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DUS CHARACTERIZATION OF SWEET CORN INBREDS UNDER TEMPERATE CONDITIONS

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Abstract

Sweet corn is the result of a naturally occurring recessive mutation in the genes which control conversion of sugar to starch inside the endosperm of the corn kernel. Unlike field corn varieties, which are harvested when the kernels are dry and mature (dent stage), sweet corn is picked when immature (milk stage) and prepared and eaten as a vegetable, rather than a grain. Since the process of maturation involves converting sugar to starch, sweet corn stores poorly and must be eaten fresh, canned, or frozen, before the kernels become tough and starchy. A major challenge facing those involved in the testing of new plant varieties for Distinctness, Uniformity and Stability (DUS) is the need to compare them against all those of 'common knowledge'. Protection of Plant varieties and Farmers Right Act (2001) insists on Distinctness, Uniformity and Stability (DUS) characterization of new varieties and recommends the registration of varieties for any one specific novel character. The present experiment was carried out at Dry Land Agriculture Research Station (DARS), Budgam, SKUAST-Kashmir to evaluate 35 sweet corn (*Zea mays* L. var. *saccharata*) inbreds laid out in Augmented Block Design (ABD) for DUS characterization. The results revealed wide variation in various traits among different sweet corn inbreds. The assessment of 35 genotypes for 31 traits revealed that all the traits were informative with respect to trait expression *cum* characterization.

Key words: Anthesis, DUS, inbreds, Sweet corn, Tassel

Introduction

Sweet corn (*Zea mays* L. var. *saccharata*) is one of the major types of speciality corn used as a vegetable with high sugar content. New varieties of sweet corn have been developed with improved consistency, taste and shelf life through different breeding approaches. The adoption of newer "high sugar or sweeter" varieties with longer shelf life and new sweet corn products have increased sweet corn consumption and have helped to further expand the market. Yield gains due to the genetic improvement have been smaller in sweet corn than in field corn, because the breeders have often focused on improving quality and ear appearance, rather than on enhancing yield (Tracy, 1993). Moreover, all commercial sweet corn hybrids are based on one or more defective endosperm mutants, and production of high quality seed is more difficult for sweet corn than for most types of corn (Tracy, 1994). The new varieties of plants to be released should always fulfil the criteria of distinctness, uniformity and stability as per the guidelines prepared by UPOV. DUS testing is one of the important criteria to test in-bred lines for distinctness, uniformity and stability (Yadav and Singh, 2010). DUS testing of cultivars is one of the requirements for granting Plant Breeders Rights (PBR) granted by PPV& FRA (2001). Morphological traits have been widely accepted in plant variety protection, registration and patenting as their description has been found to be capable of showing both identity and distinctness (Camussi *et al*., 1983). Characterisation of morphological variability also allows breeders to identify accessions with desirable characteristics such as earliness, improved ear traits *etc* and avoid duplication of accessions in germplasm collection. Traditionally, numerous morphological traits have been used to describe inbred lines and hybrid cultivars of Maize (*Zea mays* L.). The aim of the present study was to formulate an identification key and to develop varietal characterization as per the guidelines of PPV & FRA for sweet corn (*Zea mays* var *saccharata*) inbreds in Kashmir region

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Table 1: Frequency distribution of DUS traits in Sweet corn (*Zea mays* L. var. *Saccharata*) inbreds based on DUS descriptor of DMR, ICAR, New Delhi (2011).

