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Morphological Characters of Some Exotic Sugarcane Varieties

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Abstract: Six exotic varieties of sugarcane (CP84-1198, CP85-1491, CP88-1165, CP77-400, CP89-846, TCP86-3368) planted at the National Agricultural Research Centre during 1998-99 were described for their morphological characters. All the varieties greatly varied in different characters. Mean leaf length, number of green leaves and width of leaf lamina/blade was different in different varieties. These varieties also differed in leaf sheath colour, carriage, and other leaf characters. Shape of the dewlap, its size and colour, shape of ligule and ligular process or auricle was also different. All the varieties varied in diameter of the stalks, colour of the stalks, shape of internode, bud groove characters, width and colour of growth ring, width and colour of root zone and wax band characters. Ivory markings were present on stalks of all the varieties. All the varieties were similar in bud size, but different in shapes of the bud, some having flanges and some without flanges. Position of the germ pore on the bud was also different in all the varieties.

Key words: Sugarcane, varieties, morphological characters, description

Introduction

Sugarcane varietal development in Pakistan is dependent on the import of fuzz and varieties from cane breeding stations abroad. Almost all the commercial varieties of sugarcane, presently grown in the country, are either direct introduction from the exotic material or selection from the seedlings raised from the imported fuzz (Akhtar, 1999). Sugarcane cultivars being grown at present may deteriorate with the passage of time and therefore, it is imperative to select new varieties with high yielding potential. The use of exotic germplasm for the improvement of sugarcane is an excellent example in genetic improvement of economically important crop species (Martin 1996). A system of scientific description of sugarcane was first developed by Barber (1915). Artschwager (1940) has described in detail the morphology of the vegetative organs of sugarcane. Morphological description of Artschwager (1940, 1948, 1951) Barber (1919), and van Dillewijin (1952) are followed worldwide to describe various parts of different sugarcane varieties. Different sugarcane varieties generally resemble each other in their appearance, but factually each variety has different morphological characters. The characters those are generally influenced by environmental factors are usually quantitative characters as size, number and colour etc. These character are not as valuable in identifying a variety as are stable characters, like shape of vegetative organs (Artschwager 1948), shape and arrangement of various floret parts (Grassl 1956). Many attempts have been made to define the morphological and agricultural characteristics for identification of different sugarcane varieties (Cowgill 1917). These characteristics are size, number and colour of stalks, bud, node and nodal characteristics, ivory markings, splits, bud groove, leaf characteristics, adult root system and underground branching. Some of these characteristics as shape of the cane stalk and lodging of the cane are major constraints in mechanization and in some of the crop management practices. Small round buds, straight cane stalk, lesser leaves with erect lamina, lesser spreading range and smaller blade joint are the qualities which make a variety the most suitable for mechanical cultivation and post-harvest handling (Farooq, 1989).

Materials and Methods

Different sugarcane varieties generally resemble each other in their appearance but are morphologically different. Some of the characters, like colour of the stalk, size and number of stalks, are influenced by the environmental factors. Other characters, like shape of vegetative organs, shape and arrangement of floret parts, are stable characters and are helpful in identifying various cane varieties (Figs. 1, 2, 3, 4, 5, 6).

Sugarcane varieties for the present studies were planted at the experimental field area of the National Agricultural Research Centre, Islamabad during the crop season 1998-99. The crop was planted during September 1998 and harvested during December 1999. Six exotic varieties of sugarcane i.e. CP84-1198, CP85-1491, CP88-1165, CP77-400, CP89-846, and TCP86-3368 were planted in a Randomized Complete Block Design with three replicates. Ten rows, measuring 10 meters each, were planted for each variety in each replicate. Morphological characters of all the varieties were determined when the crop was fully mature aging 12 months. Stalks from the center of each plot were taken for this purpose. Those stalks were taken for morphological characters determination, which were not exposed to the sun. Following morphological characters were determined for each variety. Morphological description of Artschwager (1940), Barber (1919), and van Dillewijin (1952) were followed to describe various parts of all the varieties included in the study.

