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Assessment of Variation in Concrete Recovery and Chemical Constituents among the Tuberose Cultivars in Assam Condition

Kishalayee Gogoi* and Madhumita Choudhury Talukdar

Department of Horticulture, Assam Agricultural University, Jorhat-785013, India

**Corresponding author*

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A B S T R A C T

An experiment was carried out in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2017-18, to study their variation in concrete recovery and chemical constituents. The experiment was laid out with six tuberose cultivars in Randomized Block Design (RBD) with three replications. The six cultivars were Arka Nirantara, Shringar, Hyderabad Single, Vaibhav, Suvasini and Mexican Double. Aromatic variation of six cultivars were observed and found that single cultivars contain more concrete % than double cultivars. Cultivar Shringar results highest concrete% among the six cultivars. The chemical composition of the tuberose absolutes was analyzed by gas chromatography-mass spectrometry (GC-MS). Major chemical compound identified benzyl benzoate, geranyl acetate, citral, phenol, alpha-terpineol, fernesol etc. Single petaled cultivars were found more promising for concrete recovery. So these cultivars should be cultivated commercially for industrial purpose.

Introduction

Tuberose (*Polianthes tuberosa* L) is a bulbous fragrant ornamental plant, native to Mexico (Trueblood, 1973). In India, tuberose occupies a prime position in the floriculture industry. The major portion of tuberose flowers consumption is in the form of loose flowers and cut flowers. The loose flowers of tuberose have high demand in the market for making garlands and other floral ornaments and arrangements. The tuberose flowers are valued more because they impart sweet and lingering pleasant fragrance. The highly fragrant single petaled flowers contain 0.08 to 0.14 per cent concrete which is used in high grade perfumes. There is a good demand for tuberose concrete and absolute in the international market and fetches a good price. It's essential oil is exported at an attractive price to France, Italy and other countries (Sadhu and Bose, 1973). Hence, tuberose is extensively cultivated as a source of raw material for perfume industry (Gandhi, 2017).

Materials and Methods

The experiment was done during 2017-18 which included 6 genotypes of the species conducted in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Assam. The genotypes were Arka Nirantara, Shringar, Hyderabad Single, Vaibhav, Suvasini and

Mexican Double. The experiment was laid out in randomized block design with three replications. The experimental field was ploughed thoroughly followed by harrowing and levelling to bring it to a fine tilth. The field was divided into plots for allotment of various treatments. Eighteen plots were laid out to accommodate all the six treatments replicated three times. The gross size of an individual plot was 2.5 x 1.5 m in each replication. Medium sized bulbs of 3.0 - 3.5 cm diameter weighing about 25 grams were selected and treated with Bavistin for half an hour. The treated bulbs were planted in rows at 30 x 25 cm spacing accommodating 28 plants per plot.

Concrete recovery

For tuberose concrete recovery from florets, solvent extraction method described by Martolia and Srivastava (2012) was taken. In this method flowers which are about to open were harvested in the morning and were soaked in hexane and left overnight. Hexane was decanted in the next morning. The flowers were rinsed 2 times with fresh hexane and the entire hexane fractions were combined. This hexane solution was evaporated in a rotary evaporator at 50- 55^0 C to get semi liquid yellow coloured concrete. Concrete per cent was calculated by recovery of concrete (ml) divided by weight of florets and was expressed in terms of percent volume of concrete yield per unit floret weight (% v/w).

Tuberose absolute sample preparation from tuberose concrete

One part of tuberose concrete dissolved with 9 part of anhydrous ethyl alcohol at 30^0C. The solution was cooled at -10^0C for one minute. Thereafter the solution was spin dried for one hour at 800 rpm in centrifuge. The upper part of the solution recovered upon ultra filtration. The recovered solution was cooled in deep freezer for 1 hour and again spin dried for one hour to get upper part crystal clear solution (absolute).GC-MS analysis of the absolutes of the six cultivars of tuberose were performed in GCMS Shimadzu system.

Results and Discussion

Concrete yield

The concrete per cent of florets of six cultivars (Table 1) indicated that var. Shringar performed best (0.050%) and minimum concrete per cent was recorded in Mexican Double (0.029%). The result showed significant variation among all the tuberose cultivars and double cultivars showed low concrete per cent than single cultivars.