Characteristics	Class	Code	AbsoluteNumber	Frequency
Leaf: Angle between blade and stem	Small	3	20	57.14
	Wide	7	15	42.86
Leaf: altitude of blade(on just above upper ear	Straight	1	17	48.57
	Drooping	9	18	51.43
Stem: anthocyanin colouration of brace roots	Absent	1	24	68.57
	Present	9	11	31.43
Tassel: time of anthesis (on middle third of main axis)	very early	1	0	0
	Early	3	0	0
	Medium	5	15	42.85
	Late	7	20	57.15
Tassel: anthocyanin coloration at base of glume	Absent	1	20	57.15
	Present	9	15	42.85
Tassel: anthocyanin colouration of glumes excluding base	Absent	1	15	42.85
	Present	9	20	57.85
Tassel: anthocyanin colouration of anthers	Absent	1	19	54.28
	Present	9	16	45.72
Tassel: density of spikelets	Sparse	3	24	68.57
	Dense	7	11	31.43
Tassel: angle between main axis and lateral branches	Narrow	3	19	54.28
	Wide	7	16	45.72
Tassel: altitude of lateral branches	Straight	1	19	54.28
	Curved	5	16	45.72
	strongly curved	9	0	0
Ear: time of silk emergence(50% plants)	very early	1	0	0
	Early	3	0	0
	Medium	5	15	42.85
	Late	7	20	57.15
Ear: anthocyanin colouration of silks	Absent	1	30	85.71
	Present	9	5	14.29
Leaf: anthocyanin colouration of sheath	Absent	1	18	51.42
	Present	9	17	48.58
Tassel: length of main axis above lowest side branch	Short	3	13	37.14
	Medium	5	18	51.42
	Long	7	4	11.44
Plant: length (upto flag leaf)	Short	3	4	11.44
	Medium	5	12	34.28
	Long	7	19	54.28
Plant: ear placement	Low	3	12	34.28
	Medium	5	23	65.72
	High	7	0	0
Leaf: width of blade(leaf of upper ear)	Narrow	3	13	37.14
	Medium	5	13	37.14
	Broad	7	9	25.72
Ear: length without husk	Short	3	4	11.44
	Medium	5	11	31.41
	Long	7	20	57.15
Ear: diameter without husk	Small	3	21	60
	Medium	5	11	31.41
	Large	7	3	8.59

Characteristics	Class	Code	AbsoluteNumber	Frequency
Ear: shape	Conical	1	19	54.28
	conico-cylindrical	2	7	20
	Cylindrical	3	9	25.72
Ear: number of rows of grains	Few	3	1	2.85
	Medium	5	18	51.42
	Many	7	16	45.73
Ear: type of grain	Flint	1	23	65.72
	Semi flint/semi dent	2	5	14.28
	Dent	3	7	20
Ear: colour of top of grain	White	1	4	11.42
	white with cap	2	3	8.58
	Yellow	3	11	31.41
	yellow with cap	4	14	40
	Orange	5	3	8.59
	Red	6	0	0
	others(specify)	7	0	0
Ear: anthocyanin colouration of glumes of Cob	White	1	32	91.42
	light purple	2	1	2.86
	dark purple	3	2	5.72
Kernel: row arrangement	Straight	1	18	51.43
	Spiral	2	6	17.15
	Irregular	3	11	31.42
Kernel: popiness	Absent	1	2	5.72
	Present	9	33	94.28
Kernel: sweetness	Absent	1	0	0
	Present	9	35	100
Kernel: waxiness	Absent	1	17	48.57
	Present	9	18	51.43
Kernel: opaqueness	Absent	1	34	97.14
	Present	9	1	2.86
Kernel: shape	Shrunken	1	2	5.72
	Round	2	16	45.72
	Indented	3	4	11.42
	Toothed	4	13	37.14
	Pointed	5	0	0
Kernel: 1000 kernel weight	very small	1	0	0
	Small	3	2	5.72
	Medium	5	28	80
	Large	7	5	14.28

of Jammu and Kashmir.

