

## Underutilised Plants

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### Research Article

## Underutilised Traditional Loose Flower Crops of Goa with Good Commercial Potential

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### ABSTRACT

Popularity of traditional flowers like Crossandra and Jasmines has come down in Goa due to the advent of modern cut flowers advent and impact of Western culture. Hence a study was conducted to collect and conserve traditional loose flower crops of Goa at ICAR-CCARI. Extensive and systematic surveys were conducted in all talukas of Goa for collection of different *Jasminum* and *Crossandra species*. Materials used for the study consisted of crossandra accessions viz., C-1(Big dark orange), C-2(Ratan-aboli), C-3(light-orange), C-4(bright-yellow) and C-5(dark-orange) and fourteen *Jasminum* accessions belonging to *J.sambac*, *J.auriculatum*, *J.grandiflorum* and *J.multiflorum*. Significant variation was noticed among the accessions of these loose flower crops for various morphological and floral-quality traits. Plant height, leaf length and width, no. of branches/plant, length and diameter of flower, flower stalk length, no. of flowers/month and weight of individual flower in crossandra varied from 25.87cm to 67.49cm, 9.43cm to 11.10cm, 3.03cm to 4.19cm, and 3.00 to 6.24, 3.13cm to 4.67cm, 2.14cm to 4.29cm, 1.91cm to 2.43cm, 90.23 to 153 and 0.02g to 0.11g respectively. Plant height, bud and flower fresh weight, bud diameter and length, bud stalk length, corolla tube length, flower diameter, no. of petals/flower, length and width of petals and flower stalk length in jasmine accessions ranged from 66cm(J-7) to 143cm(J-5), 0.052g(J-5) to 0.563g(J-1), 0.05g(J-5) to 1.37g(J-10), 1.14cm(J-8) to 0.264cm(J-5), 2.54cm(J-6) to 0.85cm(J-5) and 2.30cm(J-14) to 1.08cm(J-8), 2.70cm(J-14) to 0.864cm(J-10), 6.68cm(J-6) to 1.96cm(J-5), 43(J-10) to 5.0(J-1), 0.96(J-5) to 3.50(J-6), 0.32cm(J-5) to 1.74cm(J-4) and 2.80cm(J-14) to 1.10cm(J-10) respectively. Hence accessions of these underutilised flower crops exhibited an implausible diversity with potential floricultural traits.

**Key words:** Accessions, Crossandra, Diversity, Jasmine

### INTRODUCTION

Crossandra and Jasmines are two important underutilised traditional loose flower crops of Goa with good commercial potential. Goa forms a typical part of the west coast ecosystem and is endowed with a wide range of landforms including Ghats,

Marshy lands and Coasts. Goa is blessed with warm humid tropical climate which is very much promising for cultivation of crossandra and Jasmines. Crossandra is an underutilised loose flower crop commonly found in Goa and it belongs to the family Acanthaceae. The flowers are mostly used for hair adornment in the form of garland, either alone or in combination with jasmine flowers. Though not fragrant, flowers are very popular because of its attractive bright colour, light weight and good keeping quality. Using Crossandra flowers in combination with jasmine is becoming increasingly

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popular in India, particularly in southern parts, because the jasmine flowers provide colour contrast and the desired fragrance. Jasmines are cultivated and esteemed for its attractive fragrant flowers, and it belongs to the family Oleaceae. Jasmine flowers are used for making veni, garlands, floral decorations apart from extraction of essential oil. The most common species of Jasmines found in Goa are *Jasminum sambac*, *Jasminum auriculatum*, *Jasminum grandiflorum* and *Jasminum multiflorum* locally called as mogra, jai, jui and kunda respectively. Due to the advent of modern cut flowers and impact of Western culture, the popularity for these traditional loose flower crops has come down in the state of Goa. The rich diversity in present in these traditional flower crops are not properly conserved and developed to a sustainable utilization level due to the lack of scientific management. Well structured research and developmental programmes have to be laid out for crops, not only to conserve the biodiversity but also to broaden the genetic base by breeding programmes and make it a successful venture (Priya Devi *et al.*, 2013). In the present era of modernization and urbanisation, we are in the verge of losing our valuable natural genetic resources in these traditional loose flower crops. A better understanding of genetic diversity and its distribution is essential for its conservation and use (Ramanatha Rao and Toby Hodgkin, 2002). Therefore, efforts should be made for conservation, proper management and research. These underutilised flower crops have a remarkable potential for economic upliftment of the State and sustainable development, however need appropriate management practices. Hence priority should be given for ensuring conservation of local flower crops and utilising them for the sustainable development of floriculture industry. Important and potential genotypes of these underutilised flower crops with commercial traits should be identified, evaluated and characterised. Such a study would be a record to reflect the details of characteristics of the prominent genotypes to represent the broad variability existing in crops of Goa (Desai and Singh, 2011). Hence, with this background, the present investigation on evaluation and conservation of underutilised flower crops of Goa viz., crossandra and jasmine under coastal humid ecosystem of Goa was carried out.

