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Characterization of four varieties of *Prunus* L. from the Northern Iraq Region via phytochemical analysis using the GC-MS technique

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Abstract. *Al-Talab N, Hisham SM, Abdulla RM. 2024. Characterization of four varieties of* Prunus *L. from the Northern Iraq Region via phytochemical analysis using the GC-MS technique. Biodiversitas 25: 3712-3719.* *Prunus* L. is a widely distributed fruit-producing plant cultivated since ancient times. Their morphology resembles most of the world's well-known temperate fruit crops, classified as pome and stone. This comprehensive study employed chemical taxonomic indicators to analyze distinct varieties within the *Prunus* L. genus, focussing specifically on *Prunus armeniaca* L. (represented by the Sayeb and Canion varieties) and *Prunus domestica* L. (represented by the Songold and Freedom varieties). The study then isolated and identified the active chemical compounds through Gas Chromatography-Mass Spectrometry (GC-MS) analysis. The findings showed that the Sayeb variety of *P. armeniaca* was found to have high concentrations of hexadecanoic acid (11.31), dl-phenylephrine (6.08), and 6-Bis-dimethylaminomethyl (3.00). Similarly, the Canyon variety of cultivar of *P. armeniaca* exhibited high concentrations of eucalyptol (46.35), hexadecanoic acid, methyl ester (13.21), and 11-octadecenoic acid (11.12). (46.35), hexadecanoic acid, methyl ester (13.21), and 11-octadecenoic acid (11.12).(46.35), hexadecanoic acid, methyl ester (13.21), and 11-octadecenoic acid (11.12). The Sungold variety of *P. domestica* was found to have sixteen compounds, with eucalyptol (40.72), alpha-pinene (9.64), and hexadecanoic acid, methyl ester (8.31) being the major compounds. The Freedom variety of *P. domestica* was also analyzed, with eucalyptol (50.36), α-pinene (11.27), and hexadecanoic acid (9.76) identified as the major compounds. These distinct differences in chemical composition and abundance among different compounds provide valuable insights and open up exciting possibilities for their use as distinctive traits to determine diversity in the *Prunus* genus.

Keywords: GC-MS, oil compounds, phytochemical, *Prunus* L.

INTRODUCTION

Prunus L. is a woody plant that belongs to the Rosaceae family and comprises about 343 species. It includes trees and shrubs such as apricots, plums, peaches, almonds, cherries, and nectarines. It consists of five distinct subgenera, including Prunophora, which consists of plum and apricot (*Prunus domestica* L. and *Prunus armeniaca* L.) (Pallas et al. 2012; Balkrishan et al. 2021). Apricots and peaches are the most popular *Prunus* and are widely distributed throughout Asia, North America, South America, Europe, and South America. It has been cultivated since ancient times, but recently, it has drawn attention due to its health benefits-related to the presence of antioxidants and bioactive components that relieve pain have drawn attention (Matteson and Langelotto 2009; Rymbai et al. 2016; Alrashedi et al. 2021).

Most countries have several plant species of the family Rosaceae, which produce tasty fruit. The drupe, or fleshy, somewhat hard-coated seeds, is a distinguishing characteristic of fruits in the *Prunus* genus. It is well known that *Prunus* trees have adapted to both summer droughts and cold winters, and apricots and peaches are particularly popular. In addition, many plum species have attractive flowers, diverse growth patterns, rapid development, ease of cultivation, and the ability to adapt to various climates and soil types (Petri et al. 2018; Zuriaga et al. 2018). Although budding or grafting is commonly used to propagate fruit trees and ornamental cultivars, seed production remains essential for root growth and reproductive purposes (Jiang et al. 2019; Sidorova et al. 2019). There is little information on taxonomic differences in seeds and their characteristics, often attributed to differences in genetic material or environmental conditions. There is ample information on seed size, germination rates, and other traits (Grisez et al. 1974; Bassi et al. 2016). However, significant differences between varieties or groups within each domesticated fruit species can be observed. The fruit of these plants usually consists of a thick, fleshy cotyledon with a strong, bony inner shell enclosing the seed, commonly referred to as a stone or pit. The diameter of most fruit species ranges from 5 to 25 mm in diameter, although apricots and plums have larger diameters of 9 and 10 mm, respectively (Pereira et al. 2020; Siddiqui et al. 2022).