Stalk: Various morphological characters of the stalk like, colour, shape, thickness, shape of individual joints were recorded from stalks selected from the middle of the field, those were not exposed to the Sun. Shape of internode, presence or absence of ivory markings and bud groove, width of growth ring, root zone and wax band was also determined. Bud shape, size, presence of flanges and germpore characters were recorded from the buds. These characters were noted from the middle portion of the stalk i.e. from the top most joint whose leaf was dried. According to the diameter of the stalk, following classification was made.

Cane or Stalk:

< 2 cm diameter	=	thin
2 – 2.5 cm diameter	=	medium thin
2.5 – 3 cm diameter	=	medium
3 – 3.5 cm diameter	=	mediumthick
> 3.5 cm diameter	=	thick

Table 1: Various leaf morphological characters of six sugarcane varieties

Name of variety		CP84-1198	CP85-1491	CP88-1165	CP77-400	CP89-846	TCP86-3368
Mean leaf length (cm)		171	165	201	173	120	195
Number of green leaves		11	10	10	10	7	12
Leaf lamina blade		3.5	4.2	4.4	4.5	2.4	4.1
Width at its broadest (cm)		narrow	medium	medium	medium	narrow	medium
Leaf sheath colour		Yellowish green	Purplish green	Purplish green	green upper light Brown lower	Purplish yellow	light yellowish green
Leaves	Scanty	*					
	Abundant		*	*	*	*	*
Carriage	Spreading						
	Efect with tips drooping			*	*	*	
	Strictly erect	*	*				*
Top	Open				*	*	
	Compact	*	*	*			*
Leaves	Scarious boarders	*	*	*	*	*	*
	Non-scarious boarders						
Leaf scar	Absent		*	*	*		*
	Present	*				*	
Spines on back of leave	Present			*	*	*	*
	Absent	*	*				

* Represents the character

Table 2: Various leaf morphological characters (Dewlap, ligule and auricle) of six sugarcane varieties

Name of variety		CP84-1198	CP85-1491	CP88-1165	CP77-400	CP89-846	TCP86-3368
Blade joint or dewlap	Shape	Tall-triangular with convex Upper and lower margin Rayada	Squarish-subcrescent dewlap with horizontal upper margin and downward Sloping baseline	Squarish subcrescent dewlap with horizontal upper margin and downward Sloping baseline	Squarish subcrescent dewlap with horizontal upper margin and downward Sloping baseline	Deltoid dewlap with horizontal baseline	Triangular dewlap with horizontal basel margin
	Size	16mm	14mm	10mm	8mm	7mm	10mm
	Colour	Light purplish green	Light purplish dirty green	Purplish dirty green	Light green	Purplish dirty green	Dark green
	Wax	*	*	*	*	*	*
Ligule	Shape	Deltoid (deltoid-w-lozenge)	Deltoid deltoid-w-lozenge)	Deltoid (deltoid-w -lozenge)	Crescent shaped (w-narrow-Lozenge)	Deltoid (deltoid-w-lozenge)	Crescent shaped (w-narrow-lozenge)
Ligular process or auricle	Shape	Ascending-transitional	Deltoid	Dentoid	Ascending transitional	Ascending transitional	Dentoid

*Represents the character

Table 3: Morphological characters of cane stalk (diameter, colour, shape, splits, ivory marking and bud groove) of six sugarcane varieties

Name of variety			CP84-1198	CP85-1491	CP88-1165	CP77-400	CP89-846	TCP86-3368
Cane or stalk	Diameter (cm)		2.36	2.61	2.46	2.40	2.47	2.33
	Colour		medium-thin Light purplish green	medium Purplish green	medium-thin Purplish green	medium-thin Light purplish green	medium-thin Yellowish green	medium-thin Light purplish green and light purplish yellow
Joint or internode	Shape		Cylindrical	Obconodal	Convex-concave	Bobbin-shaped	Cylindrical	Cylindrical
	Splits	Present		*				
		Absent	*		*	*	*	*
Ivory marking or cracky cracks		Present	*	*	*	*	*	*
		Absent						
Bud groove		Long	*		*			
		Short						
		Deep	*					
		Shallow			*			
		Absent		*		*	*	*

*Represents the characters

Table 4: Morphological characters of cane stalk (growth ring, root zone, root eyes and wax band) of six sugarcane varieties