## MATERIAL AND METHODS

To contribute to the conservation and management of diversity in different traditional loose flower crops, the present study was conducted in Goa state during 2009-2016. Extensive and continuous surveys were conducted for collection and conservation of underutilised traditional loose flower crops like Crossandra and Jasmine in a repeatable and systematic manner under the context of conserving the precious germplasm resources of Goa. Field surveys were conducted in all the eleven talukas / zones of Goa namely, Pernem, Bardez, Tiswadi, Bicholim, Ponda, Sanguem, Sattari, Salcete, Mormugoa, Quepem and Canacona running from north to south. The latitude, longitude and altitude of the spot, where the accession is located were recorded using GPS. Seeds of different types of Crossandra viz., Crossandra local (Big dark orange), Crossandra local (Bluish green), Crossandra local (light orange), Crossandra local (light yellow) and Crossandra local dark red (Ratan aboli) were collected from different talukas of Goa and seedlings were raised. Similarly, different Jasmine accessions belonging to *Jasminum sambac*, *Jasminum auriculatum*, *Jasminum grandiflorum* and *Jasminum multiflorum* were collected, identified and were serially numbered from 1 – 14 and used as respective accession numbers.

## OBSERVATION

The details of the 14 jasmine genotypes used and their respective accession numbers in the study are presented in Table 1.

**Table 1 : List of jasmine genotypes used for morphological characterization**

Accession No.	<i>Jasminum sp.</i> / genotype
J - 1	<i>Jasminum grandiflorum</i>
J - 2	<i>Jasminum sambac</i>
J - 3	<i>Jasminum multiflorum</i>
J - 4	<i>Jasminum sambac</i>
J - 5	<i>Jasminum auriculatum</i>
J - 6	<i>Jasminum sambac</i>
J - 7	<i>Jasminum sambac</i>
J - 8	<i>Jasminum sambac</i>
J - 9	<i>Jasminum sambac</i>
J - 10	<i>Jasminum sambac</i>
J - 11	<i>Jasminum sambac</i>
J - 12	<i>Jasminum sambac</i>
J - 13	<i>Jasminum multiflorum</i>
J - 14	<i>Jasminum multiflorum</i>

Further, field study was conducted for evaluation of the collected flower accessions under open field conditions at the Experimental Farm of ICAR– Central Coastal Agricultural Research Institute, Ela, Old Goa. Uniform package of practices was adopted for all the genotypes studied. The material used for the study consisted of five crossandra accessions viz., C-1(Big dark orange), C-2( Bluish green), C-3(light-orange), C-4(light-yellow) and C-5( Ratan Aboli : dark-red) and fourteen local jasmine accessions viz., J-1, J-2, J-3, J-4, J-5, J-6, J-7, J-8, J-9, J-10, J-11, J-12, J-13 and J-14 belonging to *Jasminum sambac*, *Jasminum auriculatum*, *Jasminum grandiflorum* and *Jasminum multiflorum* which were collected from different parts of Goa. District and Taluka wise locations of collected flower accessions under study is presented in Table 2.

