



Asian Journal of Plant Sciences

ISSN 1682-3974

science
alert

ANSI*net*
an open access publisher
<http://ansinet.com>

Cultivation of Rose Scented Geranium (*Pelargonium* sp.) as a Cash Crop in Kashmir Valley

A.S. Shawl, T. Kumar, Nahida Chishti and S. Shabir
Regional Research Laboratory, Sanat Nagar,
Srinagar-190005, India

Abstract: Essential oil of scented Geranium is widely used in high grade perfumery and cosmetic industries. It is also employed as a flavouring 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 RRL Field Station Bonera Pulwama revealed that the morphological characters, growth behaviour, 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 wt. basis. Fifty three chemical constituents 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 studies by a leading perfumer has found that the oil is highly acceptable to the user industry.

Key words: Rose scented geranium, cultivation, *Geranium* spp., geranium oil, citronellol, geraniol, linalool, citronellyl formate, Kashmir

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. *Pelargonium odorantissimum*, *P. asperum*, *P. graveolens*, *P. crispum*, *P. radula*, *P. capitatum*, *P. roseus*, *P. tomentosum*, *P. zonale* and *P. roseum*. It is generally believed that present day cultivars cultivated for distillation of oil rich in citronellol or 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. To avoid ambiguity the plant is referred as *Pelargonium* species, until the botanical identity of these cultivars is firmly suggested. Common geraniums which are largely grown for ornamental purposes have no relation with Rose scented geranium, which produces geranium oil of commerce (Rajeshwara, 2000, 2002).

Geranium was introduced in India in 1900-1915 by two French 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 Nilgiri, Pulney Hills of Tamil Nadu, Plains of Andhra Pradesh, Karnataka, Maharashtra and Uttar 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 flavouring 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 antibacterial and insecticidal properties and substantial use in aromatherapy. The current international demand is more than 600 tons mostly met by countries like China, Morocco, Egypt, Reunion Island and South Africa (Anonymous, 1996-1997). As against the annual consumption of 149 tons India produces 5 tons of Geranium oil annually and rest is met largely through imports (Rao and Bhattacharya, 1992).

As part of institute's programme to develop the agro and processing technologies of high value crops and to spread the area under cultivation to other agro climatic zones of country, rose scented geranium cv. Bourbon was successfully grown in Kashmir valley. The present study describes the cultivation, essential oil composition of rose geranium in Kashmir valley.

MATERIALS AND METHODS

Geranium cuttings cv. Bourbon were made in the first week of November and grown in the nursery beds of conventional polyhouses (18×4 m). About 16-20 healthy cuttings were obtained from reserve plants obtained from Bangalore. 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 in the field plots at a spacing of 0.5×0.5 m 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 nurtured in the fields as per standard agronomical practices. Climatic, soil factors and other experimental details are presented in Table 1. Harvesting is 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 hydrodistillation using cleveger apparatus on the laboratory scale and also by steam distillation followed by cohabitation on pilot scale.

Gas Chromatography (GC): GC analysis of an oil sample was carried out on PE gas chromatograph 8500 series with flame Ionisation Detector (I.D) using a fused silica capillary column(30×0.32 mm ID) coated with dimethyl siloxane (BP-I). Oven temperature was programmed from 60 to 220°C at 5.5°C min⁻¹. Injector temperature 250°C and detector temperature 300°C, Carrier gas nitrogen at 8 psi, split ratio being 1:80.

Table 1: Climatic, soil and experimental details at RRL field station Pulwama

Soil texture	Clay loam
Altitude (m)	1660
Mean maximum temp (°C)	20-30
Mean minimum temp (°C)	8-15
pH of soil	6.8
Peak solar radiation	15-20000 Lux
Date of planting	07-03-2003
Date of harvesting	14-08-2003 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

GC-MS data obtained on PE mass spectrophotometer using a PE wax column (60×0.32 mm, 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 upto 240°C. The compounds were identified by peak enrichment on co-injection with standard compounds and comparison of Kovat retention indices from C-9 to C-21 alkanes with literature values and finally by comparison of mass spectra of peaks with published data (Jennings and Shibamoto, 1980 and Adams 1990).

RESULTS AND DISCUSSION

The herbaceous parts of scented Geranium (*Pelargonium* sp.) cv Bourbon gave an oil in 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.