The significant varietal difference for concrete per cent of florets of tuberose was also corroborated by Srinivas and Murthy (1997) in tuberose, Sharma and Singh (1979) and Singh and More (1982) in jasmine. Single petaled varieties of tuberose found to be best in concrete per cent as compared to double petalled varieties. This study was supported by Srinivas *et al.,* (1996) in tuberose. Mohan *et al.,* (2006) who extracted the tuberose concrete in North India also supported this study. Kahol *et al.,* (2002) found the average yield of concrete from tuberose flowers grown in Lucknow area was 0.15%.

GC-MS analysis of absolute

Among the single cultivars the main compounds identified in cv. Arka Nirantara were methyl benzoate, benzyl benzoate, tetradecane, hexadecanoic acid, linalool, beta fernesene, phenol etc. In Hyderabad Single the main compounds identified were benzyl benzoate, tricosane, benzaldehyde, 2-hydroxy-4-(phenylmethoxy), farnesol, geranyl acetate etc. Similarly the possible

compounds present in cv. Shringar were benzyl benzoate, neryl phenylacetate, phenol, hexadecanoic acid, pentacosane, nonadecane, tridecane etc. Among the double cultivars the main compounds identified in cv Suvasini were benzaldehyde, 2-hydroxy-4-(phenylmethoxy), methyleugenol, benzyl benzoate, tricosane, germacrene D, pentacosane etc. In cv. Vaibhav the possible compounds identified were geranyl acetate, benzyl benzoate, beta farnesene, heptacosane, alpha terpenol, nonadecane, methyleugenol etc. Similarly the possible compounds identified in cv. Mexican Double were benzyl benzoate, linalool, tetradecane, farnesol, methyleugenol, beta farnesene etc. From the analysis it was observed that highest % relative peak areas for all the cultivars were obtained for benzyl benzoate, methyl benzoate, phenol, tetradecane, farnesene and benzaldehyde, 2-hydroxy-4-(phenylmethoxy). The difference in the compounds of absolute and their percentage shows the varietal, seasonal and environmental factors on composition of absolute of tuberose (Martolia and Srivastava, 2012). Martolia and Srivastava (2012) identified methyl isoeugenol, benzyl benzoate and benzyl acetate in cv. Kalyani Single. Martolia and Srivastava (2012) identified 16 major compounds from cv. Shringar and found that α- terpineol was present in highest amount (16.15 %) (Fig. 1–6; Table 2a–2f).

Table.1 Concrete % of six tuberose cultivars

Cultivars	Concrete %
Arka Nirantara	0.047
Hyderabad Single	0.044
Shringar	0.050
Subhasini	0.037
Vaibhav	0.030
Maxican Double	0.029

Table.2a Possible compound of cv. Arka Nirantara

Possible compound	% Relative peak area
Benzyl benzoate	47.67
Methyl benzoate	44.72
Hexadecanoic acid	43.07
Tetradecane	41.42
Nonadecane	37.62
Benzaldehyde, 2-hydroxy-4-(phenylmethoxy)	32.09
Beta farnesene	29.07
Pentacosane	27.18
Phenol	20.85
Linalool	20.36

Table.2b Possible compound of cv. Hyderabad Single

Possible compound	% Relative peak area
Methyl benzoate	44.72
Benzyl benzoate	41.42
Benzaldehyde, 2-hydroxy-4-(phenylmethoxy)	32.17
Tricosane	29.17
Farnesol	27.23
Nonadecane	20.88
Hexadecanoic acid	20.7
Geranyl acetate	17.83
Phenol	14.19
Linalool	15.04

Table.2c Possible compound of cv. Shringar

Possible compound	% Relative peak area
Tetradecane	54.9
Benzyl benzoate	50.64
Benzaldehyde, 2-hydroxy-4-(phenylmethoxy).	47.7
Phenol	45.01
Nonadecane	44.7
Hexacosyl heptafluorobutyrate	37.77
Pentacosane	37.57
Hexadecanoic acid	37.44
Neryl phenylacetate	35.01
Alpha.-terpineol	33.67

Table.2d Possible compound of cv. Suvasini

Possible compound	% Relative peak area
Benzaldehyde, 2-hydroxy-4-(phenylmethoxy).	54.9
Methyleugenol	53.33
Benzyl benzoate	50.67
Tricosane	47.70
Germacrene d	45.11
Pentacosane	44.7
Nerolidol	37.77
Phenol	37.57
Octadecanoic acid	37.44
Hexadecanoic acid	33.67