Plants of the genus *Prunus* are widely used for medicinal purposes mainly due to their high anthocyanin content with anticancer properties. Seeds are the primary sources of proteins and fatty acids and are traditionally used as expectorants, tonics, antidiabetics, aphrodisiacs, diuretics, and antidiarrheals. In addition to its medicinal uses, this plant has also been used to produce flavouring agents and lotions. The plant’s fruit is a potent free radical scavenger. Plum species are abundant sources of various polyphenolic compounds, including flavonols and phenolic acids, contributing significantly to treating multiple diseases (Zhi et al. 2017; Wang et al. 2022).

Oil compounds play critical roles in cells, serving as basic building blocks, functional factors, and storage materials. In plants, seed oils are stored within oil bodies, which consist mainly of triacylglycerols. These triglycerides act as high energy reserves for seed germination. The composition of triacylglycerols in seed oil varies significantly between plant species and often shows distinct patterns associated with specific plant families (Bejaoui et al. 2016; Hernández et al. 2016). *Prunus* seed is one such plant source, as it has conjugated linolenic fatty acids, which are isomers of octadecatrienoic fatty acids. Previous studies have documented that different *Prunus* seed oil chemical compositions vary according to the country of cultivating countries. Furthermore, some plants produce unique oil compounds that constitute a large proportion of the total fatty acids in stored fat. These characteristic oil compounds are usually found in specific plant families or sometimes exclusively within a particular species belonging to a family or genus (Hölzl and Dörmann 2019; Mohammed and Ebraheem 2020; Altemimi et al. 2023).

Gas chromatographic analysis is an effective technique for the detailed analysis of unique fatty compounds, facilitating phytochemical classification. The main objective of this study was to classify varieties and cultivars of *P. armeniaca* (apricot) and *P. domestica* (plum) through the analysis of oil extracts using GC-Mass Spectrometry.

MATERIALS AND METHODS

Materials

Samples were collected directly from 8-year-old trees of eight distinct cultivars within the genus *Prunus*. The collection process involved conducting field visits across various regions in northern Iraq and its fields. All the cultivars chosen for this study are well-established varieties carefully selected by experienced growers. Among the *P. armeniaca* cultivars, Sayeb and Canion were included, along with two *P. domestica*, Songold, Freedom, and Rosa. Fruits were handpicked when they reached full maturity on the trees. To get the seeds. The fruits were cracked, and the pits were carefully separated using rounded-edge hand pruners to get the seeds. The seed coat was meticulously removed, and twenty-five seeds were obtained. The cotyledons were frozen in liquid nitrogen and preserved at -20°C. Subsequently, the lyophilised kernels (1 g) were crushed and subjected to extraction using hexane (100 mL) in a Soxhlet apparatus for 6 hours. The extracts were then evaporated under a vacuum until dryness was achieved. The dried extracts were stored in dark, airtight bottles and preserved in a refrigerator until further use.

