CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES

https://cajmns.casjournal.org/index.php/CAJMNS

Volume: 07 Issue: 01 | January 2026 ISSN: 2660-4159

Article

GC-MS Analysis of Essential Oil Isolated from Mediasia Macrophylla Pimen Plants

Nayimova Bahora[1], Mukhamadiev Abdukodir [2], Mukhamadiev Nurali[3], Fazliyeva Nigina[4], Dusov Tursunmurod[5], Radjabov Asatillo[6], Kulmirzayeva Sabina[7]

1. Samarkand State University named after Sharof Rashidov, Uzbekistan
2. Samarkand State University named after Sharof Rashidov, Uzbekistan
3. Samarkand State University named after Sharof Rashidov, Uzbekistan
4. Samarkand State University named after Sharof Rashidov, Uzbekistan
5. Samarkand State University named after Sharof Rashidov, Uzbekistan
6. Samarkand State University named after Sharof Rashidov, Uzbekistan
7. Samarkand State University named after Sharof Rashidov, Uzbekistan

* Correspondence: nayimovabahora@gmail.com, mqodir0808@gmail.com, nuralimukhamadiev@gmail.com, dusov86@gmail.com, asatillo.radjabov1950@gmail.com, sabinakulmirzayeva12@gmail.com

Abstract: Mediasia macrophylla Pimen, a forthcoming source of bioactive substances, has not been sufficiently investigated, and this study reveals the chemical composition of its essential oil. There is little prior research for this genus, indicating a knowledge gap regarding its chemical and functional characteristics. To our knowledge, this is the first comprehensive laboratory study of the chemical composition of this essential oil, which was isolated by hydrodistillation and subsequently analyzed by GC-MS.

Twenty five compounds was found in the extraction, with methyleugenol as the major component (46.28%) followed by trans ligustilide (11.66%) and geranyl acetate (7.45%). The highest percentage of oil was made up of phenylpropanoids, esters, terpenes, phenols and lactones. Chiral properties were demonstrated by several components, implying that isomeric differences might impact both aroma and biological activities. The present results provide the first in depth chemical characterization of the essential oilof the species while also revealing the presence of compounds with established antimicrobial, antioxidant and anti-inflammatory activity.

Therefore, these results indicate strong applications in the field of pharmaceuticals, cosmetics and aromatherapy. Collection from Account Track Macro This initial study addresses an important gap by documenting the chemical diversity of the essential oil of M. macrophylla and lays the groundwork for future studies focused on the chemical, pharmacological, and enantiomeric composition of M. macrophylla essential oil.

Keywords: essential oil, Mediasia macrophylla, GC MS analysis, methyleugenol, ligustilide, phenylpropanoids, bioactive compounds

Citation: Bahora, N, Abdukodir, M, nurali, M, Nigina, F, Tursunmurod, D, Asatillo, R & Sabina, K. GC-MS Analysis of Essential Oil Isolated from Mediasia Macrophylla Pimen Plants. Central Asian Journal of Medical and Natural Science 2026, 7(1), 243-247.

Received: 10th Aug 2025
Revised: 16th Sep 2025
Accepted: 24th Oct 2025
Published: 30th Nov 2025

1. Introduction

Mediasia Macrophylla Pimen is one of the promising objects for study among the genus Mediasia plants because the chemical composition of these plants is considerably unsatisfactory studied despite the known potential of bioactive compounds. However, the isolation and study of essential oil of this plant especially in the conditions of the local

flora of the Surkhandarya region opens up great opportunities for the creation of innovative products with high added value.

Increasing global interest in environmentally pure and natural products, as well as a search for novel sources of bioactive compounds for medicine and industry, make the research relevant as well. The essential oil of Mediasia Macrophylla Pimen in large quantities in the future can be a raw material for the manufacture of new products in various fields [1], [2], [3].

As for chemistry of natural compounds, the study of essential oils is one of the developing fields. Currently, many studies are focused on the qualitative and quantitative composition, as well as the biological activity of the essential oils of various plants, but for the genus Mediasia, particularly Mediasia Macrophylla Pimen there are no data [4], [5].

The genus Mediasia are few studied plants with bronhigh potential as sources of bioactive constituents. While the chemical composition of essential oils from each of species of the genus is described by many publications, systematic data on their overall composition and properties is scarce. Such experimental studies are very scarce, especially for plants growing in certain climatic conditions, for example in Surkhandarya region [6], [7].

The high performance of GC-MS in the analysis of complex mixtures of essential oils has made it the method of choice for this application. However, the majority of these existing studies report only on overall oil composition, with limited information on more detailed aspects such as component chirality or compound interactions [8], [9], [10].

