50	22.43	7.25
25	BUAT -C-25	N 24*64.431'/E078*36.150'	Lalitpur	Creamy white with pink tinge	2990.23	17.77	26.75	10.10
26	BUAT -C-26	N 24*64.432'/E078*36.171'	Lalitpur	Creamy white with pink tinge	2400.95	20.25	25.75	12.12
27	BUAT -C-27	N 24*64.432'/E078*36.171'	Lalitpur	Creamy white with pink tinge	2654.95	21.78	25.34	12.23
28	BUAT -C-28	N 24*64.433'/E078*36.160'	Lalitpur	Creamy white with pink tinge	3020.87	20.91	26.75	10.50
29	BUAT -C-29	N 24*64.425'/E078*36.140'	Lalitpur	Creamy white with pink tinge	3100.07	15.56	33.32	11.22
30	BUAT -C-30	N25*08.51.70/E080*19.337	Chtrakoot	Creamy white with pink tinge	2333.79	18.14	22.52	12.50
31	BUAT -C-31	N23*25.003/E080*08.705	Chtrakoot	Creamy white with pink tinge	2266.90	17.65	21.89	9.13
32	BUAT -C-32	N23*38.015/E080*19.689	Chitrakoot	Creamy white with pink tinge	2133.56	16.22	21.25	9.25
33	BUAT- C-33	N24*38.042/E 80*19.667	Satana	Creamy white	2793.66	18.50	26.43	11.17
34	BUAT- C-34	N23*38.496/E080*18.929	Satana	Creamy white with pink tinge	2243.44	15.54	22.11	8.75
35	BUAT- C-35	N23*38.042/E080*19.663	Satana	Creamy white with pink tinge	3650.10	28.50	34.55	13.50
36	BUAT -C-36	N24*55.528/E080*52.454	Satana	Creamy white	2483.60	15.60	24.52	11.75
37	BUAT -C-37	N24*55.277/E080*19.629	Satana	Creamy white with pink tinge	2936.25	19.54	30.25	9.50
38	BUAT -C-38	N23*38.043/E080*19.624	Satana	Creamy white with pink tinge	3097.43	20.43	31.56	8.00

39	BUAT -C-39	N24*54.530/E080*56.013	Satna	Creamy white with pink tinge	2410.98	19.12	25.44	9.50
40	BUAT -C-40	N25*.505/E080*47.966	Satana	Creamy white with pink tinge	2693.85	20.50	28.25	6.75
41	BUAT -C-41	N24*36.22/E083*49.454	Rohtas	Creamy white with pink tinge	2033.76	19.60	22.61	6.75
42	BUAT- C-42	N24*36.528/E083*49.21	Rohtas	Creamy white with pink tinge	2940.37	22.50	30.75	10.50
43	BUAT -C-43	N24*36.528/E083*49.21	Rohtas	Creamy white with pink tinge	3300.27	26.20	30.24	8.25
44	BUAT -C-44	N23*38.700/E080*19.337	Katni	Creamy white	2620.40	20.45	23.50	6.00
45	BUAT -C-45	N23*38.003/E080*19.705	Katni	Creamy white with pink tinge	3560.77	28.34	34.44	13.25
46	BUAT -C-46	N23*38.015/E080*19.689	Katni	Creamy white with pink tinge	3500.12	27.55	34.21	13.20
47	BUAT -C-47	N23*38.042/E080*19.667	Katni	Creamy white	2754.99	24.50	25.75	9.50
48	BUAT -C-48	N23*38.496/E080*18.929	Katni	Creamy white with pink tinge	2520.55	23.75	27.50	9.75
49	BUAT -C-49	N23*38.042/E080*19.663	Katni	Creamy white with pink tinge	2700.56	20.53	30.23	10.50
50	BUAT -C-50	N23*38.512/E080*18.876	Katni	Creamy white	2233.85	21.52	20.25	8.00
51	BUAT -C-51	N23*38.031/E080*19.629	Katni	Creamy white	2066.58	18.71	19.24	7.75
52	BUAT -C-52	N23*38.043/E080*19.624	Katni	Creamy white with pink tinge	2233.35	19.50	24.50	8.25
53	BUAT -C-53	N23*38.044/E080*19.618	Katni	Creamy white with pink tinge	2755.65	22.25	28.10	10.50
54	BUAT -C-54	N 22*32.339'/E074*07.739'	Dahod	Creamy white with pink tinge	3430.35	27.25	34.18	13.10
55	BUAT -C-55	N 22*32.106'/E074*07.811'	Dahod	Creamy white with pink tinge	2980.26	19.50	33.25	11.25
56	BUAT -C-56	N 22*48.667'/E073*37.144'	Panchmahal	Creamy white	3400.21	26.25	33.75	12.75
57	BUAT -C-57	N 22*48.387'/E073*37.216'	Panchmahal	Creamy white with pink tinge	2870.47	24.50	29.75	10.50
58	BUAT -C-58	N 22*48.383'/E073*37.207'	Panchmahal	Creamy white with pink tinge	3297.36	18.21	31.50	11.22
59	BUAT -C-59	N 22*48.371'/E073*37.204'	Panchmahal	Creamy white	2870.56	22.12	24.12	8.55
60	BUAT -C-60	N 22*41.573'/E073*31.579'	Panchmahal	Creamy white with pink tinge	2893.45	21.50	26.54	9.50
61	BUAT -C-61	N 22*41.573'/E073*31.578'	Panchmahal	Creamy white with pink tinge	1954.06	19.14	21.66	11.00
62	BUAT -C-62	N 22*41.558'/E073*31.582'	Panchmahal	Creamy white with pink tinge	2950.65	19.24	27.22	10.21
63	BUAT -C-63	N 22*41.597'/E073*31.554'	Panchmahal	Creamy white with pink tinge	3090.67	20.25	33.44	12.20
64	BUAT -C-64	N 22*41.573'/E073*31.581'	Panchmahal	Creamy white with pink tinge	2900.25	18.28	27.15	11.25
65	BUAT -C-65	N 22*41.578'/E073*31.541'	Panchmahal	Creamy white with pink tinge	2330.65	22.15	24.25	8.65
66	BUAT -C-66	N 22*41.582'/E073*31.563'	Panchmahal	Creamy white with pink tinge	2960.54	20.50	31.12	9.26
67	BUAT -C-67	N 22*41.600'/E073*31.557'	Panchmahal	Creamy white with pink tinge	2473.75	25.27	22.50	8.45
68	BUAT -C-68	N 22*41.600'/E073*31.557'	Panchmahal	Creamy white with pink tinge	2860.35	19.22	27.75	10.73
69	BUAT -C-69	N 22*31.389'/E074*07.900'	Dahod	Creamy white with pink tinge	2840.24	24.25	31.14	11.26
70	BUAT -C-70	N 22*48.371'/E073*37.204'	Dahod	Creamy white with pink tinge	2500.90	22.51	20.23	9.50
71	BUAT -C-71	N 22*41.692'/E073*31.598'	Dahod	Creamy white with pink tinge	2266.96	16.25	19.50	8.22
72	BUAT -C-72	N 22*48.371'/E073*37.204	Burhanpur	Creamy white	2463.57	18.65	21.50	6.54
73	BUAT -C-73	N 22*48.371'/E073*37.204	Burhanpur	Creamy white	2593.35	20.25	24.31	8.51
74	BUAT- C-74	N 22*48.371'/E073*37.204	Burhanpur	Creamy white with pink tinge	2933.80	21.34	28.50	10.75
	Mean			-	2732.14	20.23	26.47	10.00
	SE±			-	46.58	0.40	0.53	0.22
	Coeff. Var. %			-	14.66	16.98	17.26	18.64

