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Morphological variability and character assessment in mulberry hybrid (Kajli x Viswa)

KEYWORDS: Mulberry, kajli, viswa, hybrids

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ABSTRACT *Breeding of mulberry is a herculean task and mixing and fixing of characters is still more complicated due to its heterozygous and cross pollinated nature. Crossing between the varieties is a routine process and evolving a new variety which surpasses and possess favorable traits superior to parents is of paramount importance. Kajli - a female parent crossed with male counterpart Viswa and the resultant First Generation Hybrids showed considerably important variations in characters and was found FH-1>FH-2>FH-3>FH-4. Growth and propagation parameters were encountered showing morphological improvement over the kajli and with varied modification in sex expression in different seasons in hybrids. Surprise observation was presence of lobed and unlobed leaves in alternate nodes in FH-4 hybrids. Kajli which completely possess lobed leaves, diploid in nature and viswa-a diploid with unlobed leaves.*

INTRODUCTION

Silkworm *Bombyx mori* L. is a monophytophagus insect which feeds exclusively on the mulberry leaves. Increased production mulberry result in maximum volume of rearing which helps in the production of highest silk per hectare of land. These can be achieved through systematic breeding programme.

Qualitative quantity of the mulberry leaves is the need of the and attention has been drawn to improve the leaves with more protein, carbohydrate and moisture required for the easy assimilation of silkworm. Unlike sericulturally advanced countries like China, Korea and Japan where number of seasonal and regional varieties of mulberry are available with maximum production of mulberry leaves and India, through both indigenous and exotic varieties are available in large numbers, the genotypes differ from one or the other morpho-economic traits. Fugundez and Izco, (2011),. Kaya *et al.*,(2011) and Menon and Srivastava, (1984) worked on the morphologies, leaf yield and biomass production and opined that commercial exploitation in different agro-climatic regions of India by identifying certain intrinsic characters for mulberry improvement programme.

Materials and methods:

Mulberry varieties *viz,* kajli and viswa procured from Karnataka state sericulture and development institute (KSSR&DI), Thalaghattapura, Bangalore and varieties are authenticated by the institute. Kajli is highly lobed, branches very thin and short and belongs to *Morus indica* L. diploid in nature, yield of variety is poor but could resist drought and disease conditions (Amitabha sarkar, 2005).

Crossing between kajli (Female) and viswa (Male) was conducted in germplasm bank, V V Pura College of science, K.R.Road, Bangalore-4. When the female inflorescence bloom, male inflorescence is placed on the female inflorescence and tied with a thin thread. The inflorescence was covered with butter bags to avoid contamination. After a gap of one month, ripened fruits were harvested, seeds extracted and dried in shade for 2 days. Seed sowed in pots and allowed to grow for six months and three replications were maintained. Control seeds of kajli and viswa separately potted for comparison. Four morphological superior genotypes were selected from the seedlings and named First hybrid-1 (FH-1), FH-2, FH-3 and FH-4 and grown for two years (12 pruning). Data recorded was compared with the control.

Stomatal number and frequency was determined by adopting nail polish impression method. Light pink colored nail polish was smeared on the biaxial surface of tender leaves and allowed to dry for 10-15 minutes. Later nail polish was carefully peeled off and observed under the microscope using 40 x magnifications.

Result and discussion

Two mulberry varieties viz, kajli and viswa crossed through and vagaries of morpho- anatomical and sex expression were observed. Data of hybrids recorded exhibited intermixing of characters, variation in morphological characters such as sprouting, number of branches, intermodal distance, flower traits, stomatal frequency were recorded.

All the selected hybrids showed semi-erect branches compared to kajli which signifies spreading type and viswa possesses only erect type. Unlobed condition observed in all the hybrids and kajli and viswa varieties have lobed and unlobed leaves respectively (Table-1)

Table-2 indicated the number of branches and FH-2 and FH-4 has 20 and 18 branches respectively and 16 branches in FH-3 and FH-1 compared to kajli (37) and viswa (13). Branches performed in hybrid found to be better compared to viswa and although kajli has many number of branches, the leaves are highly dissected. More number of nodes per meter of shoot increases the number of leaves per meter but this doesn't have any significant contribution on leaf yield as number of nodes per meter was found to be significantly negatively correlated with total length of branches, total shoot weight and leaf area(Singhvi et al.,2000). They also observed that water use efficiency had significant correlation with yield. Number of leaves also drastically increased in the hybrids (Table-2).

