

Research Article

Phytochemical, Physiochemical, Macroscopic, and Microscopic Analysis of *Rosa damascena* Flower Petals and Buds

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Macroscopic and microscopic analysis of *R. damascena* buds and flower petals was used to find the main morphological and anatomical features of these types of medicinal plant material (MPM). The presence of polysaccharides, free and bound monosaccharides, tannins, flavonoids, saponins, and essential oils was confirmed by chemical and histochemical reactions. The quality indicator of *R. damascena* buds and flower petals was evaluated in this study; weight loss on drying gave the next result: $6.69 \pm 0.20\%$ for flower petals and $6.65 \pm 0.13\%$ for buds. The swelling index showed a high result for *R. damascena* flower petals and buds. *R. damascena* buds swelling index— 5 ± 0.2 and *R. damascena* flower petals swelling index— 15 ± 0.6 . The determination of volatile substances by GC/MS shows the presence of 18 volatile compounds in flower petals and buds, this number varies up to 17. Nonadecane, heneicosane, and octadecane are the main components in both medicinal plant materials. Both buds and flower petals contain approximately the same amount of citronellol. Phenylethyl alcohol is present in large amounts in buds but in small amounts in flower petals. *R. damascena* flower petals and buds are the sources of volatile compounds, phenols, and polysaccharides. The results of our investigation showed great differences and similarities between buds and flower petals of *R. damascena*. We have confirmed that not only buds but also flower petals could be a source of biologically active substances (BASs) such as essential oils, polysaccharides, and phenolic compounds. Flower petals could be an alternative MPM. We would also like to underline the importance of standard documentation for MPM: its macro and microscopic description, harvest time, control techniques of the qualitative composition, and the quantitative content of the main BAS. Because it will help in the production of various high-quality products that can be used in medicine, pharmacy, food, and the perfume industries.

1. Introduction

R. damascena Mill L. is one of the most important plants of the *Rosaceae* family and the subfamily is *Rosoideae*. It is a cross between *Rosa phoenicia* and *Rosa gallica* [1–4]. There are approximately more than 1800 different cultivars of the plant, including more than 200 species of roses [3–5].

The origin of *R. damascena* is the Middle East, and some evidences indicates that the origin of rose water is Iran, but

the origin of its fragrant oil and extracts is Greece [5]. It originated in Iran and the essential oil extracted from its flowers has been started since the seventh century A. D [4, 6, 7]. Iranians have a strong bond with *R. damascena*, and in addition to its medical properties, it is also revered for its purported spiritual properties. *R. damascena* is known as “Gole Mohammadi” in Iran, which translates to “flower of Prophet “Mohammad,”” and it plays a significant role in Iranian traditional medicine [4, 8]. It was brought to

Europe and has been cultivated in European countries [4, 6, 9].

Also, some of the historical documents show that Iran was the main exporter of rose water to China and India. For hundreds of years, *R. damascena* has been planted and grown in Iran and currently there is a wide market of its products in the country—Rose water and Rose oil [7, 9].

Nowadays, Bulgaria and Türkiye are the main producers of *R. damascena* essential oil in the world [4, 6, 9]. In addition, among the leading nations that produce Damask rose are Syria, Iran, Türkiye, India, and Bulgaria [3, 10].

The medical effects of the *Damask rose* relate to the chemical composition present in the petals and buds. These chemicals can be broadly split into essential and non-essential oil components. The content and composition of essential oils is highly complex and varies depending on the plant [5].

Numerous research have found that rose oil contains β -citronellol, geraniol, nerol, phenylethyl alcohol, nonadecane, linalool, citronellyl formate, heneicosane, tricosane, β -citronellol, trimethylsilyl ether, geraniol, trimethyl silyl ether, *n*-hexatriacontane, and hexacosane in varying amounts from different places in the world are listed in Table 1. [4, 5, 7, 10].

In research by Eman M. Halawani and Ulusoy et al. rose absolute and essential oil showed potent antibacterial activity against *E. coli*, *P. aeruginosa*, *B. subtilis*, and *S. aureus*. Although proposed in this work, the molecular mechanism of action of *R. damascena* extracts on Gram-negative bacteria is unknown. The high concentration of hydrocarbons and the simultaneous presence of monoterpenes (linalool) can further contribute to the inhibition of microbial DNA gyrase [5, 8, 10–12].

Another study showed that HSV-1 and *Haemophilus parainfluenzae* type 3 were sensitive to the primary antiviral components of rose essential oil, citronellol, and geraniol [4]. In addition, rose essential oil and absolute have a respectable antibacterial activity associated with chemical components, in particular: geraniol, citronellol, and nerol or synergistic effects between these components [4]. *R. damascena* has been confirmed to have cytotoxic, antitumor and anticarcinogenic effects on cancer cells. Geraniol, one of the main components of *R. damascena*, exerts its effects in a variety of ways [4]. Rose essential oil has also been linked to antidepressant, epileptic, and reproductive benefits, as well as antiallergic, anticephalic, and antimigraine effects [2, 4, 10].

Aromatherapy also uses rose essential oils as a sedative and analgesic [3].

In the industry, *R. damascena* and its products are also used in cosmetics and perfumery as a flavoring. Damask rose, rose water and oil are added to many cosmetics as soap, shampoo, flavoring, and active agents also [3].