Although much biological activity such as antimicrobial, antioxidant, and anti-inflammatory investigation has been performed on essential oils, essential oils from Mediasia genus with Mediasia macrophylla Pimen as an example of the small number of conducted pharmacological studies on essential oils. This gap restricts our understanding of their further therapeutic potential [11], [12].

Thus, although progress has been made in essential oil studies, the chemical profiles and characteristics of the essential oil from Mediasia macrophylla Pimen are still underexplored, highlighting the importance of ideally chemical studies of such a new essential oil in various applications. The main aim of this study is to identify the chemical constituents of the essential oil of Mediasia Macrophylla Pimen by GC-MS [13].

Methodology

Plant material–Mediasia macrophylla Pimen, was collected in the period from October to November in Vakhshivar village, Altynsay district, Surkhandarya region. The material was air dried and stored for a year prior to oil extraction. A Clevenger apparatus was used for the hydrodistillation of 500 g of either fresh or dried plant material, with 2.0 liters of distilled water processed for three hours (except where indicated). The distillate was decanted off from the aqueous phase, dried on anhydrous sodium sulfate and kept at +4 °C in sealed dark glass vials prior to analysis.

The essential oil was analyzed using YL6900 GC-MS system attached with HP-5MS capillary column (30 m × 0.25 mm × 0.25 μm) to find chemical composition profile. The oven program was 60 °C for 2 min, then 280 °C at 10 °C per min and a hold of 5 min. The injector temperature was maintained at 250 °C and 1 μL (hexane, 1:100) of the diluted sample was injected. Carrier gas was Helium (1.0 mL per minute). Mass spectra were obtained between 40 to 500 amu, with electron impact ionization detection at 70 eV. The components were identified with NIST and AMDIS libraries and were confirmed with retention index calculations using C8 to C20 n alkanes [14]. Quantification was based on peak area percentages, and data were processed using Statistika software. Standard deviations for all hydrodistillation and GC-MS analyses were below two percent for three repetitions.

The obtained chromatogram of the essential oil isolated from the plant Mediasia Macrophylla Pimen is shown in Figure 1.

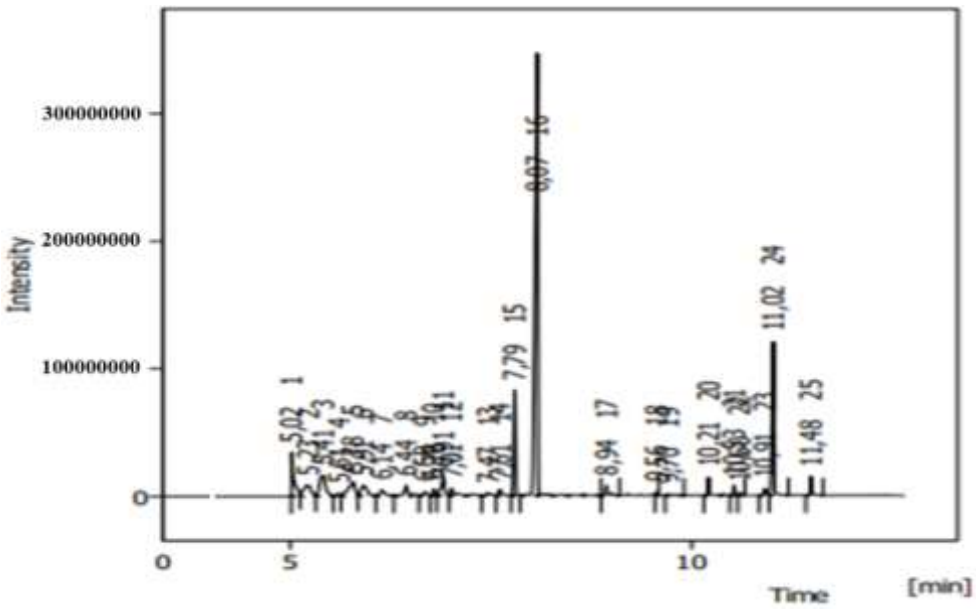

Figure 1. Chromatogram of the essential oil isolated from the plant Mediasia Macrophylla Pimen

The contents of the components were computed as a percentage on the basis of peak area in the chromatogram. The data obtained were processed with the Statistika software [15]. Both stages (hydrodistillation and GC-MS) were done triplicates to promote the reliability of the results. The standard deviation was lower than 2%.

2. Results

As a result of the analysis by gas chromatography-mass spectrometry (GC-MS) 25 compounds were identified in the composition of the essential oil of Mediasia Macrophylla Pimen, the composition and content of which are given in Table 1.

