A Royal Story About Myrtle

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"What is this?" asked Queen Elizabeth as she picked a small twig from a border hedge, put it to her nose and exclaimed "It has a nice smell." "It is myrtle, your Majesty" answered one of the guides who accompanied her.

This was October 20, 1988, during the afternoon visit to the gardens of the Arabian Palace, The Royal Alcazar in Seville, Spain. Queen Elizabeth was accompanied by her husband, Prince Philip, the royal family of Spain and several officials from Andalucia.

The royal families had a gala-banquet and enjoyed the famous Sevillian flamenco dancers. The weather was beautiful, like spring in October and they went out for a walk in the gardens of the Alcazar, and there Her Highness picked the little twig from the myrtle border.

What Is Myrtle?

First some botanical details. Myrtle, with the Latin name *Myrtus Communis L.* belongs to the plant family Myrtaceae, which also concerns the better known Eucalyptus species.

Myrtle is an evergreen shrub with small, shiny, dark green leaves, sweet-scented white flowers and bluish-black berries. The close-growing bushy shrub can grow up to five meters, but is mostly two to three meters high, with aromatic egg-shaped pointed leaves, 2 to 3 cm by 1.5 cm. The white flowers are solitary, 2 cm across, in the axils of the leaves, with a great many stamens. Myrtle wood is heavy: it is excellent to work with and produces the finest charcoal.[1-4]

The background information about myrtle and its applications may be more interesting. These little-known stories sometimes reveal amusing aspects, such as the German saying "Was nicht in der Annalen steht." We read with the famous British botanists Polunin and Huxley[1]:

"The myrtle shrub has been well known since classical times. As a symbol of love and peace it was held sacred to Venus. Wreaths of myrtle were worn by magistrates and by victors in the Olympic Games; in Roman times poets and playwrights were garlanded with it. To this day myrtle is worn with orange blossom as a traditional bridal flower, and the Jews still adorn booths with it at the feast of the Tabernacle. It is the 'myrtle' tree of the Bible. The bark, leaves and flowers produce an oil known as 'Eau d'Anges' (angels' water) used in perfumery; the berries are sometimes fermented to make an acid drink. The nymph who turned into a myrtle was called Daphne; this botanically misleading episode results in classically minded Greeks calling the myrtle, Daphne."

This same mythological story however, can be read with Lopez Gonzalez[2], but for laurel instead. Furthermore, Lopez Gongalez tells us, "Not long ago myrtle leaves were used as a deodorant applied in the groin and the axilla to prevent disagreeable odours. The Latin name *Myrtus* stems from the Greek name *Myrtos,* which is in turn derived from *Myron* (perfume), since it is a very aromatic plant. Because of its voluptuous odor and its exciting character, according to the classical (antique) folks, myrtle was consecrated in the mythology to the Goddess Venus."

Helge Vedel[3] states, "In the opposite standing dark-green leaves of myrtle, one can observe, with permeating light, a lot of oil-glands, which contain a well-smelling oil. By pressing of the plant material one obtains myrtle oil (Eau d'Anges) and from the fruits one can make a myrtle-liquor. Myrtle has been mentioned in Arab legends, Egyptian women put it in their hair, the Persians regarded it as holy, the Greeks devoted it to Aphrodite and they, as well as the Romans used it to make wreaths; all these applications probably due to its delicious odor."

Finally the Schönfelders[4] mention that myrtle

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played a role in Greek mythology and even today is used in bridal bouquets.

What did the Queen really smell?

We know already that her Highness smelled a broken twig of the Myrtus Communis L. and that she exlaimed "It has a nice smell," but which components were emitted from this little branch with its tiny leaves and maybe some fruits?

To discover anything about aromatic plants, we first must read what the late Ernest Guenther[5] stated about plants and their essential oils in his famous encyclopedia. Here I have to say that Ernest Guenther was a good friend of the late Ramon Bordas (father), whom he visited several times. He was also often present at the field-distillations of Spanish essential oils, which he analyzed at home with Fritzsche Brothers and published in his books.

Guenther stated that Spanish myrtle needs 7 to 9 hours for steam distillation of the oil and Moroccan myrtle only 2 to 2½ hours. Why? Does Spanish myrtle contain more highboiling components? According to Guenther, the myrtle oil contains α-pinene, cineole, dipentene, d- and l-myrtenols (mainly as acetates), nerol and geraniol and 1.8 percent of aldehydes. Furthermore d-myrtenol, saponified from the acetate, was reminiscent of myrtle. Guenther also mentioned that the oil was used in Cologne type toilet waters, to which it imparted an agreeable spicy note. Remember this spicy note, because at that time no spicy constituents had been detected in myrtle. However, this concerned the period up to 1947. Forty years have passed since then.

