Research and Current Profile of Iranian Production of Damask Rose (*Rosa damascena* Mill.)

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Abstract

Damask rose, the national flower of Iran, is native to the Middle East. It has a long history; commercial distilleries existed in 1612 in Shiraz, Fars. It is one of the most popular plants in Iran. This plant grows both naturally and in cultivation in many parts of Iran as it is very resistant to drought conditions. The major production areas in Iran are Kashan, Fars, and Azerbaijan. The major products of damask rose in Iran are rose water, rose oil and rose bud. Harvesting is done mostly by hand in May-June. The yield range is 2-7 tons/ha. Distillation and production of rose water is mostly traditional but there are also some industrial distilleries. Rose water is used mostly in religious ceremonies and the food industry, although it is also used in traditional Iranian medicine along with rose hip which is rich in vitamin C. Rose oil is exported for use in the perfume industry. This paper discusses aspects of research, and topics related to cultivation and products of Damask rose in Iran.

INTRODUCTION

Rosaceae is an ancient family; some American fossils date to 30 million years ago (Vetvicka, 1997). Rose is the king of flowers (Peter Bealis, 1990) and Damask rose is the national flower of Iran (Kafi and Riazi, 2002). Two major groups of roses are old garden roses (including *Rosa gallica* and *Rosa damascena*) and modern roses (including miniature roses and hybrid tea roses) (Vetvicka, 1997; Peter Bealis, 1990). The origin of Damask rose is the Middle East and some documents cite the origin of rose water as Iran but the origin of its fragrant oil and extracts as Greece (Zargari, 1982). Its ancestors are probably *Rosa moschata* and *Rosa gallica*. The major cultivation areas of Damask rose in the world are Bulgaria, Turkey, Iran and India. Kashan, Fars and Azerbaijan are the major cultivation areas in Iran. Among them, the most famous is Kashan, in the heart of the desert, where shrubs are generally irrigated 2-3 times per year. The yield range is 2-7 tons/ha, with the highest quality of rose water being produced there. Damask rose has an ancient history and its utilization dates back at least 1500 years. There is a deep relationship between this plant and Iranians, who hold some special beliefs about it. Its popularity is due not only to its medicinal effects but also to holy thoughts about it. People call this plant Flower of Prophet Mohammed; because its pleasant aroma reminds them of the prophet Mohammad. In this study we provide a brief history of this plant, Iranian beliefs about it, its processing methods and its therapeutic and herbal usages.

BOTANY AND CULTIVATION

Two major types of oil-bearing roses used to be cultivated for attar extraction: the pink and the white rose. Until 1970, pink rose plantations accounted for almost 90% of the total output. White roses were preferred for planting in higher altitudes. Rose is a thorny shrub up to 2.5 m in height with fragrant pink flowers in corymbose inflorescences of 6-12 flowers. Each flower has an average of 33 petals, and most Iranian cultivars are light pink in color. The leaves are compound with 5-7 leaflets (Rechinger, 1982). Unlike some Bulgarian cultivars which produce flower 2 times per year, Iranian ones flower one time per year, in May-June, although some individual shrubs flower during the entire growing season. Some Iranian cultivars exist in England, such as ‘Ispahan’, ‘Gloire de

Guilan' and 'Omar Khayyam'. Damask rose propagation is achieved primarily by cuttings and suckers, but micropropagation is a developing method in Iran (Nikbakht et al., 2004). Some rose growers used to plant white roses in the outer 2-3 rows of their gardens where they were more exposed to the northeastern winds, in order to protect the rows of pink roses. By the end of the 19th century, areas planted with white roses accounted for as much as 30% of the total acreage of rose plantations. However, because of its lower content and inferior content of attar and it's more labor-intensive and fuel-consumptive cultivation, the white rose came to be less frequently planted. The fact that white rose flowers were sold at half the price of pink roses also explains why the interest towards this rose subsided. It is generally accepted that there are more than 5000 varieties of roses, yet only a few of them exhibit the marked fragrance that is sought by perfumeries. Prior to planting, the ground had to be well plowed. This was usually undertaken in late summer. In early autumn, about 45 d prior to planting, rose growers started digging parallel ditches. The row orientation was based on prevailing winds, or in the case of sloped terrain, on contour. The cuttings necessary for planting were procured from old rose fields, selected beforehand from among fields not younger than six years. Cuttings were taken from the base of rose shrubs and carefully inspected. Dry and diseased parts were removed and then burned. An older method for procuring cuttings was to uproot the entire rose shrub and use the roots as well. Later, this method was abandoned as inefficient, because the old rose garden died, the roots were not reliable planting material, and the procedure was too labor intensive. The woody 30-100 cm long cuttings were placed into ditches horizontally, their ends overlapping (Bulgarian Pharmaceutical, 2004).