Materials and Methods

The experimental material used for the present study comprised of 35 sweet corn *(Zea mays* L. var. *saccharata*) inbreds viz. BIOL-10, BIOL-41, BIOL-27, ALSC-1, BIOL-18, BIOL-42, BIOL-50, BIOL-61, BIOL-68, BIOL-6, BIOL-3, BIOL-48, BIOL-30, BIOL-65, BIOL-9, BIOL-21, BIOL-33, BIOL-67, BIOL-4, BIOL-69, SC-17-3, BIOL-32, BIOL-17, BIOL-66, BIOL-22, BIOL-51, BIOL-5, BIOL-23, BIOL-62, BIOL-8, BIOL-16, BIOL-70, BIOL-64, BIOL-52, BIOL-40. The trial was laid out in Augmented Block Design (ABD), each inbred was grown within plot of 2 rows of 2 m long with checks replicated thrice. In each plot representative plants were tagged and subsequent observations were recorded on tagged plants. The inbreds were evaluated for DUS characterization at Dry-land Agriculture Research Station (DARS), Budgam, SKUAST-Kashmir during the year 2017-18 by using the descriptor prescribed by Directorate of Maize Research, ICAR, New Delhi (2011). The characters used for DUS characterization consists of 31 traits as per the descriptor. Each trait is represented by class and code. The various characters

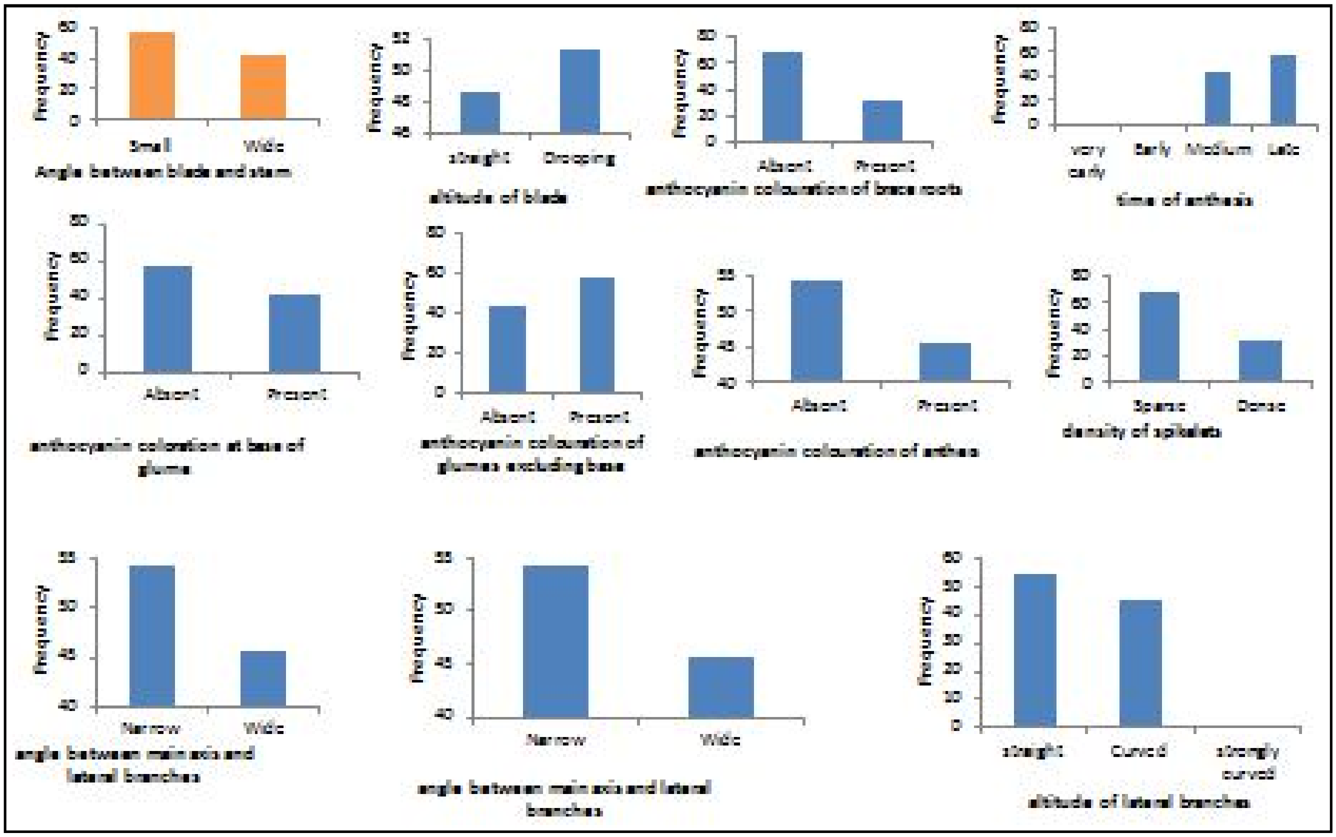

Fig. 1: Graphical representation of frequency distribution og DUS traits.