Shoot length varied from 148cm-164.67cm in hybrids where as control varieties possessed 131cm² (kajli) and 112cm² (viswa). Weight of the leaves was prominent in hybrids ranged from 59-80gms. Where kajli (18) and viswa (85) recorded the weight of 25 leaves. Another important leaf yield contributing trait of mulberry is the leaf area and was found to be vary from (226-256cm²) compare to control which ranged from 216 – 247 cm².Both lobed and unlobed leaves were observed alternatively in nodes as well as in branches (Fig-5). Mulberry is polygenic in nature and branching pattern is controlled by polygenes (Ramesh et al., 2012). Leaf lobation is common in higher plants and lobation may be due to heterophylly and some plants shift abruptly from juvenile to adult leaf patterns while shift through a more gradual change with successive leaf development (Elmar Gray and Richard E. Gray, 1987).Katsumata (1982) reported that lobed leaf shape dominates the entire or unlobed one. Due to lack of clear cut idea regarding the inheritance pattern of different characters of economic importance, the breeding technique in mulberry is not very directional.

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Blooming of inflorescence was observed in all the seasons in both the hybrids and control. Notable changes observed in the catkin type included only the winter seasons in kajli and viswa exhibited male bisexual (MLBI), male female (MLFL) and female male(FLML) in the above said maintained seasons. Hybrids been altogether different type of catkins and instead of only female catkins, Female Bisexual (FLBI), Female male (FLML), Male Bisexual (MLBI) types of inflorescence were observed in hybrids compared to control. Pollen viability in viswa was 96% compared to hybrids which ranged from 80-90%. Another notable and attracted feature seen in hybrids was lobed and unlobed leaves were developed alternatively even after 12 pruning. Mulberry exhibits high degree of plasticity and Tikader et al.,1999) who reported that during season expression of Male Female Bisexual (MFBI) in Tamilnadu and Berhampore conditions. Thangavelu et al., (1997) opined that sexual polymorphism was observed in Suj-1 which was in conformity with the earlier reports (Table-5). The morphological characters vary slightly from one hybrid to other indicated in figure Plate-1, 2, 3 and 4.

Stomatal frequency is considerably reduced in all the hybrids when compared to Kajli and ranged from 480-556 and stomatal size was least at FH-1(271 µm) and highest at FH-4 (297.33Sq. µm) (Table-4).Susheelamma and Datta (1993) have correlated small stomatal size with moisture retention capacity maintaining high water potential in mulberry. The hybrids with decreased stomatal frequency and size have the capacity to retain water for longer duration with high yield.

Survival percentage in all the hybrids is more than 90% and kajli (81.97%) and viswa (86.67%) indicated better than 90%. More number of leaves observed in hybrids from 34-37 and kajli and viswa possessed 11 and 21 respectively.

Table-1: Data on morphological features of the F1 hybrids

Sl. No.	Morphological features	FH-1	FH-2	FH-3	FH-4
01	Branching nature	Semi - erect	Semi-erect	Semi - erect	Semi - erect
02	Straightness	Straight	Open spreading	Straight	Straight
03	Color of young shoot	Purple green	Grayish green	Green	Green
04	Color of mature shoot	Greenish brown	Greenish brown	Grey green	Greenish brown
05	Phyllotaxy	½	½	½	½
06	Stipule nature	Free lateral	Free lateral	Free lateral	Free lateral
07	Stipule duration	Caducous	Caducous	Caducous	Caducous
08	Lenticels density (No./cm²)	8	6	6	7
09	Lobation type	un lobed	Unlobed	Unlobed	Unlobed/ lobed
11	Leaf color	Green	Dark green	Dark green	Dark green
12	Leaf nature	Homophyllous	Homophyllous	Homophyllous	Homophyllous
13	Leaf surface	Rough	Succulent	Smooth	Smooth
14	Leaf texture	Coriaceous	Chartaceous	Chartaceous	Chartaceous
15	Leaf apex	Caudate	Acuminate	Acuminate	Acuminate
16	Leaf margin	Serrate	Serrate	Dentate	Dentate
17	Leaf base	Cordate	Cordate	Cordate	Cordate
18	Leaf shape	Ovate	Ovate	Ovate	Ovate
19	Leaf length(cm)	23.62	21.61	18.86	19.86
20	Leaf width(cm)	19.06	15.71	13.1	14.1
21	Petiole width	0.43	0.51	0.49	0.41
22	Petiole length (cm)	4.7	5.5	3.5	5.4

Table-2: Showing growth parameters of the F1 hybrids

Sl. No.	Growth parameters	FH-1	FH-2	FH-3	FH-4
01	Number of branches	16	20	16	18
02	Shoot length	164.67	170	150	148
03	Internodal distance(cm)	8.12	7.17	6.68	6.13
04	Weight of 25 leaves (g)	80	78	71	59
05	Leaf area(cm²)	256	247	238	226
06	Petiole weight (g)	0.75	0.557	0.325	0.654
07	Laminar index (%)	87.84	87.49	86.75	84.44
08	Leaf petiole ratio by length	6.45	5.5	4.5	4.7
09	Leaf petiole ratio by Weight	9.67	8.67	8.32	8.88
10	Leaf shoot ratio	2.56	2.04	1.89	1.49