Table 1. Results of GC-MS analysis of the essential oil isolated from Mediasia Macrophylla Pimen plants

Name	Chemical formula	Retention time, min	Percentage content %
allo-Ocimene	$C_{10}H_{16}$	5,017	4,00
3,7,7-Trimethyl-8-(2-methyl-propenyl)-bicyclo[4.2.0]oct-2-ene	$C_{15}H_{24}$	5,228	3,39
5-Pentylcyclohexa-1,3-diene	$C_{11}H_{18}$	5,407	5,04
p-Mentha-1,5-dien-8-ol	$C_{10}H_{16}O$	5,608	0,48
Thymol	$C_{10}H_{14}O$	5,780	3,80
Estragole	$C_{10}H_{12}O$	5,909	2,75
Fenchylacetate	$C_{12}H_{20}O_2$	6,142	1,28
Geraniol	$C_{10}H_{18}O$	6,439	1,53
1,2-15,16-Diepoxyhexadecane	$C_{16}H_{30}O_2$	6,676	0,67
Lavandulyl propionate	$C_{13}H_{22}O_2$	6,783	0,73
Bornyl acetate	$C_{12}H_{20}O_2$	6,905	2,77
Phenol, 2-methyl-5-(1-methylethyl)-	$C_{12}H_{18}O$	7,005	0,76
(2,2,6-Trimethyl-bicyclo[4.1.0]hept-1-yl)-methanol	$C_{11}H_{20}O$	7,468	0,63
Phenol, 2-methoxy-3-(2-propenyl)-	$C_{10}H_{12}O_2$	7,607	1,00
Geranyl acetate	$C_{12}H_{20}O_2$	7,794	7,45

Methyleugenol	$C_{11}H_{14}O_2$	8,073	46,28
cis-Methylisoeugenol	$C_{11}H_{14}O_2$	8,937	0,86
Isopentyl 3-hydroxy-2-methylenebutanoate	$C_{10}H_{18}O_3$	9,560	0,30
3-propylidenephthalide	$C_{11}H_{10}O_2$	9,704	0,21
4H-1-Benzopyran-4-one, 2,3-dihydro-2,7-dimethyl-	$C_{15}H_{12}O_4$	10,209	1,27
Butylidenephthalide	$C_{12}H_{12}O_2$	10,528	0,65
Valeranone	$C_{15}H_{26}O$	10,600	0,32
3-Butylidene phthalide	$C_{12}H_{12}O_2$	10,911	0,70
trans-Ligustilide	$C_{12}H_{14}O_2$	11,015	11,66
(E)-Ligustilide	$C_{12}H_{14}O_2$	11,485	1,44

According to the data, the terpenes and their derivatives are those based on monoterpenes (allo-Ocimene (4,. The sesquiterpene Valeranone (0,32%) and phenol p-Mentha-1,5-dien-8-ol (0,48%) constitute 4,8% of the essential oil of Mediasia Macrophylla Pimen.

Conclusion: The total of phenols and their derivatives (Thymol (3,80%), Estragole (2,75%), Phenol, 2-methyl-5-(1-methylethyl) (0,76%), and Phenol, 2-methoxy-3-(2-propenyl) (1,00%)) in essential oil of Mediasia Macrophylla Pimen makes 8,31% of the oil.

The essential oil of Mediasia Macrophylla Pimen consists of 60,24% phenylpropanoid, the main component being Methyleugenol (46,28%) trans-Ligustilide (11,66%), which also determine the major biological and aromatic properties of the essential oil.

Esters such as Geranyl acetate (7,45%), Bornyl acetate (2,77%) ect., account for 12,23% of Mediasia Macrophylla Pimen essential oil and represent the second contributor to the aroma.

Particularly lcoalized properties such as biological and aromatic characteristics in the essential oil of Mediasia Macrophylla Pimen (Lactones; 3-Propylidenephthalide (0,21%), Butylidenephthalide (0,65%) and 3-Butylidene phthalide (0,70%) constitute 1,56%)

Additionally, there are other oxygenated compounds (2,24% of the essential oil of Mediasia Macrophylla (Pimen)): 1,2-15,16-Diepoxyhexadecane (0,67%), Isopentyl 3-hydroxy-2-methylenebutanoate (0,30%), 4H-1-Benzopyran-4-one, 2,3-dihydro-2,7-dimethyl- (1,27%). The major components of Mediasia Macrophylla Pimen essential oil (EOMP) could also have given rise to the formation of optical isomers which has a great impact on its odor and biological properties. For instance, Geranyl acetate (7,45%) possesses a chiral center (isomers change its biological activity), and Bornyl acetate (2,77%) has the ability to vary its aromas: (+)-form has an intense camphor smell, while (-)-form has more gentle shades. Likewise, isomeric fenchyl acetates 1,28% also give small contributions to the aroma characteristics of the oil. The spatial configuration of trans-ligustilide (11,66%) and (E)-ligustilide (1,44%) is responsible for the exceptional therapeutic potential of these compounds. The major component is methyleugenol (46,28%), and it has pseudo-chirality that may greatly affect its biological properties. This observation stresses that further studies on the enantioselective composition should be performed to better comprehend the physico-chemical and the biological properties of the essential oil.