Harvesting and Distillation

Rose water festivals and ceremonies are held annually in Kashan from May-June. Harvesting damask rose flowers is labor-, time- and money-intensive work. It is mostly performed from dawn through morning. Delay in harvesting or transport to distillery results in decreased essential oil quantity and quality.

Distillation is an ancient industry in Iran. Willow-water, fennel-water and rose water are some products of this traditional industry. Avicenna, the 10th century Persian physician, distilled the petals of Damask rose for medical purposes, and commercial distilleries existed in 1612 in Shiraz, Fars. The easiest method of distillation is boiling petals, which is still done in traditional homes in Kashan (Fig. 1), although there are some industrial distilleries in Iran which distill petals through steam distillation. An average of 2-3 kg of rose water is produced per kg of flowers. A study in Iran showed that the quality of traditionally distilled rose water is higher than industrially distilled rose water, probably because of the shorter time interval between harvest and distillation (Malek, 2001). Distillation waste is used for livestock feed and composting.

Rose Flower Water (*Rosa damascena*)

Rose water is a colorless liquid with a specific aroma, an essential oil content of 0.075% and an ethyl alcohol content of 3.81%. Its relative density at 20ºC is 0.9927; its pH is 6.55; and its microbiological purity corresponds to standard grade. Natural rose water is a gently cleansing and toning product for all skin types. It maintains the skin's pH balance, stimulates regenerative processes, and has a calming effect on acne and sunburns. As a result of its application, skin texture becomes evenly elastic (Bulgarian Pharmaceutical, 2004)

ROSE OIL INDUSTRY

The history of Iranian rose oil production and allied aromatic industries can be traced through four periods, starting from the mid 17th century. These periods vary in length, but each is characterized by a specific method, technology employed, tools of production, or equipment used, as well as by the way in which production was organized.

The First Period, marking the beginning of Iranian rose production, started around 1664. It ended with the introduction of the first steam still in 1902. This period of about

240 years was characterized by adherence to the technology and equipment adopted at the beginning of the period and by application of the traditional method of rose production. It can be called the period of the gyulpans.

The Second Period started in 1902 when the first steam still was put into operation. The still differed from a traditional alembic primarily in its capacity, the structure of the cooler and the use of steam from a separate source. That period saw the construction of large steam distilleries as well as a number of direct fire distilleries. A large, directly fired still was designed, using Florentine flasks as receivers. The introduction of the direct fire still marked the end of the gyulpans. The more up-to-date equipment using large stills was skillfully adapted to use the technology introduced with the gyulpans. It was in this period that small-scale production of another product derived from rose flowers began: rose concrete. Rose concrete was extracted by petrol-ether with technology and equipment borrowed from France. This second period lasted as little as 18 years, until the end of World War I in 1918.

The Third Period lasted until the end of World War II in 1945. The beginning of the period was marked by post-World War I reduction of the rose plantations. By 1932, the area in rose cultivation had risen to 6837 ha, and remained at about 6000 ha until World War II; between 1941 and 1944, production area shrank to 2563 ha. The first steps in scientific research in rose production were taken at this time. Oil purity (quality) as well as trade in attar was placed under governmental control.

The Fourth Period started at the end of World War II. This period was characterized by rose and other essential oil crop cultivation being done on a cooperative basis (Bulgarian Pharmaceutical, 2004).