Besides its application as an aromatic *R. damascena* is used in food industries. Rose damask, rose water, and rose oils are widespread spices and cuisine ingredients in Syria, Persian, Indian, and Middle Eastern. *R. damascena* buds and petals are used to obtain herbal teas, jams, syrups, and so on [3]. Dried petals are added to yogurt as flavoring and tasting ingredients, and this mix can solve digestive system problems [8].

Several phenolic compounds are also present in the *Damask rose* and include flavonoids [2, 10, 13, 14]. One study

found that fresh flower extracts contained quercetin, whereas spent flower extracts also contained epicatechin. Petals are given their color by the presence of anthocyanins [10].

However, other BASs are present in *R. damascena* petals and buds, such as polysaccharides, tannins, flavonoids, carotenoids, glycosides, ascorbic acids, α -tocopherol, fatty acids, and organic acids [2, 3, 15]. Phosphorous, calcium, sodium, potassium, magnesium, iron, and zinc are the mineral contents that are present in *R. damascena* [2, 3, 15]. Overall, *R. damascena* antibacterial, antitumor, antioxidant, anticonvulsant, and immunomodulating, gentle laxative properties as well as its impact on the cardiovascular, gastrointestinal systems, and its antiaging properties are explained by the presents of these BAS [4, 8–10].

Buds are the most studied MPM of *R. damascena* and are well known as a source of essential oils. Petals could be an alternative to MPM. It also has been noticed that, is a possible source of different BAS. Buds are mostly used for export and obtaining rose oil and rose water. But flower petals could be stored and used later when distilleries cannot accept the whole produced MPM anymore [8].

To the best of our knowledge, the goal of our investigation was to assess several pharmacognostical characteristics, including macroscopic, microscopic, physicochemical, and phytochemical analyses of *R. damascena* petals and buds.

2. Materials and Methods

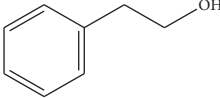
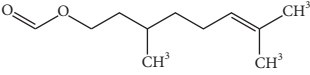
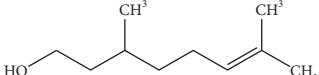
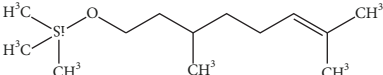
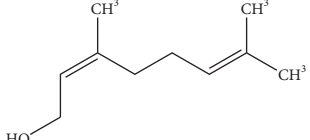
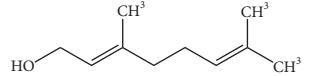
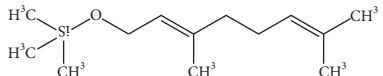
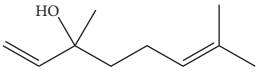
2.1. Plant Material. Flower petals and buds of *R. damascena* were collected from the Amman, Jerash, Irbid, and Ajloun areas in Jordan between late April and June 2020. Buds were harvested before flowering (budding stage) and petals during flowering. Verification of plant material was conducted under the supervision of the Doctor of Biological Sciences, Professor Minarchenko V. M. (M. G. Kholodny Institute of Botany, Kyiv, Ukraine). MPM samples were dried by air-shadow drying and grinding after (sieve size 3, 5 mm).

2.2. Macroscopic Analysis of Buds and Flower Petals of *Rosa damascena*. Macroscopic examinations were performed with the naked eye, using a magnifying glass (magnification $\times 10$) and Philip Harris binoculars (magnification $\times 20$).

2.3. Microscopic Analysis of Buds and Flower Petals of *Rosa damascena*. Dried whole and crushed medicinal plant materials were used for this study. Immediately before the start of work, the workplace and necessary auxiliary materials were prepared: blade, slide, cover glass, dissecting needle, filter paper, measuring cups, and necessary reagents (chloral hydrate, sodium hydroxide, distilled water, methylene blue solution, Sudan III). For best results, part of the studied whole MPMs was boiled in distilled water and sodium hydroxide solution.

To have a complete picture of the anatomical structure of the micro preparation, sections of various natures were made. Using a dissecting needle, the cut was transferred to a glass slide and a few drops of chlorate hydrate were added, after which it was covered with a cover glass, pressing it on top. Excess liquid

TABLE 1: Comparison data of quantity of *R. damascena* essential oils in different countries.

Essential oils	Chemical structure and a molecular formula	Percentage (%)			
		Saudi Arabia	Iran	Türkiye	Bulgaria
Phenyl ethyl Alcohol		1.276	—	—	12.60
Citronellyl formate		1.42	—	—	—
β -Citronellol		29.013	—	35.23	30.31
β -Citronellol, Trimethylsilyl ether		14.83	—	—	—
Nerol		11.66	3.05	10.26	8.46
Geraniol		11.395	15.5	22.19	16.96
Geraniol, trimethyl silyl ether		16.271	—	—	—
Linalool		—	3.68	—	2.15
Nonadecane	C ₁₉ H ₄₀	—	18.56	13.85	2.7
Heneicosane	C ₂₁ H ₄₄	7.9	—	—	—
Tricosane	C ₂₃ H ₄₈	—	16.68	—	—
<i>n</i> -hexatriacontane	C ₃₆ H ₇₄	—	24.6	—	—
Hexacosane	C ₂₆ H ₅₄	—	—	—	3.70

Note. “—” not detected

was removed using filter paper. Appropriate manipulations were made with the following sections: Sudan III, methylene blue, and sodium hydroxide were added separately to the chloral hydrate. Reagents were added to prove the presence of essential oils and polysaccharides in micropreparations.