GC-MS analysis

Agilent Technologies' 7820A GC and 5977E MSD systems, which are auto-sampler-equipped, were used in the analysis. A DB1701 capillary column (30 m length, 0.25 mm internal diameter, and 0.25 µm column phase thickness) was used for chromatographic separations. Helium was used as the carrier gas and a split-less injection mode. One microliter of the sample was injected using a split-less injection into the 275°C-heated inlet at a steady flow rate of one milliliter per minute. After setting the oven temperature to 60°C for two minutes, it ramped up to 200°C at a rate of 10°C per minute and then increased to 240°C at a rate of 3°C per minute. The mass spectrometer's conditions were an ion source temperature of 230°C and a quadrupole temperature of 150°C, with a scan range of 40-650 m/z. With an ionisation energy of 70 eV, the device ran in positive electron impact mode. The mass spectrum and chromatographic data were processed with the integrated MS Mass Hunter software (Agilent Technologies, USA). The chromatography library (NIST-14) and the MS fragmentation pattern of actual compounds were used to identify the components (Alaboo and Mohammed 2023).

RESULTS AND DISCUSSION

Identifying the chemical compounds of Sayeb variety seeds using GC-MS

Table 1 shows the results of the Gas Chromatography-Mass Spectrometry (GC-MS) analysis of the Sayeb seeds of *P. armeniaca*. The table provides a detailed list of the active compounds identified in the study. The compounds include Ethyl formate (8.67% area), Glycidol (1.39% area), Eucalyptol (46.84% area), Cyclobutanol (4.51% area), Cathine (2.92% area), 1,3-Dioxolane, 4-methyl- (3.82% area), 16-Methyl-heptadecane-1 (1.58% area), D-Arabinose (1.36% area), Sarcosine, N-valeryl- (2.07% area), Octodrine (2.31% area), Hexadecanoic acid (11.31% area), 1-Propanamine (1.85% area), dl-Phenylephrine (6.08% area), Methyl stearate (2.31% area), and 6-Bis-dimethylaminomethyl- (3.00% area). These compounds represent diverse compounds, ranging from ester alcohols to acid amines. This information is precious for the plant classification system, providing a unique chemical fingerprint for Sayeb variety seeds. Identifying these chemical compounds can help characterize the varieties of *P. armeniaca*, aid in their systematic classification systematically, and explore their biological activities or pharmaceutical compounds.

A previous study by Ali et al. (2022), using FT-IR and GC-MS techniques, identified secondary natural product compounds as well as their functional groups that appeared in the alcoholic extract of apricot kernels and showed that they contain various nutritional elements, such as moisture content (0.81%), and crude fat (56.08 %), crude fibre (3.2%), and crude protein (20.61%). This study also showed that compounds at high concentrations, such as trans-13-octadecenoic acid (78%) and methyl ester (48%), can be detected using GC-MS technology. It has also been confirmed that apricot kernels contain alkaloids, phenolic compounds, flavonoids, glycosides, and phytoestrogens. In addition, Qualitative phytochemical analysis showed the presence of flavonoids, phenolic, phytoestrogens, glycosides, and alkaloid compounds. The study showed that the food and pharmaceutical industries can benefit from these results in future applications. A study by Sharif et al. (2015) reported a similar proximate composition to apricot seeds, reinforcing the importance of these secondary metabolites. Identifying compounds such as 10-methyleicosane confirms their importance in classifying apricot seeds, thus extending their usefulness for plant taxonomy. Researcher Nafis et al. (2020) examined the fatty compounds of *P. armeniaca* and showed that the oil content was 98.33%, comprising 15 identified compounds. The oil also contained a range of compounds, including fourteen distinct compounds: nonacosane (8.76%) and (E)-2-hexenal (6.54%). The other compounds that were identified and found in large quantities were (Z)-phytol (27.18%), benzaldehyde (7.25%), pentacosane (15.11%), and heptacosane (6.50%), which constitutes a percentage of 98.57% of the oil's overall composition. The results showed that volatile chemical compounds were present in varying proportions, such as methyl eugenol (8.72%), α-terpinyl acetate (12.64%), and eucalyptol (40.85%), Eugenol (5.14%), linalool (6.81%), and sabinene (5.13%).