**Table 2: District and Taluka wise locations of collected flower accessions under study**

Sl. No	Taluka	Place of collection
<b>North Goa district</b>		
1	Bardez	Aldona, Mapusa, Nadora, Parra, Pomburpa, Revora, Saligao, Sangolda
2	Bicholim	Bicholim, Mayem, Sanquelim, Surla
3	Pernem	Bhutwadi, Dhargal, Ibrampur, Korgao
4	Ponda	Banastrim, Borim, Farmagudi, Kodar, Marcel, Nirangal, Savoi Verem
5	Sattari	Parye, Valpoi
6	Tiswadi	Bambolim, Carambolim, Divar, Goa Velha, Neura, Pilar, Ribandar, Taleigao, St. Inez
<b>South Goa district</b>		
7	Canacona	Baddem, Cotigaon, Gaondongri, Kindalkatta, Nadkem, Ziltawadi, Yedu
8	Mormugao	Cortalim, Chicalim Sancoale
9	Quepem	Morpila, Balli

10	Salcette	Curtorim, Madgaon, Nuvem, Verna
11	Sangem	Malkarnem, Darbandora, Netravali

During the field study, five random plants of each accession were selected and observations were recorded for agro-morphological traits as per the crop guidelines - Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA) of jasmine [Anon., 2015]. Characterization of jasmine germplasm accessions were done according to descriptions which are categorized into four groups viz., General plant growth, leaf, flower bud, flowering and flower characteristics (Table 3).

**Table 3 : Morphological traits recorded in the local accessions of Jasmine**

Traits recorded	Code	Description
<b>General growth characteristics of the plant</b>		
Plant growth type	PGT	Shrub / Climber
Plant growth habit	PGH	Upright/ Semi upright / Intermediate / Spreading / Strongly spreading
Plant height (at flowering)	PH	Short (<45 cm)/Medium (45 to 100cm)/ Tall(>100 cm)
<b>Leaf characteristics</b>		
Leaf Size	LS	Small / Medium / Large
Intensity of green colour (upper side of mature leaf)	IGC	Light / Medium / Dark
Leaf pubescence	LP	Absent / Present
Shape of terminal leaflet blade	STLB	Lanceolate / Elliptic/ ovate

Shape of other leaflet blades	SOLB	Lanceolate / Elliptic / ovate
Leaf tip	LT	Sharp / Medium / Blunt
Shape of base of leaf blade	SBLB	Acute / Obtuse / Rounded / Cordate / Asymmetric
<b>Flower Bud characteristics</b>		
Flower bearing position	FBP	Terminal / Axillary / Both
Boldness of flower bud	BFB	Thin / Medium / Bold
Flower bud shape	FBS	Pointed and Short / Pointed and Long
Flower bud colour	FBC	Pure white / Off white / Yellow / Pink
Tinge on flower bud	TFB	Absent / Present
Flower bud length	FBL	Short (2.0-2.5cm) / Medium ( 2.6-3.0cm) / Long (>3.0cm)
<b>Flowering and flower characteristics</b>		
Flower colour on opening	FCO	Pure white / Off white / Yellow / Pink
Shape of open corolla	SOC	Rounded / Star shaped
Shape of corolla lobe	SCL	Rounded / Lanceolate
Corolla tube length (cm)	CTL	Short (1.0-1.5cm) / Medium (1.6-2.0cm) / Long (> 2.0cm)
Flower petal tip	FPT	Blunt / Sharp

The different jasmine genotypes were tested for various morphological parameters such as Plant growth type, Plant growth habit, Plant height (at

flowering), Leaf size, Intensity of green colour (upper side of mature leaf), Leaf pubescence, Shape of terminal leaflet blade, Shape of other leaflet blades, Leaf tip, Leaf length, Leaf width, Shape of base of leaf blade, Flower bearing position, Flower bud length, Boldness of flower bud, Flower bud shape, Flower bud colour, Tinge on flower bud, Diameter of the flower bud, Total flower bud length, Length of the flower bud, Flower colour on opening, Shape of open corolla, Shape of corolla lobe, Corolla length, Corolla tube length, Flower petal tip, Diameter of the flower, Number of petals per flower, etc. The different accessions of crossandra were tested for plant height, length and width of the leaf, number of branches per plant, length and diameter of the flower, length of the flower stalk, number of flowers/ month and weight of individual flower. Data recorded on various morphological and flowering parameters in these underutilised flower crops were statistically analysed following standard procedures as described by Panse and Sukhatme (1978).