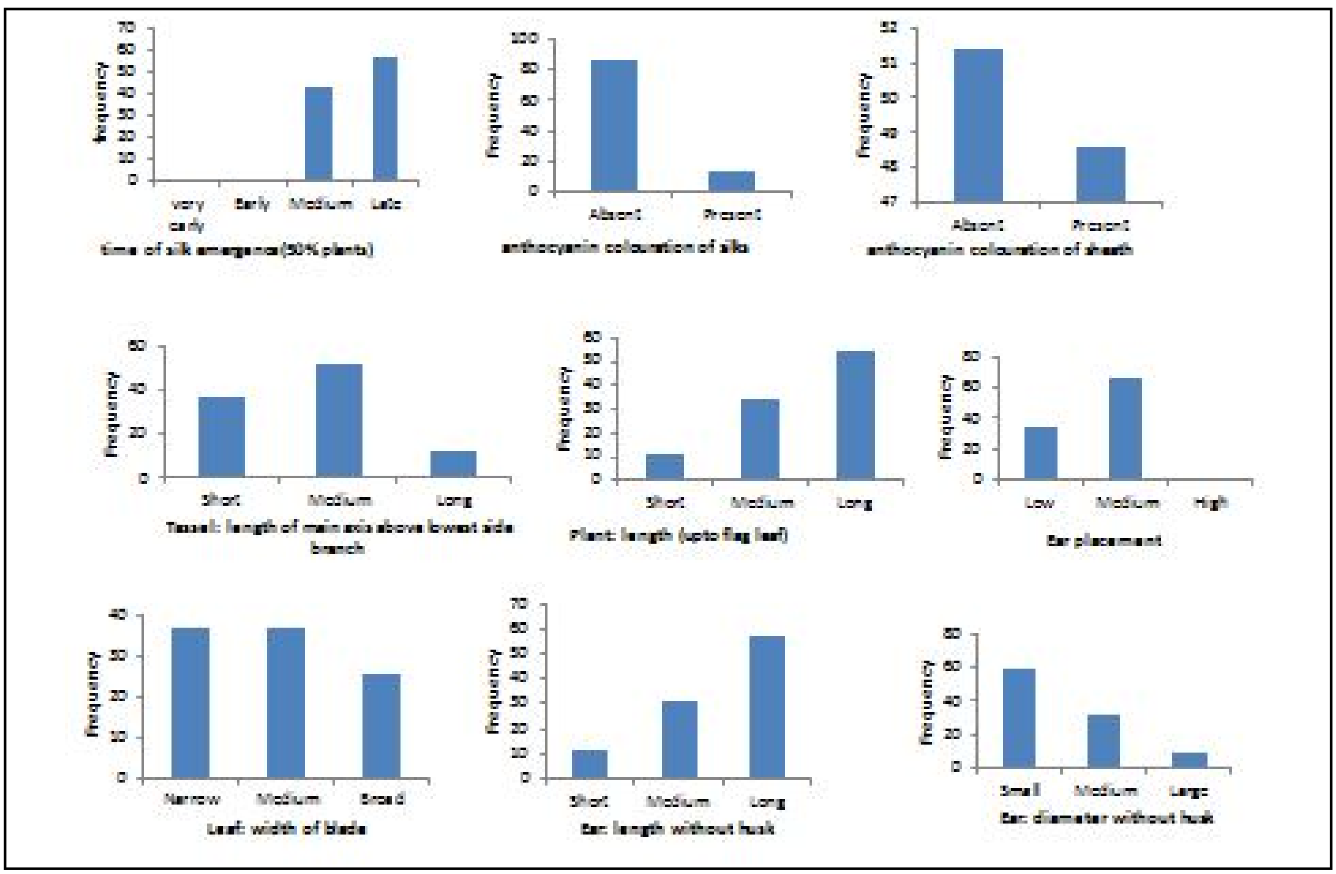

Fig. 2: Graphical representation of frequency distribution og DUS traits.

