

Cultivation of Rose Scented Geranium (*Pelargonium* sp.) and their Industrial Value and Economical Importance

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ABSTRACT

Essential oil of scented Geranium is widely used in high grade perfumery and cosmetic industries. It is also employed as a flavoring agent in many major food categories, alcoholic and soft drinks. Traditionally Geranium is used to staunch bleeding, healing of wounds, ulcers and skin disorders and also in the treatment of diarrhoea, dysentery and colic. The oil has antibacterial and insecticidal properties and is profusely used in Aromatherapy. India imports 150t of geranium oil annually. Scented Geranium (*Pelargonium* sp.) was grown successfully in Kashmir. Experiments conducted at R.R.L field Station Bonera Pulwama, revealed that the morphological characters, growth behavior, herbage and oil yield/ha were more or less similar to the hilly areas of South India. The aerial parts (fresh flowers, Stalks and leaves) on steam distillation yielded an essential oil 0.15% on fresh weight basis. Fifty three chemical, constituent representing >96% of the oil were identified by GC and GC-Mass analysis. Major Constituents were citronellol (25.55%) geraniol (20.81%), citronellyl formate (8.04%) and isomenthone (7.59%). Linalool content was comparatively higher (11.94%) as compared to south Indian Oil (6.7%). It is quite evident from the analysis that the oil produced under Kashmir conditions is quite competitive to best geranium oil produced in south India. Moreover, the odour and evaluation study by a leading perfumer has found that the oil is highly acceptable to the user industry.

Key words: Rose scented geranium, essential oil, citronellol, geraniol

INTRODUCTION

Rose scented Geranium (family Geraniaceae) is an important high value perennial, aromatic shrub originated from South Africa as well as reunion Madagascar, Egypt and Morocco. The plant was introduced to Italy, Spain and France in 17th century. There are 700 different species and only 10 are utilized for production of geranium oil viz. *Pelargonium odorantissimum*, *P. asperum*, *P. graveolens*, *P. crispum*, *P. radula*, *P. capitatum*, *P. rosues*, *P. tomentosum*, *P. zonale* and *P. roseum*. It is generally believed that the present day cultivars cultivated for distillation of oil rich in citronellol of geraniol content are referred as *Pelargonium* species (Kaul *et al.*, 1996). However other botanical names such as *Pelargonium graveolens* and *P. roseum* are also in use. Geranium was introduced in India in 1900-1915 by two France nationals and got acclimatized to South Indian climate. Presently two types of geraniums called Algerian or Tunisian and Bourbon or Re-union are

identified in India. Another cultivar Kelkar has been recently introduced by M/S SH Kelkar and Co. Mumbai, a leading flavour and fragrance company in India (Ram *et al.*, 2003) In India geranium is being grown in Niligiri Pulney Hills of Tamil Nadu plain of Andrapradesh, Karnataka, Maharashtra and Utter Pradesh. Rose Geranium is cultivated as a rainfed perennial crop in hilly areas of South India and an annual crop in plains of Northern India (Rajeshwara *et al.*, 1990). Significant data is available on scented geranium cultivated in different parts of India and its processing for essential oil (Jain *et al.*, 2001).

Essential oil obtained by distillation of aerial parts (fresh flowers, leaf and stalks) is extensively used in perfumery and cosmetic industries. It is employed as a flavoring agent in many major food categories, alcoholic and soft drinks. Traditionally it is also used to staunch bleeding, healing of wounds, ulcers, skin disorders, diarrhoea, dysentery and colic. The oil has anti bacterial, insecticidal properties and substantial use in aromatherapy. The current international demand is more than 600 tons mostly met by countries like China, Morocco, Egypt, Re-union Island and South Africa.

As part of Institutes program to develop the agro and) - processing technologies of high value crops and to spread the area under cultivation to other climatic zones of country, rose scented geranium cv. Bourbon was successfully grown in Kashmir Valley.

MATERIAL AND METHODS

Geranium cuttings cv. Bourbon were made in the first Week of November, and grown in the nursery beds of Conventional poly houses (18x4m). About 16-20 DS Cuttings took 60-70 days for rooting. The plantlets arising from the cuttings that survived (up to 85%) were transplanted in the first week of March healthy cuttings were obtained from reserve plants obtained from Bangalore field plots at a spacing of 0.5x0.5m at RRL field station, Pulwama. A light irrigation was done immediately by rose canes after planting. A uniform basal dose of 50 kg ha⁻¹ each of P₂O₅ and K₂O was applied through DAP and muriate of potash respectively at the time of planting. Nitrogen was applied through Urea fertilizer as per treatment in four equal split doses. The crop received four flood irrigations. The plants were returned in the fields as per standard agronomical practices. Climate, soil factors and other experimental details are presented in Table 1. Harvesting was done by a sickle after 150 days of planting at a height of 15 cm from the ground. The essential oil content in the fresh herbage was estimated by hydro distillation using Clevenger apparatus on the laboratory scale also by steam distillation followed by cohabitation on pilot scale.