Identifying the chemical compounds of Canion variety seeds using GC-MS

Table 2 shows the results of GC-MS analysis of the chemical compounds identified in seeds of the Canion cultivar of *P. armeniaca* and their percentage area are as follows: Eucalyptol (46.35%), Oxirane, (ethoxymethyl)- (5.61%), Acetamide, 2-fluoro- (2.34%), Octanoic acid, methyl ester (3.36%), 1-Octanamine, N-methyl- (1.68%), Silane, trimethyl(octadecyloxy)- (1.39%), Propenone, 3-(2-benzoxazolylthio)- (1.68%), N-[3,5-Dinitropyridin-2-yl]proline (1.65%), Pentafluoropropionamide (1.59%), Hexadecanoic acid, methyl ester (13.21%), Propanamide (2.15%), 11-Octadecenoic acid, methyl ester (11.12%), Methyl stearate (2.33%), Adipamide (2.95%), and Metaraminol (2.59%). Eucalyptol is a major compound of Canion variety (almost 50%) of the identified compounds. These results can significantly contribute to plant classification by serving as characteristic markers for the Canion variety of *P. armeniaca*. The composition and concentration of distinctive compounds can be utilized for species differentiation and accurately classifying and identifying plants within the genus *Prunus*.

Table 1. Identified chemical compounds in Sayeb variety seeds using GC-MS analysis

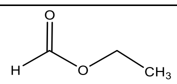
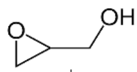
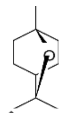
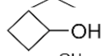
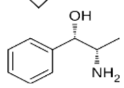
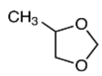
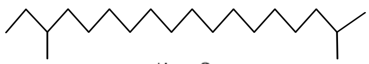
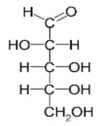
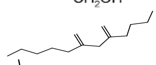
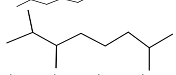
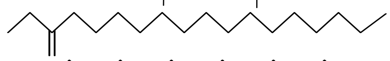
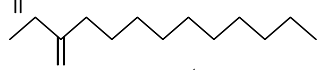
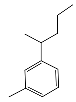
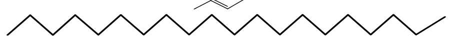
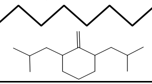
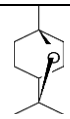
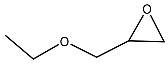
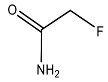
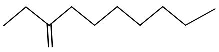
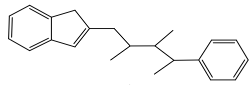
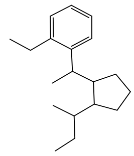
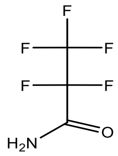
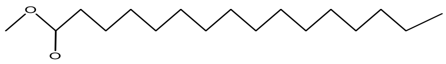
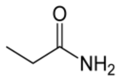
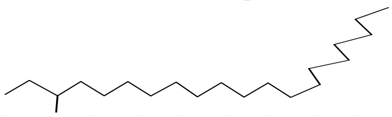
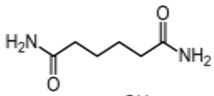
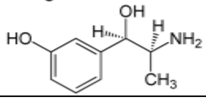
Peak no.	RT	Area%	IUPAC name	Structure formula
1	4.074	8.67	Ethyl formate	
2	4.783	1.39	Glycidol	
3	5.666	46.84	Eucalyptol	
4	6.082	4.51	Cyclobutanol	
5	6.895	2.92	Cathine	
6	7.354	3.82	1,3-Dioxolane, 4-methyl-	
7	8.981	1.58	16-Methyl-heptadecane-1	
8	12.184	1.36	D-Arabinose	
9	15.092	2.07	Sarcosine, N-valeryl-	
10	17.740	2.31	Octodrine	
11	21.133	11.31	Hexadecanoic acid	
12	21.730	1.85	1-Propanamine	
13	23.340	6.08	dl-Phenylephrine	
14	23.635	2.31	Methyl stearate	
15	30.922	3.00	6-Bis-dimethylamino methyl-	