Hence, the chemical composition of the essential oil of the species Mediasia macrophylla Pimen contains 25 identified compounds, with methyleugenol (46,28%), trans-ligustilide (11,66%) and geranyl acetate (7,45%) being the main constituents. The most abundant components, and therefore the majority of the oil properties, are the phenylpropanoids (60,24%), the terpenes (4,80%), the esters (12,23%), the phenols (8,31%) and the lactones (1,56%).

3. Conclusion

Results Also, 25 of the identified compounds were deteched in the essential oil of Mediasia macrophylla Pimen, with methyleugenol (46,28%), trans-ligustilide 11,66%) and geranyl acetate 7,45%) as the main components. Phenylpropanoids (60,24%), which are largely responsible for the specific aroma and high biological activity of the oil, make up the largest percentage.

Composed of phenylpropanoids, terpenes, esters, phenols, and lactones, the oil exhibits wide spectrum biological activities antibacterial, anti-inflammatory, and antioxidant showing its potential in pharmacology, cosmetology, and aromatherapy. In addition, chiral centres existing in compounds like bornyl acetate, fenchyl acetate and geranyl acetate could impact the fragrance profile and bioactivity of the oil, therefore highlighting the need for chiral analysis to gain a more complete understanding of their functional roles.

REFERENCES

[1] Kurimoto S., Okasaka M., Kashiwada Y., Kodzhimatov O. K., and Takaishi Y., "Four new glucosides from the aerial parts of *Mediasia macrophylla*," *Journal of Natural Medicines*, vol. 65, no. 1, pp. 180 to 185, Jul. 2010.

[2] Kurimoto S., Okasaka M., Kashiwada Y., Kodzhimatov O. K., and Takaishi Y., "A C14 polyacetylenic glucoside with an alpha pyrone moiety and four C10 polyacetylenic glucosides from *Mediasia macrophylla*," *Phytochemistry*, vol. 71, no. 5 to 6, pp. 688 to 692, Apr. 2010.

[3] Chernenko T. V., Glushenkova A. I., and Nigmatullaev A. M., "Lipids from *Mediasia macrophylla* leaves," *Chemistry of Natural Compounds*, vol. 38, pp. 307 to 309, 2002.

[4] Pulatova L. U. and Eshkaraev S. C., "*Mediasia macrophylla* Pimen application of the plant in medicine," *Multidisciplinary Journal of Science and Technology*, vol. 4, no. 10, pp. 262 to 266, 2024.

[5] Dzhumaev K. K., Tkachenko K. G., Zenkevich I. G., and Tsibul'skaya I. A., "Constituent composition of the essential oil from leaves of *Mediasia macrophylla* (Regel et Schmalh.) M. Pimen," 1988.

[6] Baser K. H. C. and Buchbauer G., *Handbook of Essential Oils*. CRC Press, 2009.

[7] Fischer-Rizzi S., *Complete Aromatherapy Handbook: Essential Oils for Radiant Health*. Sterling Publishing Co., 1990.

[8] De Vincenzi M., Silano M., Stacchini P., and Scazzocchio B., "Constituents of aromatic plants: I. Methyleugenol," *Fitoterapia*, vol. 71, no. 2, pp. 216 to 221, Apr. 2000.

[9] International Agency for Research on Cancer, "Methyleugenol," NIH, 2025.

[10] Santana H., Kumar R., Mali S., and Helena E., "Methyl eugenol: Potential to inhibit oxidative stress, address related diseases, and its toxicological effects," *Future Integrative Medicine*, Dec. 2024.

[11] Zari A. T., Zari T. A., and Hakeem K. R., "Anticancer properties of eugenol: A review," *Molecules*, vol. 26, no. 23, p. 7407, 2021.

[12] Zhang X., Felter S. P., Api A. M., Joshi K., and Selechnik D., "A cautionary tale for using read across for cancer hazard classification: Case study of isoeugenol and methyl eugenol," *Regulatory Toxicology and Pharmacology*, vol. 136, p. 105280, Dec. 2022.

[13] Adams R., *Identification of Essential Oil Components by Gas Chromatography/Mass Spectrometry*, 5th ed., 2017.

[14] Morteza Semnani K. and Saeedi M., "Chemical composition and antimicrobial activity of essential oil of *Stachys persica* Gmel.," *Journal of Essential Oil Research*, vol. 21, no. 3, pp. 279 to 282, 2009.

[15] Radulović N. S. and Blagojević P. D., "A note on the volatile secondary metabolites of *Foeniculum vulgare* Mill. (Apiaceae)," *Facta Universitatis* Series: Physics, Chemistry and Technology, vol. 8, no. 1, pp. 25 to 37, 2010.