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Effect of harvesting time of flowers on concrete and absolute recovery from rose (*Rosa* spp.): A case study of Farmers landraces

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Abstract
The present investigation was carried out to study the effect of harvesting time of flowers on concrete and absolute recovery in rose (*Rosa spp*.) genotypes. It has been found that the flowers harvested in the morning gave better results as compared to the flower harvested in the evening. The maximum concrete and absolute recovery (0.150 - 0.068%), and (0.107 - 0.050%) obtained from the cultivar of Rose-4 when flowers were harvested in the morning and evening respectively followed by, (0.123 - 0.060%) and (0.170 - 0.050%) in the cultivar of Rose-3, (0.080 - 0.042%) and (0.060-0.034%) in the flowers of Rose-8 and minimum concrete and absolute (0.0.050 - 0.030%) and (0.037- 0.019%)) was found in the cultivar of Rose-10, when flowers were harvested in the morning and evening respectively. The results obtained from the present study indicate that the flowers were harvested in the morning gave better recovery of concrete and absolute in tuberose.

Keyword: harvesting time of flowers, rose. Farmers landraces

Introduction
Among the flowers, roses have gained the popularity as the king of flowers (Peter Bealis 1990) [16]. Roses are mainly used for showy purposes (both flowers and hips) and oil extraction but they are also used for straight utilization or creation of a variety of food stuff like tea, jam and confectionary. Roses flowers have also been used in food, perfumery and cosmetic industries for many years. Genus, *Rosa* consists of approximately 200 species and up to 18,000 cultivars (Gudin 2000) [5]. They are a rich source of Vitamin C and used in the making of medicinal stuff. From ages, humans have been involved to make new scent by using the foliage and bloom for the enhancement of his surroundings The common species mainly used for oil production are *R. damascene* Mill., *R. gallica* L., *R. moschata* Herrm., *R. centifolia* L. and *R. bourboniana* Desp. (Tucker and Maciarello 1988; Kaul *et al*. 2009 and Kumar *et al*. 2014) [22, 7, 13]. Among the different species, Damask rose is being used for essential oil. This plant is called Damask rose due to it was originated from Damascus and brought to Europe (Naquvi *et al*., 2014) [15]. The plant of Damask rose is an erect shrub of 1.2m in height and presently cultivated in Turkey, Bulgaria, Iran, India, Morocco, South France, China, South Italy, Libya, South Russia and Ukraine in the world (Koksal *et al*, 2015) [10]
Rose oil is the most exclusive essential oil in the world due to its low content and unique scent. About 3000 kg of rose petals can produce only one kg of rose oil (Baydar and Baydar 2005; Baser 1992) [2, 1]. The essential oil of this plant is highly valuable and is used to cure depression, insomnia and for stress reduction (Tabaei *et al*., 2004) [21].
Harvesting and post-harvest handlings play an important role in herbal and aromatic plants. To obtain higher essential oil content and better quality, it is necessary that flowers should be harvested at appropriate stage. Time of harvesting and processing are important factors which influences the concrete and essential oil yield in aromatic plants (Kothari and Singh 1995 and Ram and Kumar 1999) [11, 19]. In the literature there is no data available for the role of harvesting time on concrete and absolute recovery in tuberose. Therefore, the objective of the study was to evaluate the harvesting time on concrete and absolute recovery in rose flowers.

Materials and methods
Rose flowers were collected from Farmers field near located to the Meerut district. The morphologically description of flowers are presented in (Table-1).

Healthy looking flowers of each type were collected in the morning. Unwanted material like sepals, pollens and anthers were removed, petals were weighed, spread in trays and kept under shade at room temperature to remove extra moisture in the petals.

The oil was extracted with the help of Soxhlet Apparatus, using N-hexane as a solvent. The oil contents were calculated as proportion (%) of flower weight. To conduct this experiment, Completely Randomized Design (CRD) was used with three replications. For each replication, 500 g of petals were used for solvent extraction. Rotary evaporator was used to remove the remaining hexane from the extract obtained from soxhlet extractor and concrete oil was obtained. To get absolute oil from concrete oil, alcohol was added and filtered until wax free rose oil obtained. The percentage of concrete and absolute oil was measured on petal weight basis.

The experimental data generated from present investigations were subjected to the statistical analysis in accordance with the procedure outlined by Gomez and Gomez (1983) [4]. The interpretations of the results were based on „F- test" at 0.05 level.