## RESULTS AND DISCUSSION

The general statistical parameters for all the traits studied in respect of different crossandra and jasmine accessions showed significant differences in the present study with wide range and high variance for different traits. Variations in morphological, flowering and floral quality traits were observed to a greater extent among different crossandra and jasmine genotypes. The different genotypes of crossandra and jasmine collected, conserved and studied were geographically located in all eleven talukas of Goa in varied elevations.

Plant height, length and width of the leaves, number of branches per plant, length and diameter of flower, stalk length of the flower; number of flowers per month and weight of individual flower in different crossandra accessions were recorded and is presented in Table 4. Variability observed in different accessions of crossandra is illustrated in Fig 1. Plant height of different crossandra accessions under study varied from 18.76 cm to 27.23 cm and 41.24 cm to 67.49cm at one and four months

after planting respectively. Significant variability was recorded with respect to the length and width of the leaf. Among the different accessions of crossandra evaluated, C2 (bluish green crossandra) had the shortest length of leaf (9.43cm) whereas longest (11.10cm) was recorded in C5 (Ratan aboli). The width of the leaf in different crossandra accessions ranged from 3.03cm to 4.19cm. Number of branches in different crossandra accessions ranged from 1.06 to 2.30 and 3.00 to 6.24 at one and four months after planting respectively. Different crossandra accessions under evaluation showed a great variation for the length of the flower. Minimum and maximum flower length was recorded in C5:

Ratan aboli (3.13cm) and C2: bluish green crossandra (4.67cm) respectively. Variations were observed with respect to diameter of flower in different crossandra accessions. The flower diameter in different crossandra accessions ranged from 2.14cm to 4.29cm. The length of the flower stalk was shortest (1.91cm) in C5: Ratan aboli and longest (2.43cm) in C1 (Dark orange). Number of flowers per month was recorded the maximum (153 no's) in C5: Ratan aboli while it was minimum (90.23 no's) in C3 (Light orange). Flowers of C3: light yellow crossandra had the least weight of individual flower (0.02g) whereas the highest weight (0.11 g) was found in C2 (bluish green crossandra).

**Table 4: Vegetative and flower quality traits as influenced by local accessions of crossandra**

Treatments	Plant height (1MAP)	Plant height (4MAP)	Leaf length (cm)	Leaf width (cm)	No.of branches/ plant (1 MAP) (cm)	No.of branches/ Plant (4MAP) (cm)	Length of flower	Diameter of flower	Length of flower stalk	No. of flowers/ month	Weight of individual flower
Dark orange	25.871	64.67	10.97	3.966	1.657	6.243	4.549	3.531	2.434	190.571	0.074
Bluish green	21.457	56.61	9.431	3.030	2.300	4.886	4.669	4.294	2.423	117.857	0.107
Light orange	27.229	67.49	9.564	3.114	1.129	4.857	3.466	2.677	1.983	90.229	0.037
Light yellow	18.757	41.24	10.371	3.757	1.057	3.000	3.443	2.571	1.929	95.571	0.023
Dark red	23.957	58.62	11.100	4.186	1.400	3.429	3.129	2.143	1.914	153.000	0.034
SEm+ <sub>1</sub>	0.911	3.042	0.400	0.185	0.077	0.417	0.045	0.067	0.044	24.085	0.002
CD at 5%	2.733	9.128	1.201	0.554	0.231	1.252	0.134	0.202	0.133	72.256	0.007

Out of different jasmine accessions studied, plant growth types were either shrub or climber and plant growth habit were upright or semi upright or intermediate or spreading or strongly spreading (Table 5). In the present study, comparatively large number of accessions were found to be bushy, which is one of the most desirable growth habit that is preferred for home gardening, landscaping and commercial cultivation. The genetic diversity for



**Figure 1: Variability observed in different collected accessions of crossandra**

general growth characteristics among *Jasminum sambac* and *Jasminum grandiflorum* were analysed earlier using morphological markers by Mukundan *et al.*, 2008. Size of leaf of different jasmine accessions studied was small, medium or large.

Intensity of green colour on upper side of mature leaf was light, medium or dark in the present study. Pubescence was not observed in the leaves of any of the jasmine accessions under study.