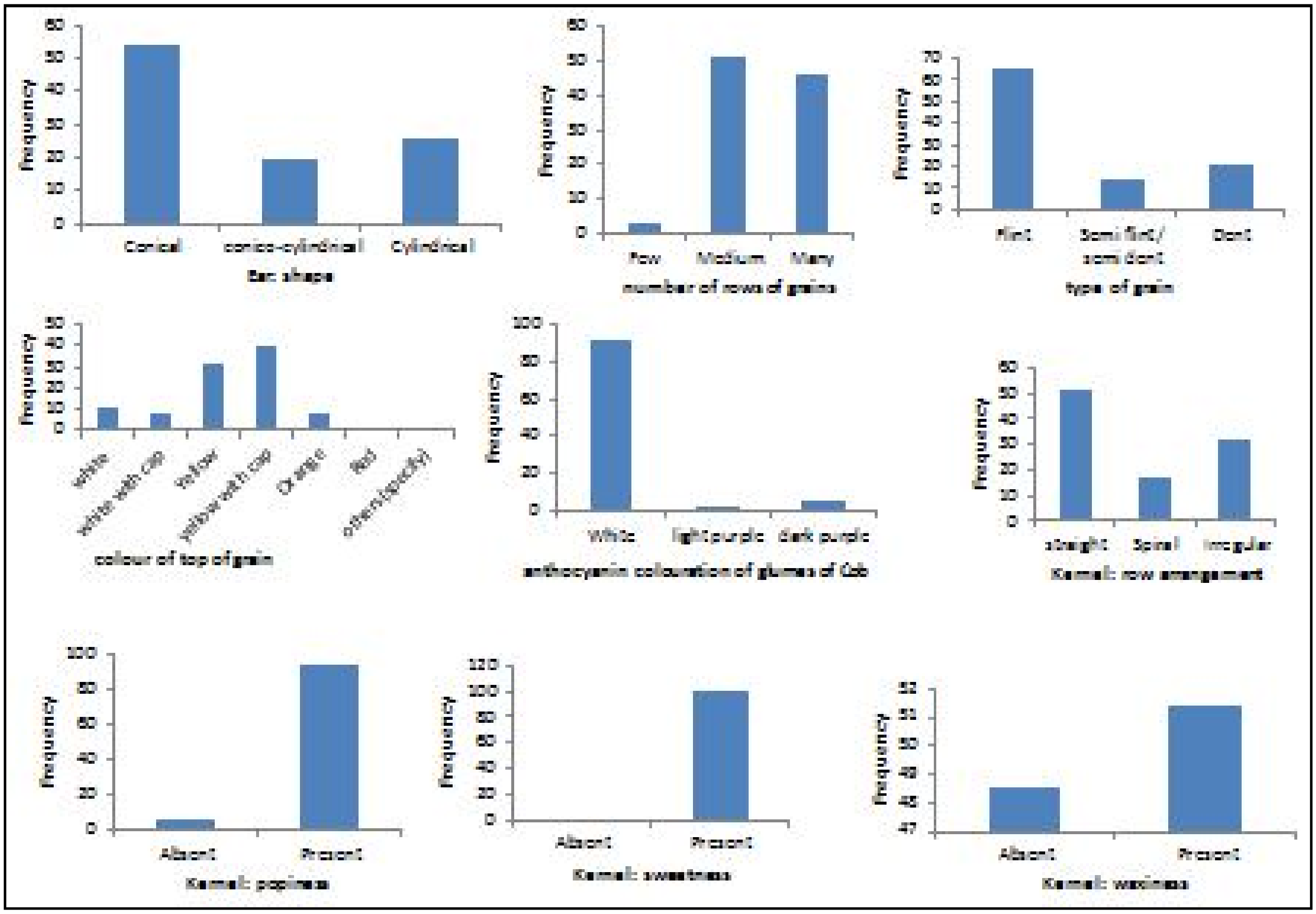

Fig. 3: Graphical representation of frequency distribution og DUS traits.