Table 2. Identified chemical compounds in Canion variety seeds using GC-MS analysis

Peak no.	RT	Area%	IUPAC name	Structure formula
1	5.675	46.35	Eucalyptol	
2	6.082	5.61	Oxirane (methoxymethyl)-	
3	6.913	2.34	Acetamide, 2-fluoro-	
4	7.354	3.36	Octanoic acid, methyl ester	
5	8.531	1.68	1-Octanamine, N-methyl-	
6	8.981	1.39	Silane, trimethyl(octadecyloxy)-	
7	12.192	1.68	Propenone, 3-(2-benzoxazolylthio)-	
8	15.083	1.65	N-[3,5-Dinitropyridin-2-yl]proline	
9	20.856	1.59	Pentafluoropropionamide	
10	21.116	13.21	Hexadecanoic acid, methyl ester	
11	21.670	2.15	Propanamide	
12	23.332	11.12	11-Octadecenoic acid, methyl ester	
13	23.643	2.33	Methyl stearate	
14	23.877	2.95	Adipamide	
15	29.676	2.59	Metaraminol	

A pioneering taxonomic study comparing (*P. armeniaca*) oil from different species of *Prunus* provided exciting information about their biochemical properties. Stryjecka et al. (2019) studied the separation and identification of some oil compounds in the Canion cultivar. The study showed the presence of different proportions of fatty acids as follows: oleic acid (18:1) represented 70.70% of the oil, while the proportions of linolenic acid (18:3), palmitic acid (16:0), stearic acid (18:0), palmitoleic acid (16:1), and linoleic acid (18:2) ranged from 28.3 and 31.4 to 50.3 mg/kg, 58.5 mg, and 40.0 mg/kg, respectively. Manzoor et al. (2012) studied the chemical composition of apricot seed oil from different sources and confirmed the high concentrations of oleic and linoleic acids. The high content of oleic and linoleic acids highlights the benefits of the oil in the industrial and medical sectors. These studies contribute to understanding the complex chemical composition of apricot oil, allowing for various applications in laboratory and taxonomic studies. A previous study on five different cultivars of apricots (*P. armeniaca*) by Stryjecka et al. (2019) showed that "Early Orange" and "Goldrich Sungiant" had the highest levels of linolenic acid, while "Somo" and "Hargrand" had the lowest one. In addition, the stearic acid was varied, with the "Goldrich Sungiant" having the highest amount, followed by the oils from the "Early Orange," "Harcot," "Hargrand," and lastly, "Somo" cultivars.

Identifying the chemical compounds of Songold variety seeds using GC-MS

Table 3 presents the results of the GC-MS analysis of chemical compounds in Songold variety seeds of *Prunus x domestica* L. The identified compounds of Songold variety seeds were alpha.-pinene (9.64%), Eucalyptol (40.72%), oxy[phosphinyl]- (3.61%), n-hexanoyl- (Peaks #4 and 6, 3.42% and 3.05%, respectively), Methyl valerate (1.88%), Cyclobutanol (1.59%), Chlorodifluoroacetamide (0.85%), ecamethyl- (1.42%), 2- Octadecanoic acid (3.52%), 2-Hydroxydesmethylimipramine (0.68%), cis-Aconitic anhydride (Peaks #12 and 18, 0.97% and 1.20%, respectively), Hexa-t-butylthiatrisiletane (2.09%), Sarcosine, N-isobutyryl- (1.30%), Norpseudoephedrine (0.72%), Acetamide, 2-cyano- (0.98%), 1-Octadecanamine, N-methyl- (Peaks 17 and 25, 0.77% and 0.77% respectively), Hexadecanoic acid, methyl ester (8.31%), n-Decanoic acid (5.74%), Phenylephrine (3.64%), Methyl stearate (1.58%), 4-Amino-2-oxy-furazan-3-carboxylic (0.72%), Methylpent-4-phenylamine (0.81%).