In the German encyclopedia initiated by Gildemeister and Hoffmann,[6] literature about myrtle is dated up to 1960. The yield of the oil can be up to one percent (as an average $\approx$ 0.5 percent). Myrtenols and their acetates can be present in the oil in about 20 percent. Also discussed is the first quantitative analysis of a Portuguese myrtle oil studied by Costa and Cardoso do Vale.[7]

Research continued with the yearly issues of the Miltitzer Berichte, presently updated to 1984/5. Two less-known publications were found.[10-14]

If Brian Lawrence[8] were asked, "What did Queen Elizabeth smell from the myrtle twig?" he probably would answer, "I already told you in 1970." Indeed the most extensive analysis of a Moroccan myrtle oil is by Lawrence. He and his co-workers detected about 60 components in the oil and determined the concentration of the most important constituents. A dry analysis of their results reveals that they found at least 8, 2-methyl-propyl and 2-methylbutyl derivatives as new components. These derivatives could be derived from the amino acids valine and isoleucine by Strecker degradation (reduction and oxidation). What appears strange, however, is that no degradation products of leucine i.e. 3-methylbutyl derivatives were present, in most plant material the relation of leucine : isoleucine $\approx$ 3-4 : 1.

In addition they detected no less than 12 different sesquiterpene hydrocarbons and not one single sesquiterpene alcohol, only caryophyllene oxide. In spite of these comments, the number of detected components from their analysis has not been increased until now. Still a Moroccan oil could be different from a Spanish one.

In the same year (1970), Louis Peyron[9] analyzed myrtle oil from different origins and identified: hexenal, α- and β-pinene, camphene, myrcene, limonene, 1,8-cineole, p-cymene, linalool, linalyl acetate, nerol, neryl acetate, geraniol, geranyl acetate, α-terpineol, myrtenal, myrtenol and myrtenyl acetate.

We continued our search of the literature, with the Chemical Abstracts, which were almost completely covered by Brian Lawrence in his reviews of essential oils in this journal. Lawrence reviewed the papers of Frazao, et al.[11] regarding Portuguese myrtle oil, of Shikiev, et al.[12] about Russian myrtle oil and of Vanhaelen, et al.,[13] who demonstrated that

Table I. Approximated chemical composition of myrtle oils according to published data

Components	Ref. 7 Portugese Leaves %	Ref. 8 Moroccan Leaves %	Ref. 12 Russian Leaves %	Ref. 14 Italian Leaves %	Ref. 15 Italian Berries %
Monoterpene hydrocarbons	+	~25.0	~40.0	~60.0	~50.0
1,8-cineole	36.0	44.5	11.6	+	30.9
linalool	-	+	20.2	+	2.7
linalyl acetate	-	2.2	-	+	0.9
myrtenol	12.0	+	-	+	0.05
myrtenyl acetate	25.0	~20.0	-	+	-
Other oxy. monoterpenes	-	+	-	+	9.2
Sesquiterpene hydrocarbons	-	~4.0	-	+	1.1
carvacrol	-	0.1	-	-	-
methyl eugenol	-	0.5	-	-	1.0
Other benzenoids	-	-	-	-	4.1

French and Moroccan myrtle oils were characterized by a higher concentration of α-terpineol as compared with Tunisian oils. Finally Lawrence mentioned the investigation of Mazza,[15] who used GC-MS analysis for an extract of Myrtle berries. The approximated chemical composition of myrtle oils according to published data is shown in Table I.

Lawrence wrote, "It is interesting to note that in myrtle leaf oil, the three predominant terpenoid components are α-pinene, 1,8-cineole and myrtenyl acetate, whereas in the berry extract, although α-pinene and 1,8-cineole were major compounds, myrtenyl acetate was not even characterized as a trace component." The analysis of Mazza, however, revealed 3.5 percent of neryl acetate and less than 0.5 percent of geranyl acetate in the berry extract; one may question whether neryl acetate could have been misinterpreted for myrtenyl acetate. Still some questions about Spanish myrtle oil remain open.