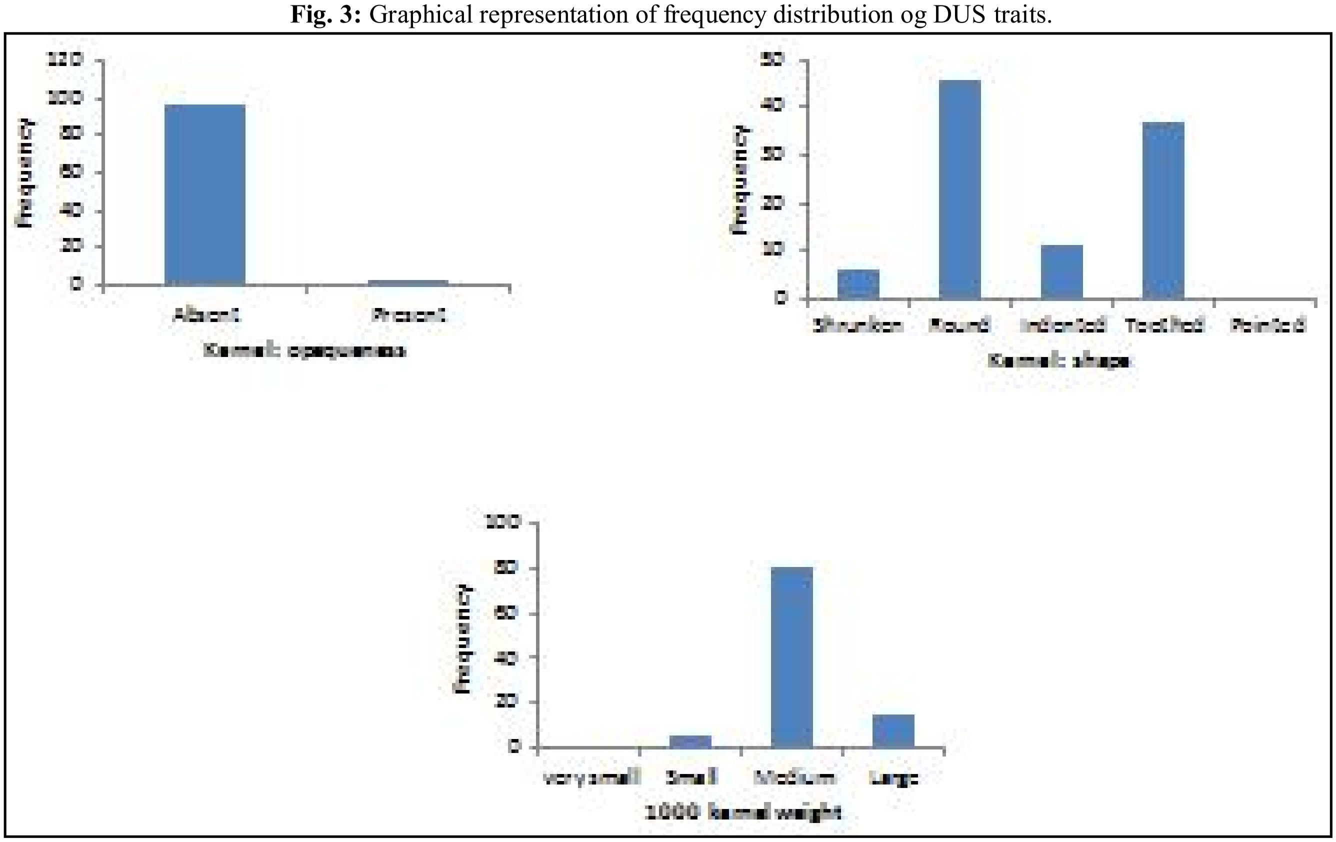

Fig. 4: Graphical representation of frequency distribution og DUS traits.