Table 1. Climate, soil and experimental details at RRL field Station, Pulwama

Soil Texture	Clay Loam
1660	Altitude (m)
Mean maximum Tem (C ⁰)	20-30
Mean maximum Tem. (C ⁰)	8-15
pH of soil	6.8
Peak solar radiation	15-20000 Lux
Date of Planting	07-03-2003
Date of harvesting	4 08-2003 and 15-10-2003
Average weight per plant	800 g
Moisture (%)	70-80
Oil content (%)	0.15-0.24
Relative humidity (%)	50-66
Precipitation (%)	100

Gas Chromatography (GC): GC analysis of an oil sample was carried out on PE gas chromatograph 8500 series with flame Ionization Detector (I.D) using a fused silica capillary column (30x0.32 mm ID) coated with dimethyl- siloxane (BP-I). Oven temperature was programmed from 60-220 °C at 5.5 °C min⁻¹. Injector temperature 250 °C and detector temperature 300 °C, carrier gas nitrogen at 8psi, split ratio being 1:80. GC-MS data obtained on PE mass spectrophotometer using a PE wax (60x0.32mm, id, film thickness 0.25 µm); carrier gas helium; temperature programming, 5 min at 70 °C then rising at 2 °C min and 3 °C min⁻¹ to enrichment on co-injection with standard compounds and comparison of mass spectra of peaks with published data (Jennings and Shipmate, 1980; Admas, 1990).

RESULTS AND DISCUSSION

The herbaceous parts of scented Geranium (*Pelargonium* sp.) cv Bourbon gave an oil 0.15% yield on fresh weight basis on steam distillation followed by cohabitation of distilled waters which is higher as compared to South and North Indian conditions (Rajeshwara *et al.*, 1990; Jain *et al.*, 2001). GC and GC-MS analysis led to the identification of 53 constituents representing 96% of total oil. The relative concentration of the identified constituents is presented in Table 2 according to their elution on BP-1 column.

Table2. Chemical composition of essential oil of rose Geranium percentage

Name of the compound	Kashmir	Southern hills*
(Z)-3-hexanol	0.09	0.1
α -pinene	0.51	0.3
Sabinene	0.1	0.7
Myrcene	0.20	0.7
α -phellandrene	0.7	p-
cymene	0.09	0.1
Limonene	0.34	0.3
(z)-B-ocimene	0.18	0.2
(E) B-ocimene	0.15	0.3
Cis-linalool oxide	0.30	0.1
Trans linalool oxide	0.18	T
Terpinolene	0.11	T
Linalool	11.94	6.7
Cis-rose oxide	0.82	0.4
Trans-rose oxide	0.92	0.2
Isomethone	7.58	--
α -terpeniol	1.03	0.3
Citronellol+nerol	25.55	26.7
Geraniol	20.81	24.1
Geranial	0.90	0.5
Citronellyl formate	8.04	8.2
Geranyl formate	5.18	3.1
Linalyl propionate	0.06	—
Citronellyl acetate	0.26	0.2
Neryl acetate	0.20	0.1
Geranyl acetate	0.52	3.1
α -yalangene	0.36	—
α -copaena	1.38	0.1
B-Bourbonene	0.06	0.5
2-phenylethyl Butyrate	1.05	—
α -cadenene	0.56	—
B-caryophyllene	0.23	0.5

Table 2 contd.....

Name of the compound	Kashmir	Southern hills*
Citronellyl propionate	0.03	—
Guaia- 6,9-diene	0.13	0.1
Geranyl propionate	0.30	0.5
α -humulele	0.23	0.1
(E)- B-farnesene	0.13	—
Aoallo-aromadendrene	0.69	—
Gerranyl isobutyrate	0.32	—
α -selinene	0.04	—
γ -elemene	0.05	—
citronellyl butyrate	0.12	—
γ - cadinene	0.31	—
Geranyl butyrate	0.15	0.2
(E)-nerolidol	0.14	—
2-phenyl etyl tiglate	0.49	0.9
10 γ - epi-eudesylol	2.89	7.6
t-cadimol	0.07	—
Geranylvalerate	0.09	0.1
Citronellyl tiglate	0.15	1.5
Geranyl tiglate	1.31	1.6
Geranylheptanoate	0.05	—

Tt= traces ; * source: Kaul *et. al.*, 1996

The major constituents from Kashmir and Southern India of India are citronellon (25.77 and 26.7%) Geranion (20.81 and 24.1%), Linalool (11.94 and 6.7%), Citronellyl format (8.04 and 8.20%) Isomenthone (7.58 and 7.90%). The percentage of linalool was higher in Kashmir sample. On the contrary percentage of 10 γ - epiudesmol was lower in our sample which may be due to the variation in agro climatic and geographical condition (Ram *et al.*, 1995). The aerial parts on lab. scale yielded an essential oil of 0.22 % on fresh weight basis while on pilot scale the aerial parts yielded an essential oil of 0.15 % on fresh weight basis. Herbage yield from the first harvest was 28t and essential oil yield recorded 37kg ha⁻¹ on pilot scale which is comparable to south Indian data. The IInd harvest was taken in the IInd week of October in Kashmir, the herbage yield from the IInd harvest was 9.33t which is one third of the first harvest and the essential oil yield recorded in the IInd harvest was 7kg ha⁻¹. Preliminary experiments initiated at RRL field station Pulwama further revealed that geranium can be suitably grown in targeted with major Horticulture Crops like apple as companion crop and thus permit increased harvest per unit area land, thereby higher economic returns. The freshly laid apple crops take several years till fruiting. During this period there are no returns. To make it more remunerative the land between the rows can be utilized by cultivating this high value crop. On the basis of above findings it is quite evident that the oil produced in the temperate climate of Kashmir is quite competitive with the best geranium oil produced in South India. Percentage composition of major constituents also shows the stability of Bourbon cultivar.

Given proper conditions, like creation of market linkages, better distillation facilities, development of cost effective agro technologies, incentives to farmers and increased Govt. user industry interaction J&K State can become major producer of geranium oil.

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