Name of variety			CP84-1198	CP85-1491	CP88-1165	CP77-400	CP89-846	TCP86-3368
Growth ring	Width (mm)		5 wide	3 narrow	3 narrow	3 narrow	11 wide	7 wide
	Colour		Light purplish green	Purplish green	Purplish green	Purplish green	Yellowish green	Purplish light green
	Depressed							
	Swollen		*	*	*	*	*	*
Root zone	Width (mm)		6 narrow	7 narrow	6 narrow	7 narrow	3 narrow	5 narrow
	Colour		Yellowish green	Yellowish green	Dark green	Yellowish green	Yellowish green	Purplish light green
	Depressed		*		*	*	*	
	Swollen			*				*
Root eyes	Regular				*		*	
	Staggered		*	*		*		*
Wax band	Heavy		*	*	*	*	*	*
	Light							
	Constricted		*	*			*	*
	Swollen				*	*		

*Represents the character

Table 5: Bud and germ pore characters of six sugarcane varieties

Name of variety			CP84-1198	CP85-1491	CP88-1165	CP77-400	CP89-846	TCP86-3368
Bud	Size	Diameter	6	6	6	6	6	6.5
		Length (mm)	5	5	4.5	5	5	5
	Shape		Pontagonal	Ovate with wing broadening towards apex	Pentagonal	Pentagonal	Ovate with wing broadening towards apex	Ovate with emerginate wing
	Flangs	Present	*	*		*	*	*
		Absent			*			
Germ pore		Apical	*					
		Sub-apical		*			*	*
		Dorsal			*	*		

* Represents the character

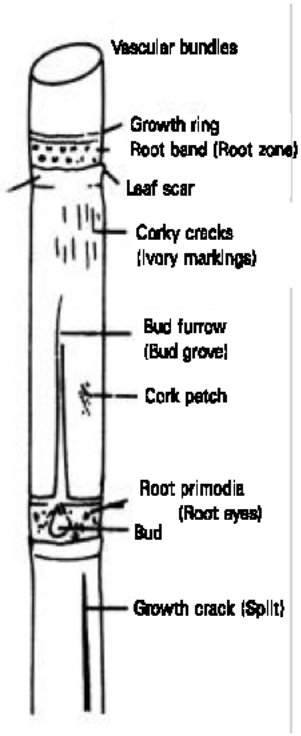

Fig. 1: Node and internode

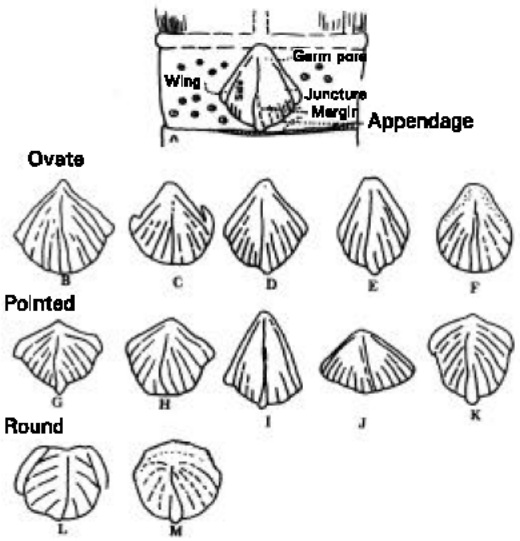

Fig. 2: Structure of root and bud: A root, band and buid; B-F, ovate-shaped buds; B, Ovate with emarginate wings; C, ovate with secondary wings; D, simple ovate; E, narrow ovate; F, ovate with wing broadening towards apex; G-K, pointed buds; G, squat shomboid, H, pentagonal; I, tall deltoid, J, short deltoid; K, squarish pentagonal with wing set high; L-M, round-shaped buds; L, roundish with wings; M, round with central germ pore. (Redrawn and modified classification after Artschwager and Brandes, 1958)