The results obtained from the current study confirm that the composition of chemical oil could be used for plant classification systems. The identified oil compounds include terpenes (alpha-pinene, eucalyptus), fatty acids (n-hexanoyl-, Octadecanoic acid, 2-, Hexadecanoic acid, methyl ester, n-Decanoic acid), and nitrogen-containing natural chemicals (hydroxides ethyl imipramine,2-, 1-Octadecanamine, N-methyl—). These results are important for identifying and classifying plant species and determining the chemical compounds and specific chemical compounds of each plant species.

Many studies have focused on studying the chemical composition of oil in apricot varieties. These oils contain linoleic, palmitic, and linolenic acids. The presence of carotenoids and other compounds can indicate the similarities and differences between apricot varieties; however, apricots also vary in sweetness, flavour, and orange colour (Fratianni et al. 2018; Pintea et al. 2020). Lipid plays a vital role in determining the aroma and colour of apricots. These compounds in apricots had good nutritional value but also provided many health benefits, such as anti-inflammatory, anti-inflammatory properties, antiviral, antibacterial, antibacterial, anti-hypertensive, and anti-inflammatory (Varesi et al. 2023). The analysis of 11 apricot varieties confirmed the presence of fatty acids such as linolenic (18:3), palmitic (16:0), and linoleic (18:2) (Erdogan-Orhan and Kartal 2011; Pintea et al. 2020). An estimated 120 chemicals are present in oily extracts, the most abundant being fatty acids. Thus, we conclude that the type and quantity of fatty acids are important in classifying apricots. Oils also contain aldehydes, esters, alcohols, ketones, terpene hydrocarbons, and lactones. These oil compounds are potential markers for classification and authenticity in apricot analysis (Hölzl and Dörmann 2019).

Identifying the chemical compounds of Freedom variety seeds using GC-MS

Table 4 presents the results of GC-MS analysis on seeds of the Freedom variety of *P. domestica*. It shows that the seeds contained various chemical compounds. The study showed that the identified compounds were alpha.-pinene (11.27%), Eucalyptol (50.36%), Ethylene oxide (4.15%), Tenamfetamine (1.54%), Cyclobutanol (1.62%), Octanoic acid, methyl ester (2.77%), 4-Tripropylsilyloxytetradecane (1.20%), Propanediamide, 2-ethyl-2-phenyl- (1.64%), Propanamide (1.78%), Hexadecanoic acid, methyl ester (9.76%), Sarcosine, N-valeryl-, pentyl ester (1.79%), Hexadecanoic acid, ethyl este (1.97%), Guanidine, N, N-dimethyl- (5.98%), Methyl stearate (1.49%), and 3-Piperidinol (2.67%). The findings of this study can be beneficial for plant classification, as the unique chemical compounds can serve as chemical markers for identification and differentiation between plant species or crops. The quantity and type of each compound may provide a basis for understanding these natural compounds' importance in the Freedom variety classification.