Results and discussion

The effect of harvesting times of flowers on concrete and absolute recovery in different genotypes of flowers has shown in Table-1. The significant variation was observed among the genotypes in terms of concrete and absolute and it was maximum obtained among the genotypes when flowers were harvested in the morning and decreasing trends was noted when flowers were harvested in the evening. The maximum concrete and absolute recovery (0.150 - 0.068%), and (0.107 - 0.050%) was obtained from the cultivar of Rose-4 when flowers were harvested in the morning and evening respectively followed by, (0.123 - 0.060%) and (0.170 - 0.050%) in the cultivar of Rose-3, (0.080 - 0.042%) and (0.060-0.034%) in the flowers of Rose-8 and minimum concrete and absolute (0.0.050 - 0.030%) and (0.037-0.019%) was found in the cultivar of Rose-10, when flowers were harvested in the morning and evening respectively. It has also been observed that the cultivar Rose-5 and Rose-10, the concentration of concrete was similar in the morning harvested flowers and similarly the flowers harvested in the evening, Rose-3 and Rose-4 gave similar concrete. As far as absolute concentration, its differed each other among the genotypes when flowers harvested in the morning and in the evening harvested flowers, the cultivars Rose-5 and Rose- 6 gave absolute similar. The results obtained from the present study in regarding absolute oil are comparable lower with the previous study where *R. damascene* produced 0.14% of absolute oil followed by 0.11% of absolute oil from *R. centifolia* while *Rosa* 'Gruss an Teplitz' produced the lowest absolute oil content (Younis *et al*., 2008) [23]. The yields of concretes from *R. damascena* flower by using n-hexane extraction were reported to be about 0.25% in Turkey (Kukcuoglu and. Baser, 2003) [12], and 0.25% concrete and 0.128% absolute in Pakistan (Khalid *et al*. 2009) [8]. Erbas and Baydar, 2016 [3] also observed significant variations in oil among the oil bearing genotypes. The variation in concrete and absolute yield might be due genetic variation in the examined genotypes. This variation could be the positive indication for the proper selection of diverse genotypes for oil content (Kokkini and Papageonrgion, 1998) [9]. Baydar and Baydar (2005) [20] reported that decreases of the essential oil content in *Rosa damasecna* Mill. at late harvests may be due to the increase of the air temperature. Misra *et al*. (2002) [14] showed that oil content in semi temperature site is higher than in semi-tropical site. Therefore, to obtain the highest essential oils, it is necessary to distill fresh flowers as soon as possible.

In the present study, the analysis of variance (Table-3) revealed significant differences (p = 0.05) for concrete yield (A), absolute (B) and genotypes (C). The existence of genetic variation among the genotypes in terms of concrete and absolute should be the primary base for breeding programs; therefore, selection for these traits could be possible. In accordance with these results, other researchers (Tabaei-Aghdaei *et al*. 2002, 2005, Rezaei *et al*. 2003, Jaymand *et al*. 2004, Yousefi *et al*. 2009a,b) [20, 19, 18, 6, 25, 24] also found significant mean squares among landraces for oil yield and its components.

Conclusion

It is concluded from this study, that harvesting time influenced the concrete and absolute contents in rose. The highest concrete and absolute yield was obtained when flowers were harvested in the morning and lowest yield obtained from the evening flowers

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Table 1: Effect of harvesting time of Flowers on concrete and absolute recovery in Rose genotypes collected from farmers field

S.N	Cultivar	Characteristics of flowers	Morning		Evening	
			Concrete	Absolute	Concrete	Absolute
1	Rose-1	Red colour, big size flower	0.070	0.035	0.050	0.030
2.	Rose-2	Bright yellow colour, big size flower	0.060	0.028	0.038	0.024
3.	Rose-3	Pink colour of flower, fragrant and medium size flower	0.123	0.060	0.107	0.050
4.	Rose-4	Light pink, fragrant and medium size of flower	0.151	0.068	0.107	0.054
5.	Rose-5	Orange colour flower with medium size flowers	0.050	0.022	0.049	0.015
6.	Rose-6	White colour with big size of flowers	0.040	0.020	0.027	0.015
7.	Rose-7	Creamy colour with medium size flowers	0.059	0.031	0.051	0.025
8.	Rose-8	Light red with more number of petals and medium size of flowers	0.080	0.042	0.060	0.034
9.	Rose-9	Light yellow colour with medium size of flowers	0.068	0.028	0.059	0.023
10.	Rose-10	Creamy colour with light red spot on petals	0.050	0.030	0.037	0.019
.		Mean	0.075	0.036	0.068	0.029

Table 2: Statistical analysis of studied traits i.e. SE (m), SE (d) and C.D.

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/A	0.006	0.004
Factor(B)	0.011	0.006	0.004
Intraction A X B	N/A	0.008	0.006
Factor(C)	0.025	0.013	0.009
Intraction A X C	N/A	0.018	0.013
Intraction B X C	N/A	0.018	0.013
Intraction A X B X C	N/A	0.026	0.018

Table 3: Analysis of variance of studied traits of ten genotypes of roses

Source of Variation	DF	Sum of Squares	Mean Squares	F-Calculated	Signficance
Factor A	1	0.001	0.001	1.535	0.21892
Factor B	1	0.046	0.046	47.091	0.00000
Int A X B	1	0.000	0.000	0.003	0.95701
Factor C	9	0.053	0.006	6.006	0.00000
Int A X C	9	0.011	0.001	1.224	0.29208
Int B X C	9	0.014	0.002	1.565	0.14021
Int A X B X C	9	0.010	0.001	1.096	0.37546
Error	80	0.078	0.001		
Total	119	0.212			

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