TECHNOLOGY AND EQUIPMENT USED FOR THE MANUFACTURE OF ROSE PRODUCTS

At the end of the 17th century, the oil-bearing rose was already cultivated in the vicinity of Kazanlak. The flowers were distilled to obtain rose water, and small quantities of floating attar could also be collected. The rose oil produced at that time had a weaker fragrance and contained significant carbonic constituents, or paraffins, called stearoptene, which froze at room temperature. The liquid constituent of the rose oil, called eleoptene, represented some 80% of the pure rose oil. The kind of rose oil that was extracted in small quantities at that time is now called “direct (raw) rose oil”. The technology used then was chiefly intended for rose water production.

Distillation was carried out in tin-coated copper vessels called alembics, of 80 to 120 L capacity. These vessels were shaped like truncated cones with two handles, of about 80 cm bottom diameter and 20-22 cm top diameter. The alembic type introduced in Kazanlak differed considerably from alembics used in Iran, especially in the design of its head. In the Iranian version, the head continued from the alembic in a hat-like shape, while the alembics used in the Rose Valley were mushroom-shaped and more similar to those used in Northern Africa.

The mushroom-shaped head was where the primary cooling was performed. It helped return the phlegm back into the alembic and liberate rose oil more effectively. The vapors were cooled in a special unit consisting of a wooden cask into which cold water was introduced (Fig. 2).

A thinning pipe, set at 45°, connected the head to the receiver, passing through the cask. It is in this pipe that the vapors were cooled.

Craftsmen gradually improved the cooling unit, transforming the conical pipe into a bunch of 3-5 pipes. The Iranian type of alembic had no special cooling unit. Cooling was done by air in a curved pipe which led from the head to a can-shaped receiver dipped in water. The cooling technique introduced in the Rose Valley was intended to extract rose oil, rather than rose water.

Thus rose oil became the main product of distillation in the Rose Valley, while in Iran the can-shaped receiver was used to collect rose water. In order to obtain as much rose oil as possible, the technology of rose distilling was constantly improved until finally

one technology gained recognition. This technology was used for more than two centuries.

For each distillation the alembic was charged with 10-12 kg of rose flowers. Then, 40-60 L of water, or residual liquid after cohobation, or a mixture of the two, was fed through a sheet-iron funnel, and the mixture was stirred. The water was added to the rose flowers in ratio of 4:1 or 5:1 (4-5 kg of fluid were added to each kilogram of flowers). The head was then replaced, the alembic was put on the fireplace and the pipe of the head was connected to the pipe of the cooling unit. The bash bottle was placed under the spout to collect the first 5-7 L of distillate. The adopted ratio in which rose flowers and water were then mixed (1:4 and 1:5) is still used in modern rose-processing technology. As soon as the bash bottle was filled, it was replaced by an ayak to collect the next 5-7 L of distillate. When the ayak was filled, the distillation process was complete. A total of about 10-14 L distillate was collected within about 1.5-2h. The amounts of charged flowers and the distillate obtained were in ratio of 1:0.85 to 1:1.20. Today this ratio is 1:1.3. Distillation was carried out over a slow fire and it took longer than the process by which rose water was obtained (Bulgarian Pharmaceutical, 2004) (Fig. 3).

The oil was decanted by means of a small metal spoon resembling a tiny funnel with a long handle. The distillate obtained in this process was added to another distillate and redistilled together with it. In this way the multiple distillation technology, which provides full liberation of the rose oil, was introduced. The technology was an original Bulgarian innovation. The skills applied continually to create this original technology and to update the equipment, produced excellent yields. Rose oil was obtained in much larger quantities. An average of 3000 kg of rose flowers produced 1 kg of rose oil (Bulgarian Pharmaceutical, 2004).