Zhou et al. (2016) used heat pressing and cold pressing techniques to determine the oil characteristics and quality of Longwangmo apricot (*P. armeniaca*) kernel oil. It showed that the primary fatty acids in the oil were oleic acid (70.29-71.25%), linoleic acid (22.31-23.00%), palmitic acid (4.55-7.87%), stearic acid (4.55-7.87%), and palmitoleic acid (0.62%). The oils included 19 to 52 different constituents at concentrations ranging from 6172 to 23871 μg/g. Interestingly, nine different chemical compounds were consistently found in all apricot kernel oils at varying concentrations, namely 2- methyl propanal; methyl pyrazine, 2,5-dimethyl pyrazine, nonanal 2 methyl buty, aldehyde methoxy pyrazine,3 ethyls 2, furfural 5 dimethyl-pyrazine, and benzaldehyde Additionally, Pavlović et al. (2018) reported specific fatty acid compositions in apricot kernel oil, with palmitic, oleic, and linoleic acids constituting 5.93%, 57.33%, and 33.81%, respectively. These findings of this study contribute valuable insights into the nutritional profile and chemical composition of apricot kernel oil, emphasizing its potential as a health-promoting dietary supplement. A study by Giligashvili et al. (2023) showed that the seeds of *P. domestica*, frequently grown in Western and Eastern Georgia, yielded neutral lipids of 37% and 38%, respectively. The analysis results also showed the presence of the following classes: triglycerides, hydrocarbons, diglycerides, fatty acids, and sterols. The results also showed that fatty acids had been detected both qualitatively and quantitatively inside the plum kernel oil from various places were eicosanoic acids, heptadecanoic, 9-hexadecanoic, 9,12-hexadecanoic, hexadecanoic, octadecanoic, and octadecanoic. Total polar lipids (p/l) were extracted from the plant whey from both areas, yielding 75% and 0.78% after removing neutral lipids. The study's results also showed the presence of compounds such as phospholipids phosphatidylethanolamine, phosphatidylcholine, phosphatidylinositol, and lysophosphatidylinositol, which had been identified qualitatively and had a total concentration of 0.15 and 0.16%. Kishan et al. (2022) revealed that the oil of *P. domestica* (plum) seeds contains all of the following compounds, i.e., 13-docosenamide, stigmast-4-en-3-one, and gamma-sitosterol, with the concentrations of 13.16%, 13.34%, and 12.46%, respectively. Chemical compounds with a concentration of more than 2% were octadecanoic acid, 2,3-hydroxypropyl ester (6.33%), tris Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) (25.95%), 13-docosenamide (12.32%), and Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) phosphate (6.84%).

Table 3. Identified chemical compounds in Songold variety seeds using GC-MS analysis

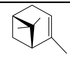
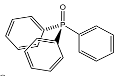
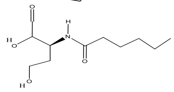
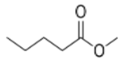
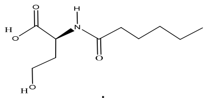
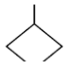
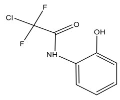
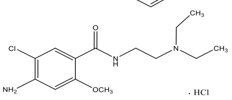
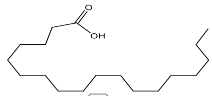
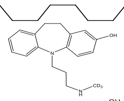
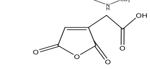
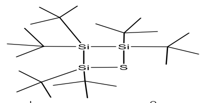
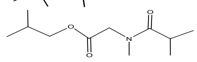
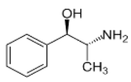
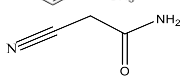
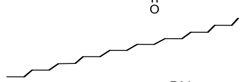
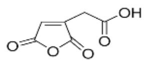
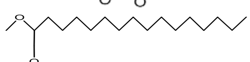
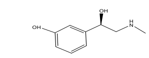
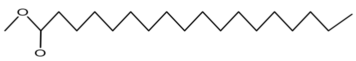
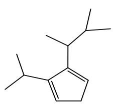
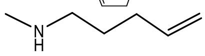
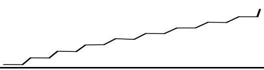
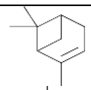
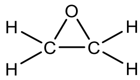
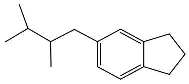
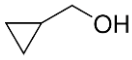
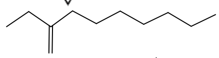
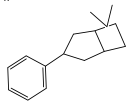
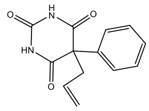
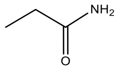
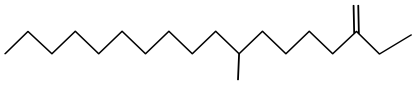
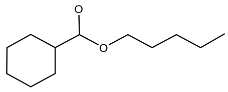
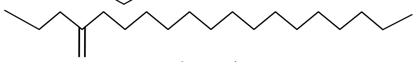
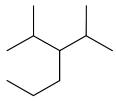
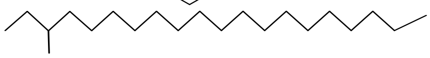
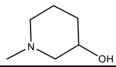
Peak no.	RT	Area%	IUPAC name	Structure formula
1.	4.091	9.64	alpha.-Pinene	
2.	5.683	40.72	Eucalyptol	
3.	6.099	3.61	oxy]phosphinyl]-	
4.	6.653	3.42	n-hexanoyl-	
5.	7.337	1.88	Methyl valerate	
6.	8.912	3.05	n-hexanoyl-	
7.	9.362	1.59	Cyclobutanol	
8.	9.795	0.85	Chlorodifluoroacetamide	
9.	11.205	1.42	ecamethyl-	
10.	11.586	3.52	Octadecanoic acid, 2-	
11.	13.421	0.68	Hydroxydesmethylimipramine,2-	
12.	14.633	0.97	cis-Aconitic anhydride	
13.	14.901	2.09	Hexa-t-butylthiatrisiletane	
14.	17.688	1.30	Sarcosine, N-isobutyl-	
15.	18.060	0.72	Norpseudoephedrine	
16.	18.987	0.98	Acetamide, 2-cyano-	
17.	19.333	0.77	1-Octadecanamine, N-methyl-	
18.	19.982	1.20	cis-Aconitic anhydride	
19.	21.116	8.31	Hexadecanoic acid, methyl ester	
20.	21.687	5.74	n-Decanoic acid	
21.	23.332	3.64	Phenylephrine	
22.	23.643	1.58	Methyl stearate	
23.	24.465	0.72	4-Amino-2-oxy-furazan-3-carboxylic	
24.	25.677	0.81	Methylpent-4-enylamine	
25.	28.005	0.77	1-Octadecanamine, N-methyl-	