Table-3: Showing propagation characters of F1 hybrids

Sl. No.	Propagation features	FH-1	FH-2	FH-3	FH-4
01	Survival (%)	>90	> 90	>90	>90
02	Number of leaves	37	35	36	34
03	Leaf weight fresh(g)	3.311	4.424	3.756	3.987
04	Shoot length(cm)	174.67	170	150	160
05	Shoot weight (g) Fresh(g)	7	6	5	5
06	Number of roots	16	14	12	`14

Table-4: Showing anatomical features of the F1 hybrids

Sl. no	Anatomical features	FH-1	FH-2	FH-3	FH-4
01	Stomatal size (µm)	271	255.63	274.97	297.33
02	Stomatal frequency(sq µm)	556	480	548	551
03	Leaf thickness(µm)	188.1	183.13	162.11	163.9

Table-5: Showing reproductive characters of the F1 hybrids

Sl. No.	Reproductive characters		FH-1	FH-2	FH-3	FH-4
01	Sex type	summer	FMBI	MLFL	FEML	MFBI
		rainy	FEML	MLFL	FEML	FEML
		winter	FLBI	MLFL	FEML	FLBI
02	Inflorescence length (cm)	Male	3.09	4.84	----	3.09
		Female	3.12	3.28	3.11	3.12
		Bisexual	2.2	4.2	----	2.2
03	Number of flowers	Male	20	50	------	20
		Female	34	20	28	34
		Bisexual	-----	-----	--------	-----
04	Peduncle length (cm)	Male	0.91	1.9	-----	0.91
		Female	1.29	1.48	1.41	
		Bisexual	-----	-----	-----	
05	Stamens length (mm)		2.06	3.03	-----	2.01
06	Anther length (mm)		0.58	0.78	—	0.48
07	Pollen diameter(mm)		-	19.43	-----	-
08	Pollen viability (%)		90	80	—	84
09	Style length (mm)		0.42	0.77	0.62	0.32
10	Stigma	Length	3.72	3.47	3.72	3.71
		Type	Erect	Erect	Erect	Erect
		Nature	Pubescent	Pubescent	Pubescent	Pubescent
11	Fruit	length (cm)	2.31	2.83	2.31	2.31
		width (cm)	1.07	1.09	1.07	1.07
		Color	Black	Black	Black	Black
		Taste	Sweet	Sweet	Sweet	Sweet

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Fig.1: FH-1

Fig.2: FH-2

Fig.3: FH-3

Fig.4: FH-4

Fig.5: FH-5

References:

1. Elmer Gray., Richard E.Gray. 1987. leaf lobation patterns in mulberry. castanea 52 : 216-224.
2. Fagundez,J., Izco,J.2011. Seed morphology and anatomy of the Mediterranean pentamerous species of Erica.Turkish j.Bot,35: 643-651.
3. Fossey, A. 2009.Epigenetics beyond genes. South. For. 71: 121-124.
4. Goldschmidt,E.2004. plant grafting: new mechanisms and implications. Front plant sci, 5:727
5. H.L.Ramesh, V.N.Yoganandamurthy., Munirajappa.2011. Cochicine induced morphological variation in mulberry variety M5.The Bioscan 6(1):115-118.
6. Kaya, A., Unal,M.,Ozgokce,F.,Dogan,B., Martin,E.2011.Fruit and seed morphology of six species previously placed in Malcolmia in Turkey and their taxonomic value. Turkish Journal of Botany, 35:653-662.
7. Laltanmawii., Roychowdhuri, S. 2010 Effects Of Chromosomal Variations On Morphology And Leaf Anatomical Behaviours In Mulberry (morus spp.). Journals Of Crop And Weed. 6(2): 35-39
8. Lang, A.1965. physiology of flower initiation" in encyclopedia of plant physiology, vol.1115, springer.
9. Menon,KKG., Srivastava, H.C.1984. Increasing plant productivity through photosynthesis. Proceedings of Indian National Academy of Sciences, 93:359-365.
10. Mudge, K., Jamick,J.,Swfield, S., Goldschmidt, E.E. 2009. History of grafting. Hort.review,35: 437-493.
11. Nderitu Wangari Peris. 2014. Morphological Characterization Of Mulberry (Morus Spp.) Accessions Grown In Kenya. Sustainable Agriculture Research; vol.3, No 1;
12. Pheasant,J.H., Clarke,J.D.1991. secondary sciences for tropical schools. University of London ,4:8-49.
13. Pratap. 1990. Regeneration of plantlets from the callus of the stem segments of mature plants of Morus alba. CSR&TI, Berhampure, west Bengal,7 :42-101
14. Spiegelman,Z., Golan, G., Wolf,S.2013. Don't Kill the messenger: long distance trafficking of mRNA movements. Plant sci,213:1-8.

Thangavelu, K., Mukherjee,P., Tikader,A.,Ravindran,S., Goel,A.K., Rao,A.A., Naik,V.G., Sekar,S. 1997.Catalogue on mulberry (Morus spp.)Germplasm. Central Sericultural Germplasm Resource Centre, Hosur, Tamilnadu, India.