Having prepared micropreparations in different variations, they were examined under a microscope. A ULAB trinocular light microscope at a magnification of 40, 100, 400, and 1000 times was used to study temporary samples. Thanks to the TREK DCM 220 digital microcamera and the Canon EOS 550 SLR camera connected to the eyepiece, we analyzed the micropreparations and took pictures that were automatically transmitted to the computer [16].

2.4. Preliminary Phytochemical Analysis of the *Rosa damascena* Flower Petals and Buds. To identify the numerous phytochemicals present in *R. damascena*, such as polysaccharides, free and bound monosaccharides, flavonoids, tannins, saponins, and alkaloids, a preliminary phytochemical screening of the plant's petals and buds was conducted by chemical reactions [17–22].

2.5. Determination of Weight Loss on Drying. The determination of weight loss on drying was carried out according to the State Pharmacopoeia of Ukraine (SPhU) 2.5 (2.2.32) [23].

To calculate the content of BAS in the dried plant, the difference between the weights should not exceed ± 0.0005 g.

Weight loss on drying of plant material (X , %) was calculated according to the formula:

$$X = \frac{W_{bd} - W_{ad}}{W_{bd}} \times 100, \quad (1)$$

where W_{bd} is the weight before drying and W_{ad} is the weight after drying.

2.6. Swelling Index. Calculation of mucilage index was carried out according to the SPhU [24, 25].

2.7. Determination of Volatile Substances by GC/MS. The qualitative composition and content ($\mu\text{g/g}$) of volatile compounds were determined in the laboratory of pharmacy at Isra University by GC/MS on an Agilent Technologies

6890 chromatograph with a mass spectrometric detector 5973.

Then, a portion of the rose sample (1.5 g) was placed in a 20 ml vial with the addition of an internal standard-tridecane-at the rate of 20 μg per portion, followed by the calculation of the obtained concentration of the internal standard for further calculations. To the vial was added 10 ml of purified water P, and the volatile compounds were distilled off with steam for 2 hours. After distillation, the volatiles adsorbed on the inner surface of the reflux condenser were washed off by slowly adding 3 ml of particularly pure pentane to a 10 ml dry vial. The wash was concentrated in a stream (100 ml/min) of particularly pure nitrogen to a residual extract volume of 100 μl , which was completely collected by a chromatographic syringe.

Determination of the qualitative composition and quantitative content of volatile compounds was performed by gas chromatography on a chromatograph Agilent Technologies 6890 with a mass spectrometric detector and a capillary column HP-5 ms (inner diameter –0.25 mm, length –30 m). Chromatography conditions: carrier gas (helium) velocity –1.0 ml/min; the temperature of the sample heater –250°C; the thermostat temperature was programmed from 50 to 320°C at a rate of 4 deg/min.

To identify the components, the obtained spectra were considered based on general laws of fragmentation of molecules of organic compounds under the action of electron impact, as well as by comparing the results with data from mass spectrum libraries NIST02 with total spectra of over 470000 in combination with AMDIS and NIST identification programs [26].

Quantitative content (X , $\mu\text{g/g}$) was determined by the method of internal standards by the formula:

$$\chi = \frac{P_1 \times 20}{P_2 \times m}, \quad (2)$$

where P_1 is the peak area of the studied substance; 20 is the mass of the internal standard introduced into the sample, μg ; P_2 is the peak area of the standard; m is the portion of raw materials, g.

2.8. Statistical Analysis. Statistical analysis of the results was carried out by the monograph of the State Pharmacopoeia of Ukraine “5.3.N.1. Statistical analysis of the results of the chemical experiment” (2015) using Microsoft Excel 2010 for Windows.

3. Results and Discussion

3.1. Macroscopic Analysis of Buds and Flower Petals of *Rosa damascena*. The dried flower petals of *R. damascena* vary in size and color. The height of dry petals varies from 1 to 1.7 cm and the width of them varies from 1.5 to 2 cm. Flower petals are broadly inverted-ovate, at the apex with a shallow notch, narrowed at the base into a short nail. The color on the top of the dry flower petals varies from an intense pink color to light pink, and in the middle to the base, this color changes to a

yellowish color. The surface is rough. There are numerous veins on the surface of each flower petal (Figure 1(a) 1, 2).

The dried buds of *R. damascena* consist of the shut pink or light-pink corolla, light-green sepals, and long pale-green receptacles. The buds are vary in size. The length of dry buds is from 2.5 to 3.5 cm and the width is 1.2–1.7 cm. In the hybrid *Rosa damascena*, the number of petals ranged between 22 and 35, with a mean number of 28. The shut corolla is symmetric, has a trapeze shape, and consists of numerous petals (from 22 to 30). The color of the corolla is pink (more intense at the top). The length of the corolla is 2.0–2.3 cm (Figure 1(b). 1,3). The receptacle has 0.8–1.2 cm in length. Rare pubescence is present on the receptacle (Figure 1(b). 2). There are 5 ovate sepals distinctly pinnate with pubescence. The length of the sepals varies from 0.5 to 1 cm (Figure 1(b). 3). There are numerous pistils and stamens located in the middle of the buds in a cut (Figure 1(b). 1).

3.2. Microscopic Analysis of Buds and Flower Petals of *Rosa damascena*. Papillae from the adaxial surface (upper) of the petals with massive cuticular striae on the outer wall surface and remnants of dried secretion (on the top of papillae) (Figures 2(a) and 2(b)). The abaxial surface (lower) consists of spongy parenchyma (Figures 2(c)–2(d)). Vessels are visible on both sides of the petals (Figures 2(a)–2(d)).