The major constituents from Kashmir and South Indian parts of India are citronellol (25.77 and 26.7%), Geraniol (20.81 and 24.1%), linalool (11.94 and 6.7%), Citronellyl formate (8.04 and 8.20%) and isomenthone (7.58 and 7.90%). The percentage of linalool was higher in Kashmir sample. On the contrary % of 10 γ-epi-eudesmol was lower in our sample which may be due to the variation in agroclimatic 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 37 kg 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

Table 2: Chemical composition of essential oil of Rose Scented Geranium

Name of the compound	Percentage	
	Kashmir	Southern hills*
(z)-3-hexanol	0.09	0.1
α -pinene	0.51	0.3
Sabinene	0.17	0.1
Myrcene	0.20	0.7
α -phellandrene	0.07	0.1
p-cymene	0.09	0.1
Limonene	0.34	0.3
(z)- β -Ocimene	0.18	0.2
(E)- β -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
Isomenthone	7.58	7.90
Terpene-4-ol	0.15	-
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 -copaene	1.38	0.1
β -Bourbonene	0.06	0.5
2-phenylethyl butyrate	0.05	-
α -cadenene	0.56	-
β -caryophyllene	0.23	0.5
Citronellyl propionate	0.03	-
Guaia-6,9-diene	0.13	0.1
Geranyl propionate	0.30	0.5
α -humulene	0.23	0.1
(E)- β -farnesene	0.13	-
Allo-aromadendrene	0.69	-
Geranyl 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 ethyl tiglate	0.49	0.9
10 γ -epi-eudesmol	2.89	7.6
t- cadinol	0.07	-
Geranyl valerate	0.09	0.1
Citronellyl tiglate	0.15	1.5
Geranyl tiglate	1.31	1.6
Geranyl heptanoate	0.05	-

t = traces; *Source: Kaul *et al.* (1996)

which is one third of the first harvest and the essential oil yield recorded in the IInd harvest was 7 kg ha⁻¹. Preliminary experiments initiated at RRL field station Pulwama further revealed that geranium can be suitably integrated 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 agrotechnologies, incentives to farmers and increased Government/user industry interaction J and K state can become major producer of geranium oil.

REFERENCES

- Adams, R.P., 1990. Identification of Essential oil by ion Trap Mass spectroscopy Academic Press-San Diego CA.
- Anonymous, 1996-1997. Impact of chemicals and allied products. Chem. weekly, 11: 237-280.
- Jain, N., K.K. Agarwal, K.V. Syamsunder, S. Srivastava and S. Kumar, 2001. Essential oil composition of geranium (*Pelargonium* spp.) from the plains of Northern India. Flavour and Fragrance J., 16: 4.
- Jennings, W. and T. Shibamoto, 1980. Qualitative Analysis of Flavour and Fragrance Volatiles by Glass Capillary Column Gas Chromatography. Academic Press New York.
- Kaul, P.N., B.R. Rajeshwara Rao, A.K. Bhattacharya, G.R. Mallavarapu and S. Ramesh, 1996. Changes in chemical composition of rose-scented geranium (*Pelargonium* sp.) oil during storage J. Ess. Oil. Res., 9: 115.
- Rajeshwara Rao, B.R., K.P. Sastry, E.V.S. Prakasa Rao and S. Ramesh, 1990. Variation in yields and quality of geranium (*Pelargonium graevolens*) under varied climatic and fertility conditions. J. Ess. Oil. Res., 2: 73-79.
- Rajeshwara Rao, B.R., 2000. Rose scented geranium (*Pelargonium* sp.): Indian and international perspective. J. Med. Aro. Plant. Sci., 22: 302.
- Rajeshwara Rao, B.R., 2002. Biomass yield, Essential oil yield and Essential oil composition of rose scented geranium (*Pelargonium* sp.) as influenced by row spacings and intercropping with corn mint. Ind. Crops Prod., 16: 133-144.
- Ram, M., M.M. Gupta, A.A. Naqvi and S. Kumar, 1995. Curr. Res. Med. Arom. Plants, pp: 17-20.
- Ram, M., D. Ram and S.K. Roy, 2003. Influence of an organic mulching on fertilizer nitrogen use efficiency and herb and essential oil yields in geranium (*Pelargonium graevolens*). Bioresour. Technol., 87: 273-278.
- Rao, B.B.R. and A.K. Bhattacharya, 1992. Indian Perfumer 36: 155-161.