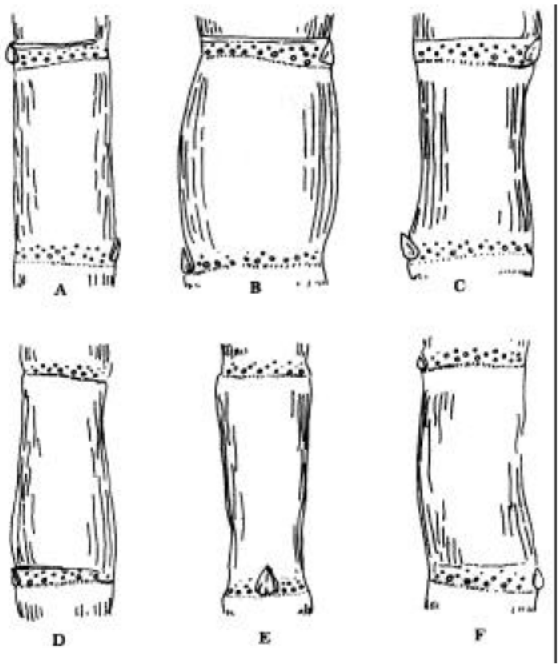

Fig. 3: Types of internodes: A, cylindrical,; B, barrel; C, bobbin-shaped; D, conoidal; E, obconoidal; F, concave-convex

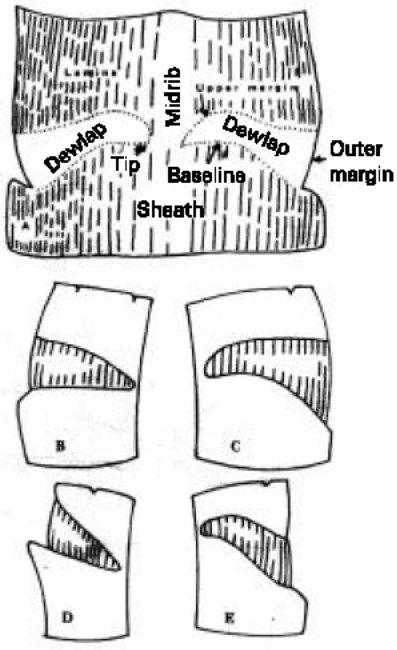

Fig. 4: A, Abaxil side (Outer surface) of a flattened blade joint with dewlaps and adjoining sheath and balde parts; B, deltoid dewlap with horizontal base lines; C, squarish-subcrescent dewlap with horizontal upper margin and downward-slopping baseline; D, deltoid dewlap with downward-slopping base line and upper margin; E, squarish-ligulate dewlap with ascending tip and downward-slopping lower margin

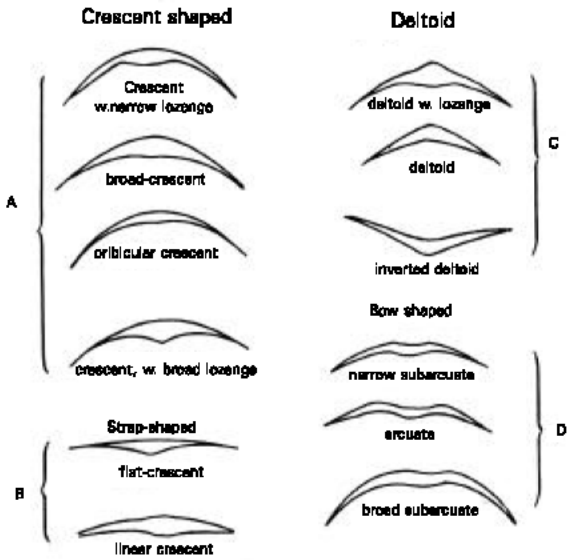

Fig. 5: Types of ligules. A = crescent-shaped, B = strap-shaped, C = deltoid, D = bow-shaped. (After Artschwager and Brandes, 1958)