studied were leaf: angle between blade and stem, altitude of blade and anthocyanin colouration of sheath, stem: anthocyanin colouration of brace roots and width of blade, tassel: time of anthesis, anthocyanin colouration at base of glume, anthocyanin colouration of glumes, anthocyanin colouration of anthers, density of spikelets, angle between main axis and lateral branches, altitude of lateral branches and length of main axis above lowest side branch, ear: time of silk emergence, anthocyanin colouration of silks, length without husk, diameter without husk, shape, number of rows of grains, type of grain, colour of top of grain and anthocyanin colouration of glumes of cob, plant: length upto flag leaf and ear placement, kernel: row arrangement, popiness, sweetness, waxiness, opaqueness, shape and 1000 kernel weight. The characters studied were recorded at proper stages like tassel characters were recorded at 50% tasseling, leaf characters were recorded at full foliage stage, ear characters were recorded after harvest of cobs except for silk emergence which was recorded when 50% of plants have emerged silks, plant height and ear placement were recorded when plants attain maximum height and kernel characters were recorded after harvesting of cobs. The different characters studied were having great impact for selection of superior inbreds for further breeding programmes.

Results and Discussion

The sweet corn indreds evulated for DUS characterization showed wide range of variability with respect to diffrent traits studied. The frequency distribution of DUS characters is presented in table-1. For leaf characters like angle between blade and stem, maximum frequency of 57.14% showed small angle and rest (42.86%) was observed for “wide” state of expression indicating that these inbreds are good water harvesters and could be best used under rainfed conditions, whereas altitude of leaf blade showed maximum frequency (51.43%) for “drooping” state of expression. Anthocyanin colouration of brace roots (68.57 %), tassels (54.28 %.) and silks (85.71%) showed maximum frequency for “absent” state. The density of spikelets on tassels showed maximum frequency (68.57%) for “sparse” state indicated less pollen count on the tassels for maximum inbreds. Time anthesis and silk emergence was found late for maximum genotypes having frequency of 57.15 % for each character**.** The anthesis silking interval (ASI) was found short for maximum genotypes revealed less pollen loss and effective pollination. Plant height was having good amount of variation for all the states, however, maximum frequency was found for “long” state having frequency of 54.28 % indicated higher number of leaves and cobs plant^{-1} for these inbreds. The placement of ears on plants showed maximum frequency for “medium” state having frequency of 65.72 %. The trait ear length without husk recorded wide variability for all states of expression with maximum frequency (57.15%) observed for “long” state. The diameter of cobs without husk showed maximum frequency (60%) for “small” state. The ear traits were evident for higher yield in the sweet corn inbreds taken for present study. Kernel sweetness was present in all genotypes represented by state “present” having 100 % frequency. The kernel shape showed variation for all states however state “round” observed highest frequency of 45.72%. Thousand kernel weight also showed variability for all states with highest frequency (80 %) recorded in “medium” state. The assessment of 35 genotypes for 31 traits revealed that all the traits were informative with respect to trait expression *cum* characterization. The results are in close conformity with the findings of Gupta *et al*. (2015), Madhukeshwar and Sajjan (2015), Pinnisch *et al*. (2012) and Yadav and Singh (2010).

Conclusion

Frequency distribution of traits for DUS characterization of sweet corn inbreds indicated that wide variation existed among different genotypes which could be better utilized in the selection of inbreds based on their specific requirement for further breeding programmes. The diversity among the different inbreds could be utilized for cultivar improvement and germplasm conservation programs aimed at improving productivity in sweet corn.

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