Table.2e Possible compound of cv. Vaibhav

Possible compound	% Relative peak area
Tetradecane	52.63
Benzyl benzoate	50.74
Beta farnesene	49.19
Geranyl acetate	47.77
Methyl benzoate	46.33
Alpha.-terpineol	44.78
Methyleugenol	43.61
Nonadecane	43.17
Phenol	20.85

Table.2f Possible compound of cv. Mexican Double

Possible compound	% Relative peak area
Benzyl benzoate	57.77
Methyleugenol	55.11
Methyl benzoate	53.51
Farnesol	54.98
Linalool	52.63
Tetradecane	49.35
Beta farnesene	49.19
Germacrene d	47.77
Neryl phenylacetate	44.78

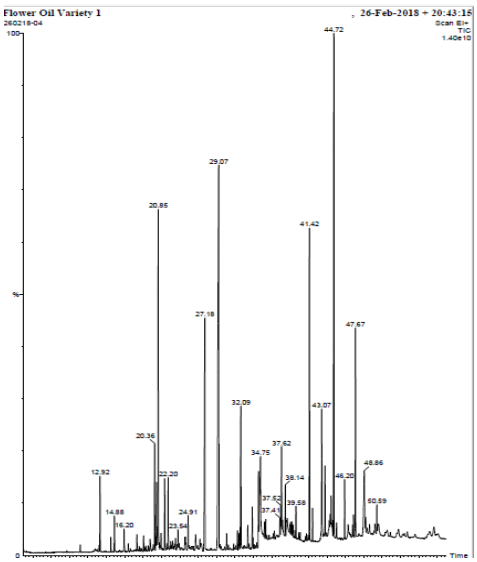

Fig.1 Chromatogram of Arka Nirantara hexane absolute

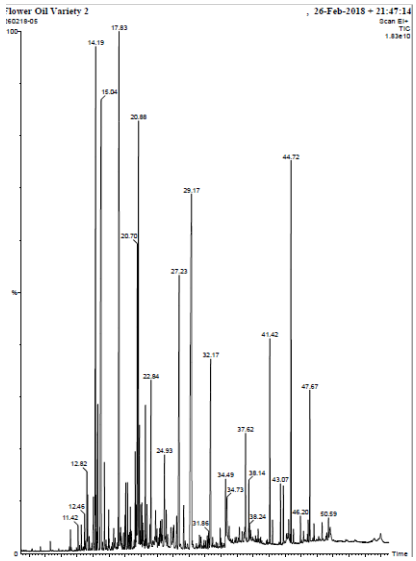

Fig.2 Chromatogram of Hyderabad Single hexane absolute

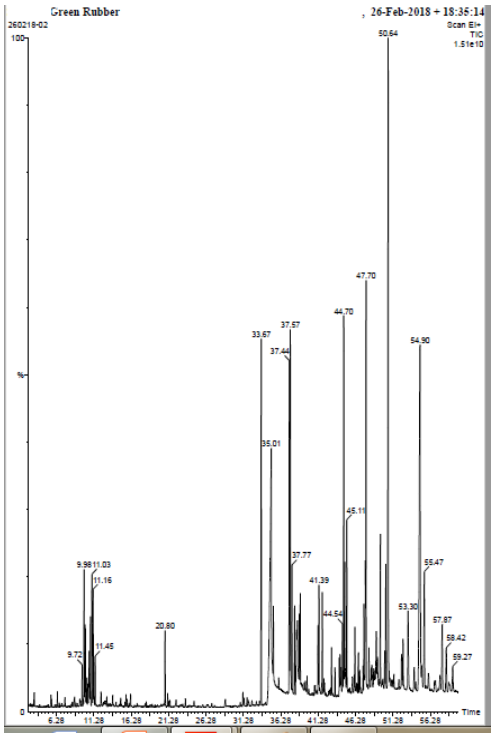

Fig.3 Chromatogram of Shringar absolute

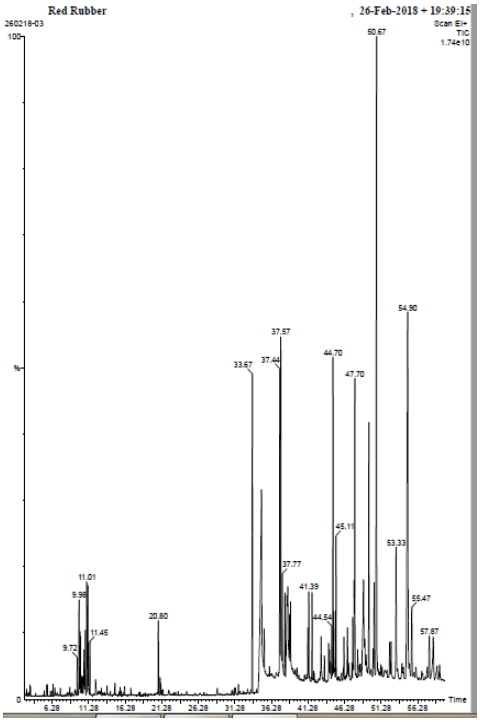

Fig.4 Chromatogram of Suvasini hexane hexane absolute

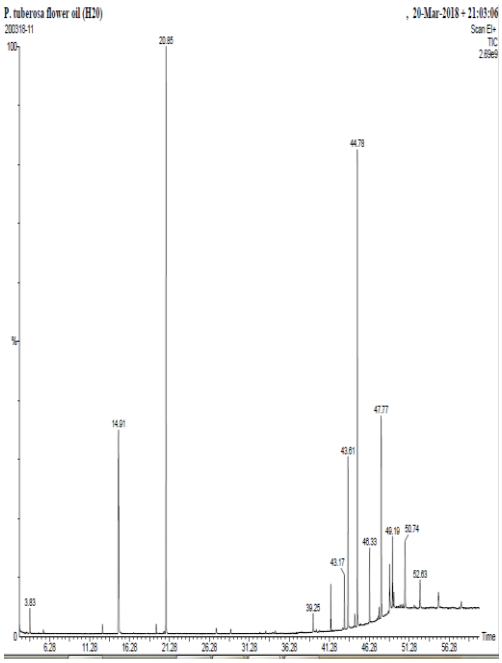

Fig.5 Chromatogram of Vaibhav hexane absolute

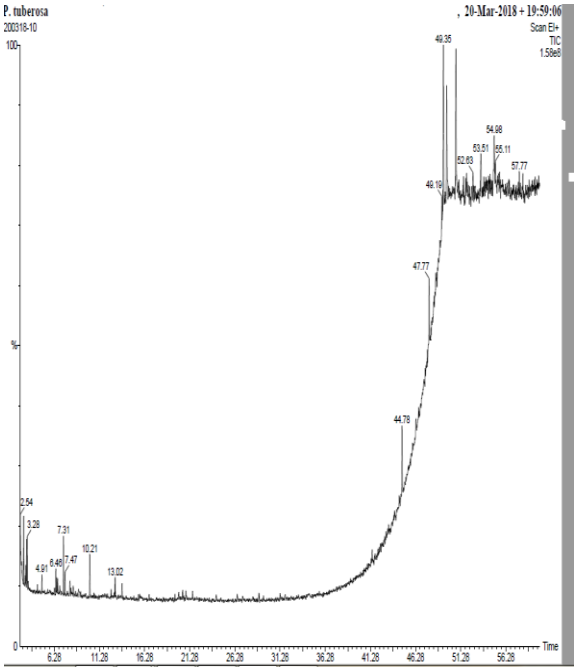

Fig.6 Chromatogram of Mexican Double hexane absolute

Methyl anthranilate, benzaldehyde and palmitate were also identified in the absolute of var. Shringar by Martolia and Srivastava (2012). Revererchon and Porta (1997) and Kahol *et al.*, (2002) reported α- terpineol but in very less amount in tuberose concrete and absolute. Methyl anthranilate was also identified by Venkateshwarlu and Srivastava (1998) in jasmine but in traces. Rao and Rout (2002) also identified these components in different jasmine oil collection but α- terpineol in low amount (0.1 - 04 %). Ramachandraiah *et al.*, (1984) studied the composition of essential oil of *Jasminum sambac* L. flowers obtained from different places and observed variation in the oil composition.

So the major chemical components present in tuberose absolute contributing to floral scent are benzyl benzoate, methyl benzoate, tetradecane, farnesene, farnesol, benzaldehyde, 2-hydroxy-4-(phenylmethoxy) or palmictic acid etc.

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