After adding methylene blue to the buds and also petals, a blue color appeared in the vessels which means mucilage and pectins are present in the buds and petals of *R. damascena* vessels (Figure 3(a)). After adding sodium hydroxide yellow color appeared in trichomes, which proves the presence of mucilage in trichomes also (Figure 3(b)). MPM in the presence of Sudan III reagent showed orange which proves the presence of essential oils in papillae (Figure 3(c)).

Buds sepals epiderma has different shape cells with uniform size, straight walls and with numerous pores (Figure 4(a)). The receptacle adaxial (upper) *epidermis* consists of sinuous wall cells, an anomocytic stomata complex with a dumbbell-like stomatal slit (Figures 4(b) and 4(c)). There are rare simple trichomes, receptacle abaxial (inner) *epidermis* with numerous simple sinuous trichomes. Pollens appear in the field of the microscope (Figure 4(d)).

3.3. Preliminary Phytochemical Analysis of the *Rosa damascena* Flower Petals and Buds. *R. damascena* flower petals and buds were subjected to phytochemical analysis, which revealed that the maximum phytoconstituents were present, as shown in Table 2.

The outcomes of this section of the preliminary phytochemical screening are consistent with previously published investigations [2, 11, 12]. These results show a wide range of pharmacological effects on the use of *R. damascena* petals and buds as potential antimicrobial and antioxidant agents. Various studies, such as determining the cytotoxicity, the mechanism of action, the interaction with other substances, and the pharmacological applicability, should be carried out.

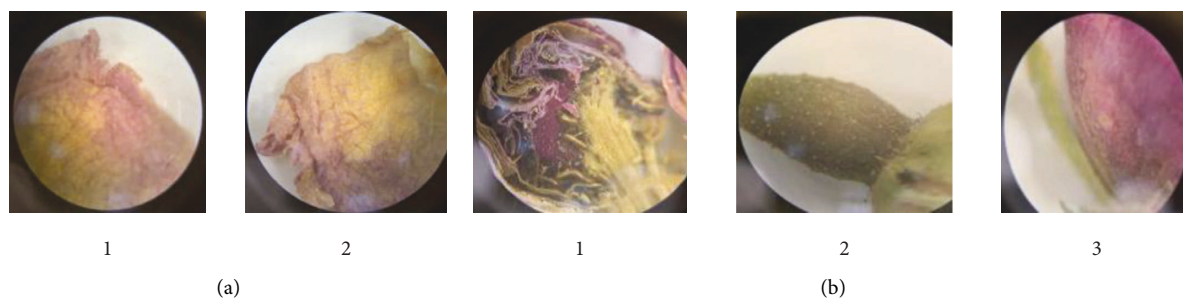


FIGURE 1: Macroscopic analysis of *R. damascena* using binocular: (a) flower petals; (b) buds.

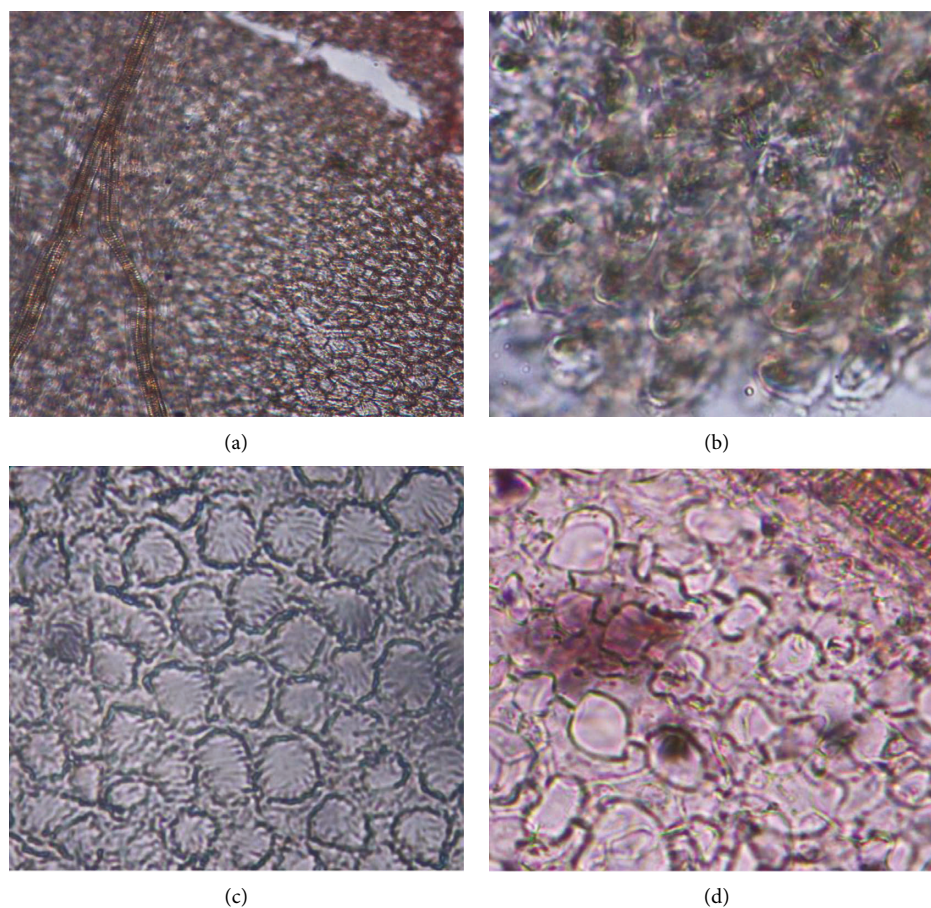


FIGURE 2: Microscopic characteristics of *R. damascena* flower petals and petals from buds: (a) parenchyma with vessels (magn. $\times 100$); (b) adaxial surface (magn. $\times 400$); (c) abaxial surface (magn. $\times 400$); (d) spongy parenchyma (magn. $\times 400$).