A.F./I.= Average number of Flower/Inflorescence, A.I.L.=Average inflorescence length (cm), A.I.W.=Average inflorescence width (cm) and A.P/I=Averagenumber ofpeduncles/inflorescence.

Table 2 Correlation matrix of various floral characters of chironji

Characters	A.F./I.	A.I.L.	A.I.W.	A.P/I
A.F./I.	1			
A.I.L.	0.476**	1		
A.I.W.	0.809**	0.540**	1	

Comment [MI2]: It is necessary to add pictures of flowers and varieties of flower types to be researched

A.P/I	0.543**	0.233*	0.453**	1

A.F./I.= Average number of Flower/Inflorescence, A.I.L.=Average inflorescence length (cm), A.I.W.=Average inflorescence width (cm) and A.P/I=Average number of peduncles/inflorescence.

Correlation for floral characters of chironji genotypes

The relationship between chironji flower characters shows positive correlations with each other. The attribute average number of flower/inflorescence exhibits a strong positive correlation with average inflorescence width (cm) ($r = 0.809$, $p < 0.01$), indicating a robust relationship between these two attributes. Additionally, average number of flower/inflorescence has a moderate positive correlation with the average number of peduncles/inflorescence ($r = 0.543$, $p < 0.01$) and a similar moderate correlation with average inflorescence length (cm) ($r = 0.476$, $p < 0.01$). This suggests that average number of flower/inflorescence is significantly interlinked with these attributes.

The attribute average inflorescence length (cm) is moderately correlated with average inflorescence width (cm) ($r = 0.540$, $p < 0.01$), indicating a meaningful relationship between these two. However, its correlation with the average number of peduncles/inflorescence is relatively weak ($r = 0.233$, $p < 0.05$), though it remains statistically significant, indicating some level of association.

Furthermore, average inflorescence width (cm) not only has a strong correlation with average number of flower/inflorescence but also a moderate positive correlation with the average number of peduncles/inflorescence ($r = 0.453$, $p < 0.01$), underscoring its importance in the association of attributes. Finally, the average number of peduncles/inflorescence shows significant but varying degrees of positive correlations with the other attributes, with the strong being with average number of flower/inflorescence ($r = 0.543$, $p < 0.01$) respectively.

Reference

Comment [MI3]: The references that have been compiled are not complete, it is necessary to add several more references as many as 50 references to maximize the discussion of this manuscript.

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