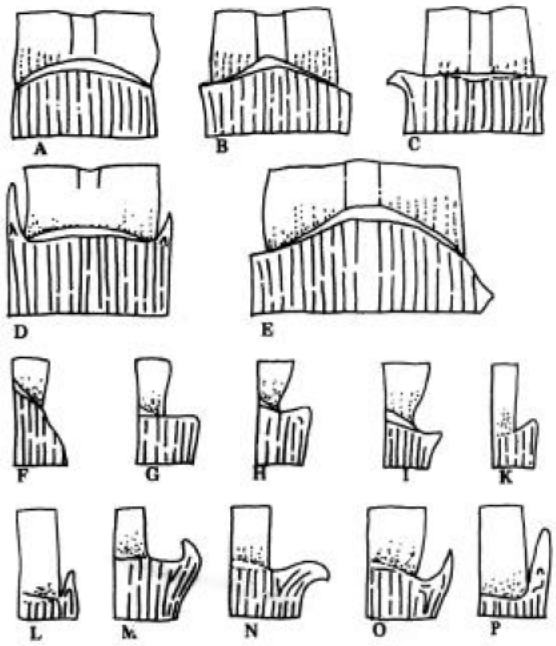

Fig. 6: Types of auricles: A, Auricles absent; B, auricles transitional; C, inner auricle calcarate; D, both auricles lanceolate; E, both auricles transitional but inner one with small deltoid hood inserted low; F, slopping transitional auricle; G, straight transitional; H, ascending transitional; I, dentoid; K, deltoid; L, short lanceloate; M, unciform; N, calcarate; O, falcate; P, long lanceolate. (After Artschwager and Brandes, 1958).

Width of the growth ring was noted as follows:
Growth rings: Width

< 3 mm	=	narrow
3 – 4 mm	=	medium
> 4 mm	=	wide

Width of the root zone was noted as follows:
Root zone: width

6 – 8 mm	=	narrow
>8 mm	=	broad

Leaf: Second green leaf above topmost dry leaf was taken to describe various characters of the leaf.

Leaf Lamina: Mean leaf length, number of green leaves and presence or absence of leaf scar and spines on the back was noted. Colour, size, width at its broadest was noted. Leaf size was classified as follows:

Leaf lamina/blade: Wide at its broadest

Below 4 cm	=	narrow
4-6 cm	=	medium
> 6	=	broad

Leaf sheath: Colour, presence or absence of spines on the back was identified.

Blade joint: Shape of the dewlap, size, colour and presence or absence of wax was determined. Shape of the ligule was also described. Presence or absence of auricles and their shapes were also noted.

Habit or general appearance: The habit, thickness and colour of cane and nature of leaves were noted.

Results and Discussion

Morphological characters of leaf: While describing various morphological characters of leaf, it was noted that all the varieties were different in their mean leaf length. Variety CP 88-1165 had the longest leaves, while the variety CP 89-846 had the shortest leaves (Table 1). Most of the varieties had medium leaf lamina and the colour of the sheath was also different in all the varieties. All the varieties also differed in other characters like carriage, presence or absence of leaf scar and spines on the back of leaves (Table 1). Shape, size and colour of the dewlap was also different in almost all the varieties (Table 2). However presence of wax was observed on the dewlap in all the varieties. Varieties CP 77-400 and TCP 86-3368 had crescent shaped ligule while all other varieties had deltoid ligule. Shape of the ligular process or auricle was deltoid in three varieties and ascending transitional in other three varieties (Table 2).

Morphological characters of cane stalk: All the varieties had medium cane diameter and different stalk colour (Table 3). Shape of the internode differed in various varieties while the splits were present in all the varieties except CP 85-1491 (Table 3). Ivory makings were present in all the varieties. Width of the growth ring and the colour of the growth ring varied in different varieties. Growth ring was swollen in all the varieties. All the varieties had narrow root zone (Table 4). Root eyes and wax band characters also differed in the varieties under study (Table 4). Diameter and the length of the bud was similar in almost all the varieties (Table 5). Shape of the bud was different in different varieties. Flanges on the

buds were present in all the varieties except CP 88-1165. Position of the germpore was also different in all the varieties (Table 5).

There are certain characters those are influenced by the environmental factors and the management of the crop. These characters are size (height and thickness) of the stalk, colour, leaf numbers and their length and width. Other characters are stable characters those are not influenced by the environmental or management factors. Those characters are shape of the stalk, dewlap, bud, auricle and other characters of these parts (Grassl, 1956). Differences in morphological characters of sugarcane varieties have been found by various researchers (Artschwager 1940, 1948, 1951) and Barber, 1919.

Detailed morphological description of all the six sugarcane varieties is presented from table 1 through 5.

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