3.4. Determination of Weight Loss on Drying. Utilizing loss drying, it is possible to calculate how much volatile matter, including residual water, is present in plant material. Flower petals and buds weight loss in *R. damascena* during drying was $6.69 \pm 0.20\%$ for flower petals and $6.65 \pm 0.13\%$ for buds. To prevent the microbiological contamination or chemical change that leads to the degradation of crude pharmaceuticals, the moisture content of a drug should be decreased. An optimal range for bacterial and fungal growth is indicated by moisture content percentages between 10 and 20% [6].

3.5. Swelling Index. The swelling index serves as a measure of the amount of polysaccharide that is contained in a certain medication. Indicating that the powder has been tampered with or improperly maintained, swelling index variations are one of the features used to identify botanical medicines [6]. *R. damascena* buds and flower petals were to be assessed for swelling index at 5 ± 0.2 and 15 ± 0.6 , respectively.

3.6. Determination of Volatile Substances by GC/MS. The results determination of volatile compounds buds and flower petals are given in Table 3, Figures 5 and 6.

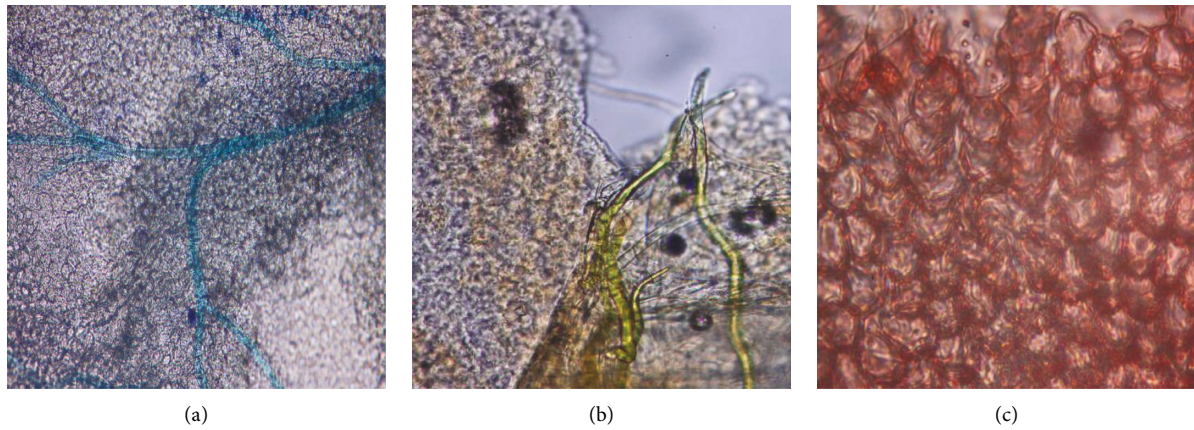


FIGURE 3: Result of histochemical reactions of flower petals and petals from buds: (a) methylene blue solution (magn. $\times 100$); (b) sodium hydroxide (magn. $\times 400$); (c) Sudan III reagent (magn. $\times 400$).