**Table 5 : General plant growth and leaf characteristics recorded in the local accessions of Jasmine**

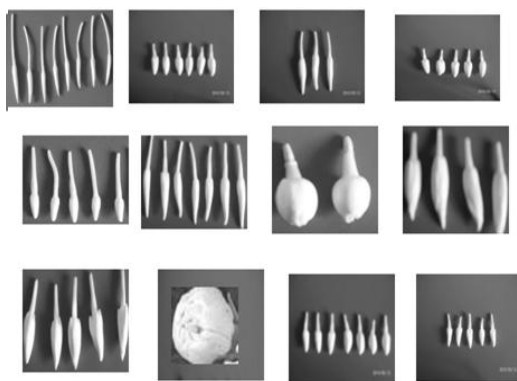
Jasmine accessions	Plant growth type	Plant growth habit	Leaf size	Intensity of green colour	Leaf pubescence	Shape of terminal leaflet blade	Shape of other leaflet blades	Leaf tip	Shape of leaf blade base
J - 1	Shrub	Intermediate	Small	Medium	Absent	Ovate	Elliptic	Medium	Acute
J - 2	Shrub	Semi upright	Large	Medium	Absent	Ovate	Elliptic	Medium	Rounded
J - 3	Shrub	Intermediate	Medium	Dark	Absent	Lanceolate	Lanceolate	Sharp	Obtuse
J - 4	Shrub	Intermediate	Large	Medium	Absent	Ovate	Elliptic	Medium	Acute
J - 5	Shrub	Intermediate	Small	Dark	Absent	Ovate	Elliptic	Sharp	Obtuse
J - 6	Shrub	Intermediate	Large	Dark	Absent	Ovate	Ovate	Medium	Obtuse
J - 7	Shrub	Intermediate	Medium	Dark	Absent	Ovate	Ovate	Medium	Obtuse
J - 8	Shrub	Upright	Large	Medium	Absent	Elliptic	Ovate	Medium	Acute
J - 9	Shrub	Intermediate	Small	Dark	Absent	Ovate	Elliptic	Medium	Obtuse
J - 10	Shrub	Intermediate	Medium	Dark	Absent	Ovate	Ovate	Medium	Obtuse
J - 11	Shrub	Intermediate	Small	Medium	Absent	Elliptic	Elliptic	Medium	Acute
J - 12	Shrub	Spreading	Small	Medium	Absent	Ovate	Elliptic	Medium	Acute
J - 13	Shrub	Spreading	Small	Medium	Absent	Elliptic	Elliptic	Sharp	Rounded
J - 14	Shrub	Spreading	Large	Dark	Absent	Ovate	Ovate	Sharp	Obtuse

The shape of terminal leaflet blade of the different accessions studied ranged from lanceolate, elliptic and ovate with sharp or medium or blunt leaf tip. Shape of base of leaf blade was acute, obtuse, rounded, cordate or asymmetric. These leaf traits recorded in the present study have importance in developing plants with attractive foliage that can suit to certain features of landscaping.

Morphological and flower quality traits as influenced by different local accessions of jasmine are presented in Table 6. Plant height at flowering in different jasmine accessions ranged from 66 cm (J-7) to 143 cm (J-5) with a mean value of 107.86 cm. Significant variability was observed with respect to the length and width of the leaf. Among the different accessions evaluated, J-6 had the longest length of leaf (12.5 cm) and leaf width (5.93 cm) with a mean

value of 7.48 cm for leaf length and 4.27 cm for leaf width (Table 6). These results are in agreement with the results of Mukundan *et al.*, 2008 who reported diversity in leaf size of *Jasminum sambac* and *Jasminum grandiflorum*. Variation of flower bud traits in different collected accessions of jasmine is illustrated in Fig 2. In the present study, maximum diameter of the flower bud (1.14 cm) was noticed in J-8 whereas shortest (0.264 cm) was noticed in J-5 with a mean flower bud diameter of 0.72 cm. Maximum and minimum total flower bud length were recorded in J-8 (4.7cm) and J-10 (1.844 cm) respectively with a mean value of 3.24 cm. The economic traits of jasmine flower trade such as length and diameter of the flower bud, diameter of the flower and stalk length of flower were studied in different accessions of *Jasminum spp* by Khan *et al.* (1970). Variations were observed with respect to fresh weight of flower buds in different accessions. Among the

accessions studied, average fresh weight of the flower bud ranged from 0.052 g (J-5) to 0.563 g (J-10) with a mean value of 0.24 g. Thangaraj *et al.*