Table 4. Identified chemical compounds in Freedom variety seeds using GC-MS analysis

Peak no.	RT	Area%	IUPAC name	Structure formula
1	4.091	11.27	alpha.-Pinene	
2	5.666	50.36	Eucalyptol	
3	6.108	4.15	Ethylene oxide	
4	6.653	1.54	Tenamfetamine	
5	6.913	1.62	Cyclobutanol	
6	7.354	2.77	Octanoic acid, methyl ester	
7	8.981	1.20	4-Tripropylsilyloxytetradecane	
8	12.192	1.64	Propanediamide, 2-ethyl-2-phenyl-	
9	15.075	1.78	Propanamide	
10	21.133	9.76	Hexadecanoic acid	
11	21.704	1.79	Sarcosine, N-valeryl-, pentyl este	
12	21.990	1.97	Hexadecanoic acid, ethyl ester	
13	23.340	5.98	Guanidine, N, N-dimethyl-	
14	23.643	1.49	Methyl stearate	
15	24.093	2.67	3-Piperidinol	

In conclusion, the current research on four species of the genus *Prunus* focused on *P. armeniaca* (represented by the Sayeb and Canion varieties) and *P. domestica* (represented by the Songold and Freedom varieties). The technology-advanced chromatography method used in the analysis process is GC-MS, widely used as a highly efficient method for analysing separated compounds. The *P. armeniaca* showed that the highest concentration of hexadecanoic acid (11.31) was obtained in the Sayeb variety. In contrast, the highest concentration of eucalyptol (46.35) was in the Canyon cultivar. The *P. domestica*, the highest eucalyptol (40.72), appeared in the Sungold variety. The highest concentration of eucalyptol (50.36) appeared in the Freedom variety. This GC-MS analysis has proven effective in showing differences between plant varieties regarding the number of compounds and the type and concentration, and it could be used for plant classification.

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