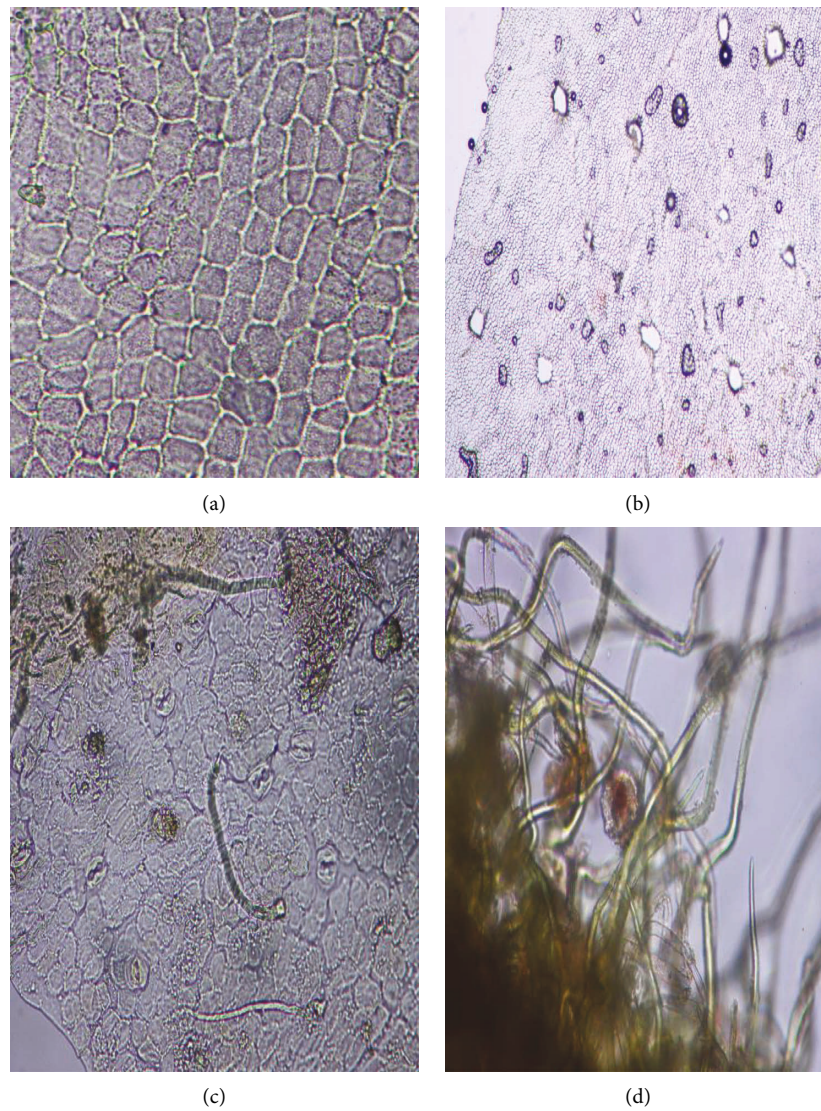


FIGURE 4: Microscopic characteristics of buds: (a) buds' sepals epiderma (magn. $\times 400$); (b) buds' receptacle adaxial epiderma (magn. $\times 100$); (c) buds' receptacle adaxial epiderma (magn. $\times 400$); (d) buds' receptacle abaxial epiderma with trichomes and pollen (magn. $\times 400$).

TABLE 2: Preliminary phytochemical analysis of the flower petals and buds of *R. damascena*.

Plant constituent	Buds	Flower petals
Polysaccharides	+	+
Free and bound monosaccharides	+	+
Flavonoids	+	+
Tannins	+	+
Saponins	+	+
Alkaloids	—	—

Note. “+”—present; “—”—absent

TABLE 3: Volatile compounds in medicinal plant material of *R. damascena*.

No	Compound 1	RT (min)		Content (mg/g)	
		Buds	Flower petals	Buds	Flower petals
		2		3	
1	Phenylacetaldehyde	7.04	—	5.19 ± 0.11	—
2	Linalool	8.05	—	4.75 ± 0.14	—
3	<i>Trans</i> -Rose oxide	—	8.296	—	2.15 ± 0.04
4	Phenylethyl Alcohol	8.35	8.49	95.45 ± 1.99	7.92 ± 0.23
5	Citronellol	10.62	10.62	9.12 ± 0.27	10.71 ± 0.32
6	2,6-Octadien-1-ol, 3,7-dimethyl	—	11.2	—	5.26 ± 0.10
7	Tridecane	11.99	11.99	Inner. stand	
8	Isohomogenol	14.009	—	35.74 ± 1.50	—
9	Heptadecane, 2,6,10,15-tetramethyl	18.96	18.96	14.34 ± 0.43	2.53 ± 0.7
10	2-Ethylhexyl salicylate	—	20.7	—	3.61 ± 0.18
11	Benzoic acid, 2-phenylethyl ester	—	21.05	—	4.90 ± 0.19
12	9-Nonadecene	21.6	21.6	35.29 ± 0.71	26.47 ± 1.32
13	Homosalate	—	21.9	—	9.17 ± 0.18
14	Nonadecane	21.95	21.95	256.89 ± 5.31	89.62 ± 1.79
15	9-Octadecenoic acid, 12-(acetyloxy)-, methyl ester, [R-(Z)]-	—	22.34	—	1.86 ± 0.05
16	Eicosane	23.34	23.34	22.21 ± 0.66	12.64 ± 0.63
17	1-Heptadecanol	24.55	—	2.14 ± 0.064	—
18	Heneicosane	24.68	24.68	170.55 ± 6.82	116.59 ± 2.33
19	Octacosane	25.95	25.95	6.46 ± 0.12	3.86 ± 0.19
20	Propanoic acid, 3-[(2-phenylethyl) sulfonyl]-, undecyl ester	—	26.8	—	1.78 ± 0.05
21	9-Tricosene, (Z)-	27.08	—	7.90 ± 0.15	—
22	Octadecane	27.18	27.18	86.97 ± 2.61	65.38 ± 1.31
23	Pentacosane	29.48	29.48	2.77 ± 0.05	35.90 ± 0.71
24	Octadecane, 1-iodo-	31.62	31.62	36.10 ± 1.08	33.99 ± 0.67

Note: “—” not detected.

According to Table 3, some of the volatile compounds are present in the buds while they are not present in the petals and vice versa. There are 18 volatile compounds in flower petals and buds; this number varies up to 17.

Heneicosane, nonadecane, and octadecane are present in large quantities in both MPMs and numerous reviews confirmed these results [8, 27].

9-tricosene, (Z)-, 1-heptadecanol, phenylacetaldehyde, sohomogenol, and linalool are present in the buds but are not found in the flower petals.

Unlike buds, which lack these compounds, flower petals contain *trans*-rose oxide, 2,6-octadien-1-ol, 3,7-dimethyl, 2-ethylhexyl salicylate, benzoic acid, 2-phenylethyl ester, homosalate, 9-octadecenoic acid, 12-(Acetyloxy)-, methyl ester, [R-(Z)]-, and propanoic acid, 3-[(2-phenylethyl) sulfonyl]-, undecyl ester.