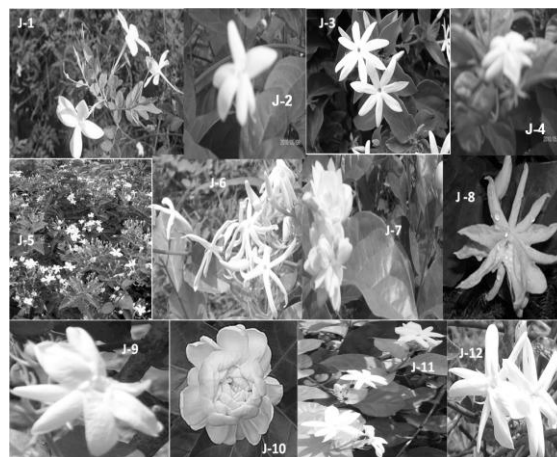


**Figure 2 : Variation of flower bud traits in different collected accessions of jasmine**

*al.* (1982) have reported high variability for flower bud weight, corolla tube length and flower bud diameter. Accessions showed a great variation for flower bud length in the present study. Bud length of the different collected jasmine accessions was in the range of 2.54 cm (J-6) to 0.854 cm (J-5) with a mean bud length of 1.64 cm. Higher stalk length is a desirable trait for easy picking of jasmine flowers. In the present study, stalk length of the flower bud ranged from 2.30 cm (J-14) to 1.075 cm (J-8) with a mean value of 1.49 cm. Considerable variation for different agromorphological traits have been reported earlier (Mukundan *et al.*, 2008, Malik Abid Mahmood *et al.*, 2013, Sushant Shekhar *et al.*, 2013 and 2014), in different collections made from agro-climatic regions of the India.

Variation of flower quality traits observed in different collected accessions of jasmine is illustrated in Fig 3. Out of the different accessions studied, the average flower diameter varied widely. Flower diameter was recorded the maximum (6.68 cm) in J-6 while it was minimum in J-5 (1.96 cm) with a mean value of 4.34 cm. Khan *et al.* (1970) has reported fifteen morphological variants in *J. sambac* and concluded that the variety Madanban was the best followed by Gundumalli and Ramabanam for various economically important characters like shape of bud, length of pedicel, length of corolla tube, diameter of flower, number of flowers per

plant and time taken for a bud to open up completely. The different jasmine accessions studied showed a great variation for fresh weight of the flower.



**Figure 3 : Variation of flower quality traits in different collected accessions of jasmine**

Average of observations on fresh weight of flower ranged from 0.046 g (J-5) to 1.37 g (J-10) with a mean fresh weight of flower of 0.35 g. The economic importance of any *Jasminum species* depends on corolla characters in terms of number of whorls and petals, corolla tube length etc. as they are commercially important for loose flower trade and essential oil extraction. These floral characters in turn influence the ornamental value of tied flower strings and garlands. In the present study, flowers of J-14 had longest length (2.70 cm) of corolla tube while it was shortest (0.864 cm) in J-10 with a mean corolla tube length of 1.77 cm. The variation in length of corolla tube of different *Jasminum spp* were also observed earlier in the study conducted by Mukundan *et al.*, 2008. Flowers of J-10 had the maximum number of petals per flower (43) whereas the lowest number of petals (5.0) was found in J-1 with a mean value of 12.33 no's. There was wide variation noticed for length of the flower petal in different collected jasmine accessions. It ranged from 0.96 cm in J-5 to 3.50 cm in J-6. The mean value for length of the flower petal was 2.06 cm.