Therapeutic Effects

Rose oil and rose water have many therapeutic effects. Rose oil soothes the mind and heals depression, grief, nervous stress and tension. It aids in problems with the digestive system, thirst reduction, healing colds, problems of respiratory system, special complaints of women, wound healing and skin health. Vapor therapy with rose oil is helpful for some allergies, headaches, migraine, etc. (Momeni and Shahrokhi, 1991; Zargari, 1982). More recent studies show that rose oil has anti HIV properties (Mahmood et al., 1996) and can stop and kill some strains of *Xanthomonas* (Basim and Basim, 2003).

Different products of Damask rose are used in Iran, as follows:

1. Rose Water. This is the major product of Damask rose in Iran. It contains 10-50% rose oil. Its main use is in religious ceremonies. The highest quality rose water is produced in Kashan. Kaaba (God's House) in Mecca, Saudi Arabia, is washed yearly by a unique and special rose water of Kashan. It is used in mosques during mourning ceremonies to calm and relax people. It is also of high value in the food industry, as rose water is an ingredient of some special Iranian foods.

2. Rose Oil. This is not the major product of Damask rose in Iran, although it is produced mainly in distilleries and is one of the components of pleasant odor of rose oil is due to the later component which itself is composed of Geraniol (45-75%) and Citronellol (20-40%) (Momeni and Shahrokhi, 1991).

3. Dried Flowers. Two kinds of dried flowers are produced in Iran. Dried buds are mostly for export. Dried petals are used for various purposes, the major use of which is for eating, as it can solve problems of the digestive system. Many Iranian people eat dried rose petals with yogurt. The second use of dried petals is for distilleries that cannot accept the whole flowers but use the petals for distillation.

4. Hips. The hips of *Rosa canina* and *Rosa damascena* (Fig. 5) are rich in vitamins A, B_3, C, D and E. Both dried and fresh, processed and not processed, rose hips are eaten in Iran. In the central parts of Iran, local research showed that the healthier body of local village people is chiefly due to a special food habit: they eat the extract of rose hips with bread as a meal.

Some other products such as rose vinegar and rose honey are produced in some areas (Bulgarian Pharmaceutical).

CONCLUSIONS

Damask rose, one of the ancient flowers, has an old history in Iran and Middle East. These nations have lived with this flower for centuries. It is important for them not only for its therapeutic actions but also because it plays a role as a holy plant. Based on an understanding of these matters, extensive research is being conducted on this plant in Iran to gather and identify cultivars, and introduce the most suitable and valuable ones while simultaneously conducting studies to breed cultivars with a longer flowering period and improved quality and quantity rose oil.

Literature Cited

Basim, E. and Basim, H. 2003. Antibacterial activity of *Rosa damascena* essential oil. Fitoterrapia 74:394-396.

Davazdah-Emami, S. 2002. Damask rose. p.104-122. In: M. Shafie (ed.), Rose. Shaghayeghe roosta, Tehran, Iran.

Kafi, M. and Riazi, Y. 2002. Cultivation of *Rosa damascena* Mill. and rose water production. Ministry of Agricultural-Jihad pub. Tehran. Iran.

Mahmood, N., Piacente, S., Pizza, C., Burke, A., Khan, A.I. and Hay, A.J. 1996. The anti HIV activity and mechanisms of action of pure compounds isolated from *Rosa damascena.* Biochemical and Biophysical Research Communications 229: 73-79.

Malek, S. 2001. An investigation on traditional and industrial production of rose water from *Rosa damascena* in Kashan area. Proceeding of the first festival of rose and rose water. 26 May 2001. Kashan, Iran.

Momeni, T. and Shahrokhi, N. 1991. Essential oils and their therapeutic actions. Tehran Univ. Press, Tehran, Iran. (in Persian)

Nikbakht, A., Kafi, M., Mirmasoumi, M. and Babalar, M. 2004. Micropropagation of Damask rose (*Rosa damascena* Mill.) cvs. Azaran and Ghamsar. International J. of Agriculture and Biology. (in press)

Peter Bealis, T. 1990. Botanica Rose. Grange Books. London, England.

Rechinger, K. 1982. Flora Iranica. Graz, Austria.

Vetricka, V. 1997. Roses. R&B Press. London, England.