Both buds and flower petals contain approximately the same amount of citronellol.

Pentacosane is present in lower amounts in buds but in high amounts in petals. A minimal amount of 1-heptadecanol is present in the buds and flower petals of *R. damascena*. Propanoic acid, 3-[(2-phenylethyl) sulfonyl] undecyl ester is present in the least amount.

Phenylethyl alcohol is present in large amounts in buds but in small amounts in flower petals.

Heptadecane, 2, 6, 10, 15-Tetramethyl and Octacosane are present in small amounts in buds and flower petals.

In the buds, nonadecane has the highest abundance (256.89 ± 5.31 mg/g) and heneicosane is more abundant in the flower petals (116.59 ± 2.33 mg/g).

The sum of volatile compounds in buds of *R. damascena* is 791.87 ± 23.75 mg/g and in petals it is 434.34 ± 13.03 mg/g. The sum showed that most volatile compounds are present in buds of *R. damascena*, while the number of volatile compounds is larger in flower petals.

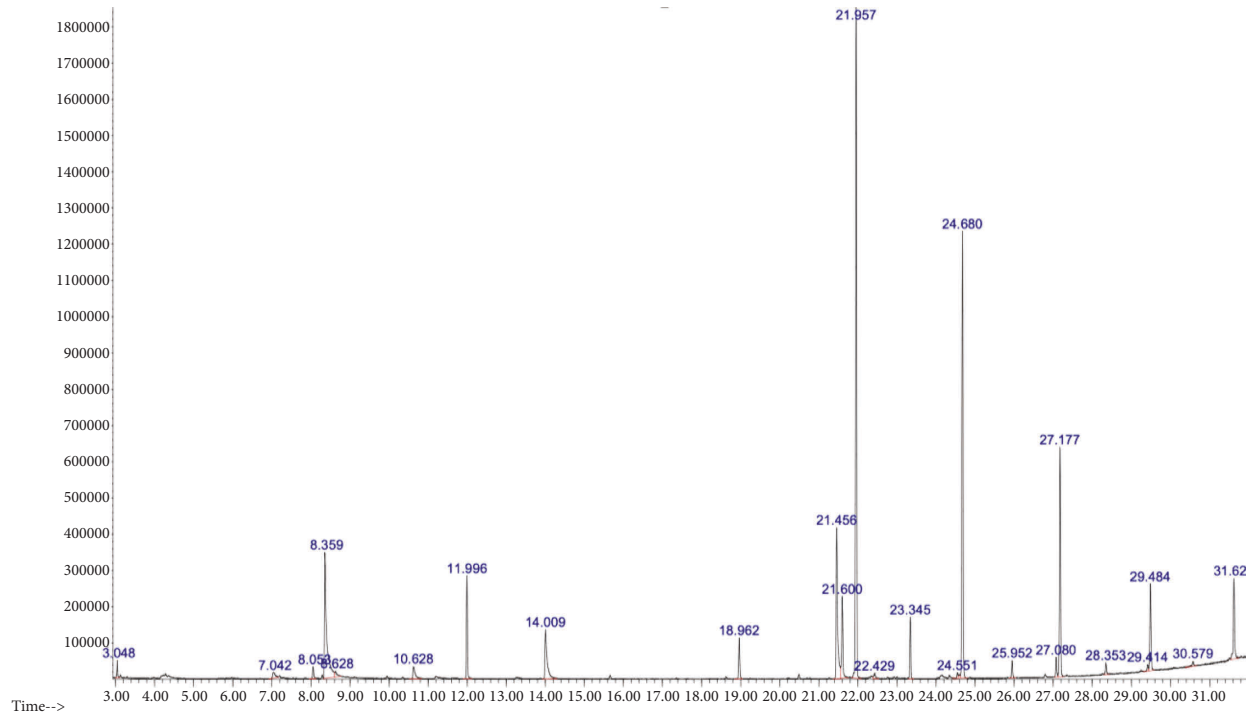


FIGURE 5: Chromatogram of volatile compounds of *R. damascena* buds.