**Table 6 : Morphological and flower quality traits as influenced by different local accessions of jasmine**

Jasmine accessions	Plant height (at flowering)	Leaf length (cm)	Leaf width (cm)	Fresh weight of flower bud (g)	Diameter of Bud (cm)	Total flower bud length (cm)	Length of the Bud (cm)	Stalk length of the Bud (cm)	Diameter of flower (cm)	Average flower weight (g)	No. of Petals/ flower	Corolla tube Length (cm)	Petal length (cm)	Petal width (cm)	Stalk length of the flower
J-1	140	2.512	1.164	0.07	0.316	3.452	1.413	1.94	3.840	0.054	5.000	2.196	1.74	0.98	2.42
J-2	89	10.26	5.780	0.23	0.724	3.004	1.636	1.2	3.860	0.258	9.400	1.568	1.8	0.96	1.48
J-3	141	5.040	3.380	0.09	1.040	2.880	1.380	1.4	5.62	0.166	6.8	1.538	2.62	0.66	2.56
J-4	73	8.528	4.780	0.256	0.812	2.824	1.436	1.388	3.656	0.284	7.360	1.632	1.74	1.74	1.2
J-5	143	4.964	3.416	0.052	0.264	2.532	0.854	1.7	1.960	0.046	6.930	1.793	0.96	0.32	2.1
J-6	80	12.50	5.930	0.232	0.594	4.488	2.540	1.94	6.680	0.586	7.400	2.540	3.5	0.7	2.56
J-7	66	8.060	4.848	0.406	1.002	2.680	1.320	1.36	3.160	0.454	34.20	1.36	1.48	0.76	1.36
J-8	123	7.916	4.884	0.436	1.140	4.700	2.372	1.075	6.280	0.648	14.56	1.664	2.725	0.875	1.48
J-9	70	6.016	3.820	0.312	0.944	2.688	1.532	1.12	3.770	0.261	7.700	1.652	1.44	1.02	1.28
J-10	110	7.784	4.544	0.563	0.992	1.844	1.00	1.1	3.2	1.37	43	0.864	1.3	1.1	1.1
J-11	72	6.944	4.452	0.224	0.718	3.020	1.600	1.2	3.940	0.296	7.820	1.490	1.88	1.04	1.44
J-12	123	7.300	3.910	0.166	0.696	3.356	1.736	1.56	4.458	0.16	7.180	1.712	2.367	0.625	2
J-13	142	5.60	3.200	0.1	0.375	3.3	1.70	1.6	4.30	0.1	7.0	2.1	2.2	0.8	2
J-14	138	11.3	5.700	0.18	0.470	4.6	2.50	2.3	6.00	0.24	8.33	2.70	3.1	0.8	2.8
Mean	107.8	7.48	4.27	0.24	0.72	3.24	1.64	1.49	1.77	4.34	0.35	12.33	2.07	0.88	1.84
CD 5%	0.285	0.817	0.438	0.008	0.061	0.230	0.234	0.062	0.319	0.019	1.916	0.206	0.040	0.047	0.054
SEm+ <sub>-</sub>	0.052	2.813	2.617	0.707	2.221	1.913	3.85	0.834	2.097	1.098	4.74	3.183	0.387	1.06	0.589
CV	0.157	8.441	7.851	2.122	6.665	5.739	11.55	2.504	6.293	3.296	14.22	9.550	1.160	3.180	1.769

Width of the flower petal in different collected jasmine accessions was in the range of 0.32 cm (J-5) to 1.74 cm (J-4) with a mean value of 0.88 cm. Maximum stalk length of the flower (2.80 cm) was noticed in J-14 whereas shortest (1.10 cm) was noticed in J-10 with a mean stalk length of 1.84 cm. High variation in number of whorls, petal lobes, petal colour, shape and size and other flower quality traits had been reported by various workers in jasmine [Mukundan *et al.*, 2008, Safeena *et al.*, 2010 and 2013] while studying the different germplasm collections. Flower bud, flowering and flower characteristics recorded in different local accessions of Jasmine are presented in Table 7.

Flower bearing position was terminal, axillary or both in the present study. Colour of the flower bud was either pure white, off white or Pink. Tinge on flower bud was either absent or present (Table 7). Boldness and shape of the flower bud are considered to be two key traits in most of the commercial jasmine

genotypes. Boldness of the flower bud of the different jasmine accessions was thin, medium or bold in the present study. Shape of the flower bud was either pointed and short or pointed and long. Raman (1955) classified and grouped conical buds under 'sujji mallige' (*Jasminum grandiflorum*) and globose buds under 'gundu mallige' (*Jasminum sambac*). Champa, 2012 reported that in jasmines, conical shaped buds are preferred for making flower strings for hair decoration while, round shaped buds are ideal for preparing garlands which makes it look big, beautiful and charming. Different Jasmine accessions under evaluation showed a great variation for flowering. The accessions attained 50 per cent flowering after 30-45 days from pruning. Generally, span of flowering spread for 8-9 weeks and flowering season lasted for two months. With respect to season of flowering, most of the jasmine accessions studied was found to be seasonal and few genotypes belonging to *Jasminum multiflorum* were observed to flower throughout the year. For jasmine flowers, there is a