In the footsteps of Queen Elizabeth

On a sunny Sunday morning, January 22, 1989, my wife and I went to the place of the crime: the beautiful gardens of the Alcazar in Seville, and we walked the same path as Her Royal Highness. Besides, we did something which normally is forbidden; we picked some myrtle twigs here and there. "It smells lovely indeed," said my wife. I asked, "What do you mean by lovely?" "Clean refreshing, eau de Cologne-like," she expressed. She had no knowledge of Guenther's words. In one half hour, we had collected a hundred twigs. We rested for a while and then went home. The twigs were in an open plastic bag in the back of the car. We enjoyed their fragrance all the way home. My wife commented, "I could certainly use them in the kitchen." We have most of the Spanish herbs, mainly labiates, in our garden and my wife uses a lot of them. When we got home, the lady next door was in front of our house and she asked, "What do you have there?" I said, "Look and smell." She replied, "It strongly reminds me of laurel."

As commonly known hundreds of aromatic plants exist from which essential oils or oleoresins are processed. A lot of these extracts are used for fragrances and another great part for flavors, but not so much for perfumes as for aromas. Why is spike lavender oil mainly suitable for fragrances, rosemary oil for fragrances and flavors and thyme oil mainly for flavors? One reason may well be that fragrance oils mostly contain oxygenated monoterpenes and flavor oils: p-menthanoids and phenylpropanoids. However, some oils like rosemary may contain all these groups of compounds. What about myrtle oil?

We put the myrtle twigs in a cold place and the next morning we found we had collected over 200 g of small branches. The leaves were stripped from the twigs and some tiny shoots were also collected. In total, there were 125 g of leaves and shoots. These plant materials were set for steam-distillation with 500 g of demineralized water, with recycling of the distillate water. The total volume of the calibrated receiver was less than 5 ml.

After boiling for one hour not a single drop of oil had separated. We noticed that the plant material with water was slowly boiling at about 80°C. Thus, there were low boiling components (ethanol, acetaldehyde, propanol, acetone?) which were causing the trouble for non-separation in the small

Table II. Approximated Chemical Composition Myrtle Oil from Alcazar, Seville

Components	Steam Distilled to 5 h Yield: 0.4% %	%	Steam Distilled 5-8 h Yield: 0.04% %	%
Total monoterp.hydrocarbon		19.5		<1.0
α-pinene	10.3		0.3	
limonene	4.7		0.5	
1,8-cineole		17.0		16.6
linalool		8.5		15.6
linalyl acetate		2.5		0.2
myrtenol		1.0		2.0
myrtenyl acetate		31.0		20.5
Other oxy. monoterpenes		10.0		5.4
Total sesquiterp.hydrocar.		1.5		<0.5
caryophylene	0.3		0.1	
α-humulene	1.1		0.3	
Sesquiterpene alcohols		0.5		1.0
carvacrol		0.5		0.3
eugenol		0.5		0.5
methyl eugenol		1.0		1.4
eugenyl acetate		4.5		25.6
Other benzenoids		2.0		10.0
		100.0		100.0

separation container.

Then we set the apparatus for distilling of the water and immediately extracted the distillate with some ml. hexane (Merck pro analysis), and the separated water was recycled. After five hours, the hexane solution contained 0.5 g (0.4%) of oil. Thereafter steam distillation was continued for another three hours in which 0.05 g of oil was collected. The oils were gaschromatographically analyzed on two fused silica columns (with SE-54 and DB-5 phases); the summarized results are shown in Table II.

We detected 150 components in the myrtle oil from plant material from the garden of the Alcazar in Seville from which about 75 could be identified and quantified. The detailed results will be published in the Journal of Essential Oils Research.

The composition of myrtle oil from the plants in the gardens of the Alcazar is rather different from the chemical composition of other oils (Table I). The Sevillian oil contains less monoterpene hydrocarbons; more oxygenated monoterpenes, especially myrtenyl acetate; and more benzenoids, above all eugenyl acetate.

Our myrtle oil possesses two distinct olfactive and organoleptic properties. First, the fragrant ol-

factive quality, refreshing floral, from the oxygenated monoterpenoids, like myrtenyl acetate, myrtenol and myrtenal. Second, the flavoring organoleptic quality, sweet aromatic spicy, due to eugenol and its derivatives: methyl ether and acetate.

Was It Myrtle?

Finally we can give a partial answer to the question: What did Queen Elizabeth really smell? Our perfumers characterize the myrtle oil from the fore-mentioned plant material as refreshing, eau de Cologne-like; sweet aromatic; spicy, laurel-like; and balsamic. However, we do not yet have sufficient knowledge about which components are responsible for all the olfactive properties, because at least 50 percent of the constituents are unknown, especially oxygenated sesquiterpenes and substituted phenylpropanoids.

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