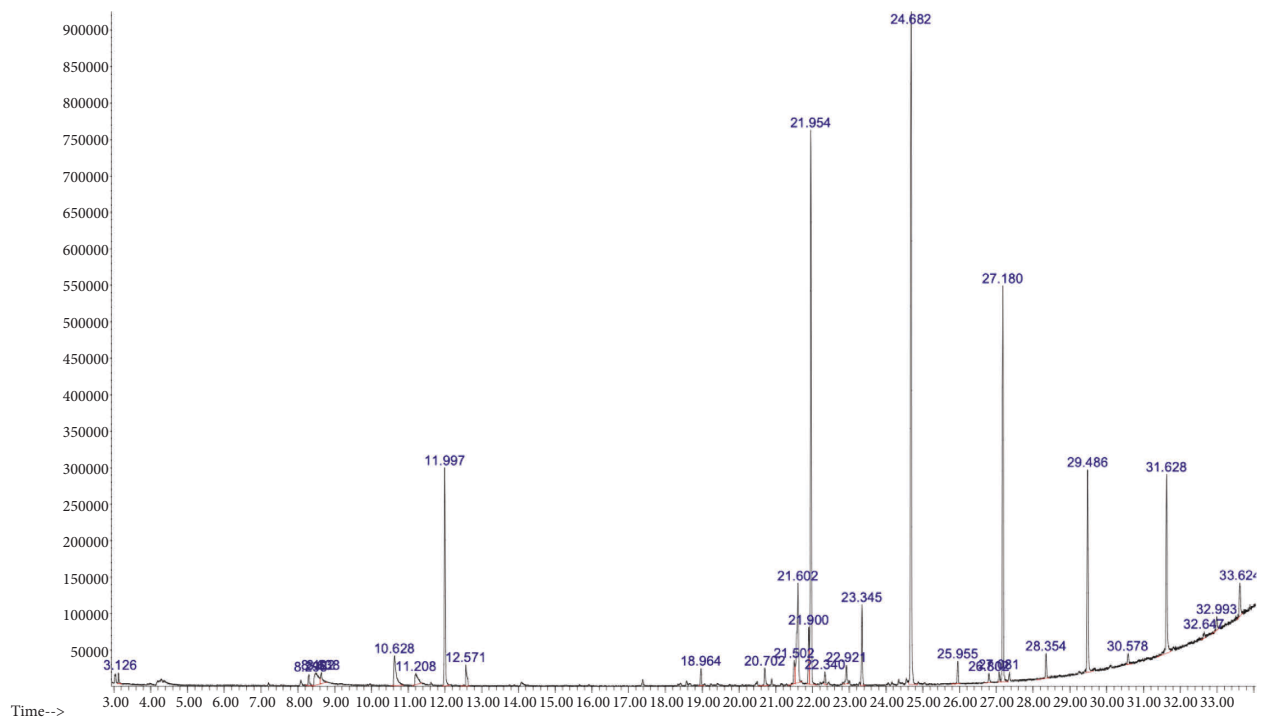


FIGURE 6: Chromatogram of volatile compounds of *R. damascena* flower petals.

Our results show the difference between qualitative composition and quantitative content of volatile compounds of *R. damascena* buds and flower petals. It depends on the MPM vegetative stage. We can see that “lighter” compounds such as terpene aldehydes, ketones, and alcohols are

dominated in buds. The number of identified saturated aliphatic hydrocarbons, such as nonadecane, eicosane, heneicosane, octacosane, octadecane increased in petals (flowering stage), but the quantitative content of saturated aliphatic hydrocarbons predominates in buds.

Significant discrepancies between the study's findings and the literature were found for volatiles, which can be related to ecological factors, genetic variations, the phases of development of the studied plant sections, the freshness or dryness of MPM, and its chemotype.

The review of *R. damascena* essential oil studies shows some qualitative and quantitative differences not only in different countries but in the same region [4]. Otherwise, citronellol is the component of *R. damascena* essential oil and volatile compounds of MPM that were found in the majority of reports [4] and it can be a marker compound for *R. damascena* MPM. We can also assume that the phenylacetaldehyde, linalool, and isohomogenol could be typical makers for buds. The *trans*-rose xide appears in flower petals during flowering period as a product of terpenes biochemical transformation in plant. Also, a high percentage of saturated aliphatic hydrocarbons (paraffin) are an important criterion for obtaining the MPM or essential oils of high quality.

The differences in qualitative composition and quantitative content of *R. damascena* buds and flower petal volatile compounds can help to recognize the falsified MPM or essential oil. The results could be used for the development of quality control methods for buds and flower petals of *R. damascena*.

The bond between the actions and chemical composition of *R. damascena* MPM according to the literature helps us predict the antibacterial, antidepressant, epileptic, reproductive, and many other activities of *R. damascena* MPM [4, 8, 27].

Microchemical reactions show the presence of mucilages and pectins. The high swelling index confirmed the microchemical reaction results. According to the SPhU, the index of swelling of plantain seeds (*Plantago psyllium*) is at least 10, and for flax seeds (*Linum ussitatissimum*) it is at least 4 [25]. According to the results of our research, the swelling index of rose flower petals is 1.5 times higher than the swelling index of plantain seeds and almost 4 times higher than that of flax seeds. Buds by the value of the swelling index [5] are close to flax seeds. This indicates the promising use of rose flower petals and buds as a source of polysaccharides. The presence of polysaccharides explains the use of this raw material for the treatment of gastrointestinal systems, and its immunomodulating and anti-inflammatory properties [4]. The swelling index could also be used as a quality indicator for standardization of *R. damascena* MPM.

Flower petals could be also a source of important biologically active compounds such as volatiles and polysaccharides.

4. Conclusions

Preliminary phytochemical screening of the *R. damascena* flower petals and buds confirmed the presence of polysaccharides, free and bound monosaccharides, tannins, flavonoids and saponins. Alkaloids are absent.

The results of our study showed general differences and similarities between *R. damascena* buds and flower petals. We confirmed that not only buds, but also flower petals could be a source of BAS such as essential oils, polysaccharides, and phenolic compounds. Flower petals could be an alternative to MPM. We also want to emphasize that it is

important to have normative documentation for MPM: its macro- and microscopy description, the time of harvesting and control methods of the main BAS qualitative composition and quantitative content. Because it will help to produce different high-quality products, which could be used in medicine, pharmacy, food, and the perfume industries.

Microchemical reactions, chemical reactions and swelling index confirmed the presence of polysaccharides. The swelling index for *R. damascena* flower petals was 3 times more than for buds. It means that polysaccharides of *R. damascena* MPM are needed to be studied more in-depth.

Data Availability

All the data used to support the findings of the study can be obtained from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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