high market demand in the off season also. *Jasminum sambac*, *Jasminum flexile* and *Jasminum multiflorum* are some of the genotypes with continuous flowering (Bhatnagar, 1956; Raman *et al.*, 1969). Flower colour on opening was either pure white, off white (cream) or pink in the present study. The predominant flower colour was cream (off white) followed by white. The overall preferences for flower colours in jasmines are white and cream for commercial cultivation while pink types are grown in home garden and landscapes.

Among different accessions studied for shape of open corolla and corolla lobe, open corolla shape ranged from rounded or star shaped and shape of corolla lobe was either rounded or lanceolate. High diversity for different flower quality traits in different collections of *Jasminum spp* has already been reported by earlier workers [Mukundan *et al.*, 2008]. Tip of the flower petals was either blunt or sharp in different collected accessions under present study.

**Table 7: Flower bud, flowering and flower characteristics recorded in the local accessions of Jasmine**

Jasmine accessions	Flower bearing position	Boldness of flower bud	Flower bud shape	Flower bud colour	Tinge on flower bud	Flower colour on opening	Shape of open corolla	Shape of corolla lobe	Flower petal tip
J - 1	Terminal and Axillary	Thin	Pointed and long	Pink	Present	Pure white	Rounded	Rounded	Blunt
J - 2	Terminal and Axillary	Medium	Pointed and short	Off white	Absent	Off white	Star shaped	Rounded	Blunt
J - 3	Terminal and Axillary	Medium	Pointed and long	Pure white	Present	Pure white	Star shaped	Lanceolate	Sharp
J - 4	Terminal and Axillary	Bold	Pointed and short	Off white	Absent	Off white	Rounded	Rounded	Blunt
J - 5	Terminal and Axillary	Thin	Pointed and long	Off white	Absent	White	Star shaped	Rounded	Sharp
J - 6	Terminal	Bold	Pointed and long	Pure white	Absent	Pure white	Star shaped	Lanceolate	Sharp
J - 7	Terminal and Axillary	Bold	Pointed and short	Off white	Absent	White	Star shaped	Lanceolate	Sharp
J - 8	Terminal and Axillary	Bold	Pointed and long	Off white	Present	Off white	Star shaped	Lanceolate	Sharp
J - 9	Terminal and Axillary	Bold	Pointed and short	Off white	Absent	Off white	Rounded	Rounded	Blunt
J - 10	Terminal	Bold	Pointed and short	Off white	Absent	Off white	Rounded	Rounded	Blunt
J - 11	Terminal and Axillary	Bold	Pointed and short	Off white	Absent	Off white	Rounded	Rounded	Blunt
J - 12	Terminal and Axillary	Thin	Pointed and long	Off white	Absent	Pure white	Star shaped	Lanceolate	Sharp
J - 13	Terminal	Thin	Pointed and long	Pink	Present	Pure white Pinkish underneath	Star shaped	Lanceolate	Sharp
J - 14	Terminal	Medium	Pointed and long	Pure White	Absent	Pure white	Star shaped	Lanceolate	Sharp

### CONCLUSION

Intensive and systematic surveys taken up throughout Goa have resulted in identification of certain promising accessions in underutilised flower crops like crossandra and jasmine for flower yield and

quality characters. Study documented various morphological, flowering and yield characteristics of different crossandra and jasmine genotypes to represent the broad variability existing in traditional loose flower crops in Goa. As an attempt towards ex-

situ conservation, a core germplasm block for elite jasmine and crossandra accessions has been established at ICAR – Central Coastal Agricultural Research Institute, Ela, Old Goa. These underutilized local flower accessions studied exhibited an incredible range of diversity for various morphological and floral quality traits. Promising genotypes of crossandra and jasmine were identified for all the traits under study for further utilization in crop improvement programmes to meet the future demand of floriculture industry. Data thus generated would be helpful in future crop improvement programmes in flower crops to cater to the needs of floriculture industry.

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