Zargari, A. 1982. Medicinal Plants. Vol. 1. Tehran Univ. Press. Tehran. Iran

www.bpg.bg (Bulgarian Pharmaceutical Group) Dr. G.M. Dimitrov Blvd., Floor 5, Sofia, Bulgaria 1125.

Figures

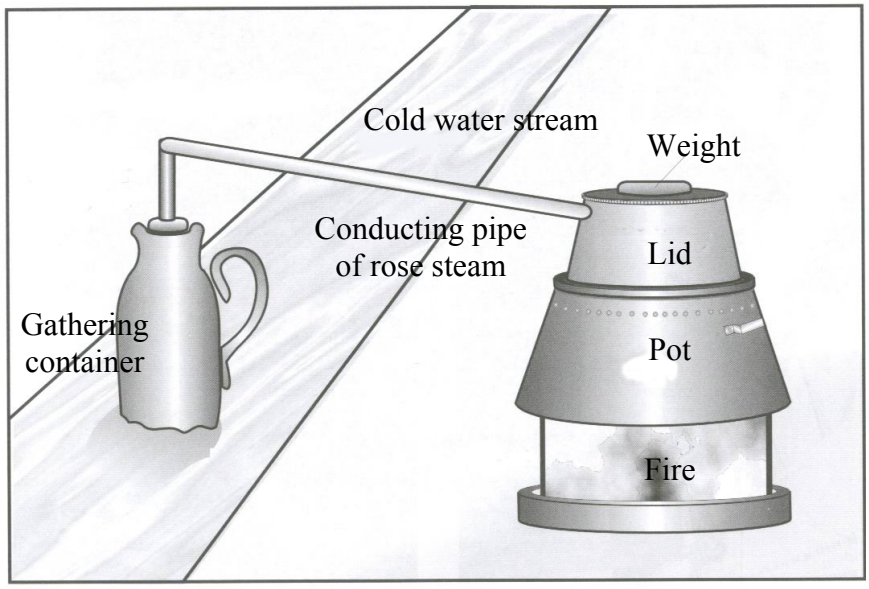

Fig. 1. Traditional system for rose distillation.

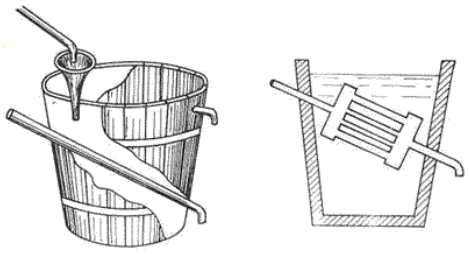

Fig. 2. The vapors are cooled in a special unit consisting of a wooden cask.

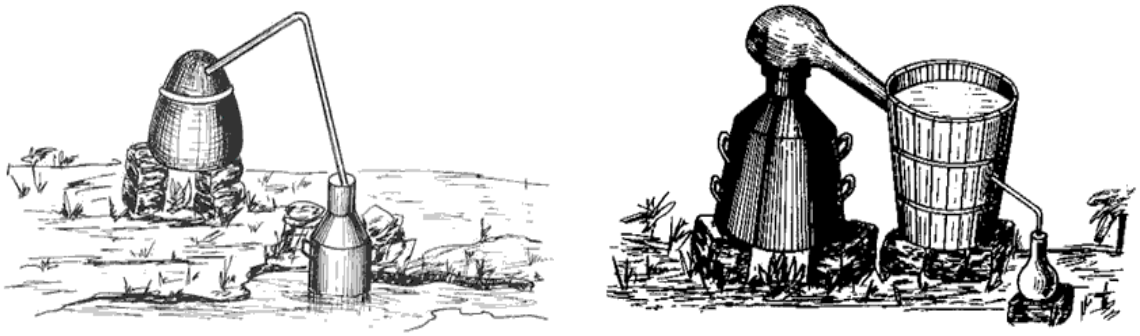

Fig. 3. The Iranian type of alembic.

Fig. 4. The oil was liberated in the neck of the receiving bottle surier.

Fig. 5. Rose hip of damask rose.