Research Article

Medically Important Compounds in *Ipomoea carnea* Flowers

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Abstract | *Ipomoea carnea* Jacq. is a medicinally important wild shrubby plant that generally grows at moist places in Pakistan. There are only a few scientific reports on *I. carnea* especially on phytochemical profile of its flowers. In the present study, flower extract of this plant was analyzed by GC-MS in search of identification of medicinally important constituents. The dried and crushed material of flowers was extracted in analytical grade methanol for one week and after filtration, it was subjected to GC-MS analysis. Major compounds in the flower extract were germacrene D (12.44%), *n*-hexadecanoic acid (12.15%), and caryophyllene (11.28%). Moderately occurring compounds included docosane (7.68%), 4H-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl (6.92%), pentadecane (6.20%), cyclopentanone, dimethylhydrazone (5.93%), dotriacontane (5.91%), humulene (5.82%), octadecanoic acid (4.05%), *cis*-vaccenic acid (3.72%), heptadecane (3.38%), and heptadecane, 2,6,10,15-tetramethyl- (3.10%). Six compounds with peak areas below 3% were categorized as less abundant. The three major compounds in flower extract of *I. carnea* possess antioxidant, antimicrobial, anticancer, anti-inflammatory, cytotoxicity, insecticidal and insect repellant properties as reported in the literature.

Received | March 22, 2023; **Accepted** | June 09, 2023; **Published** | June 27, 2023
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Citation | Javaid, A., I.H. Khan, M.F.H. Ferdosi, A. Anwar and M. Manzoor. 2023. Medically important compounds in *Ipomoea carnea* flowers. *Pakistan Journal of Weed Science Research,* 29(2): 115-121.
DOI | https://dx.doi.org/10.17582/journal.PJWSR/2023/29.2.115.121
Keywords | Bioactive compounds, Flowers, *Ipomoea carnea*, Methanolic extract, Shrub

Introduction

Plants bioactive compounds perform multiple biological functions such as antimicrobial, antiallergenic, anticarcinogenic, and antioxidant effects essential for the maintenance of good health in human (Ferdosi *et al*., 2021a; Khan and Javaid, 2022; Dinchenya *et al*., 2023). These bioactive compounds also have the ability to cure various diseases such as neurodegenerative disorders, cancer, cardiovascular diseases, autoimmune and inflammatory diseases (Javaid *et al*., 2022a; Dinchenya *et al*., 2023). In addition, plants also contain bioactive compounds which are anti-fibrotic, anti-tumor, anti-depressant,

anti-protozoal, anti-helminthic, analgesics, immune stimulatory, antiviral, antioxidant, antifungal and anti-inflammatory in nature and also help in drugs discovery (Banaras *et al*., 2021; Agubosi *et al*., 2022; Muritala *et al*., 2022). Various horticultural and medicinal plants constitute a source of bioactive compounds, which are useful in killing the various bacterial species (Ferdosi *et al*., 2020). Isolation, identification and purification of various bioactive compounds of plant origin have shown important advancements in the recent years (Khan and Javaid, 2023).

Pink morning glory (*Ipomoea carnea* Jacq.), belongs to family Convolvulaceae, with a history of its use in traditional medicines (Figure 1). It is a shrub that can reach a height of 10 meters. It is indigenous to tropical and subtropical areas of the globe, such as Asia, Africa and South America (Wadnerwar and Deogade, 2022). Its leaves and flowers are used to heal gastrointestinal issues, skin conditions and snake bites in India. This plant is used to cure a variety of illnesses in Africa, including dysentery and fever (Dubey *et al*., 2022). A tea made from the plant is used in traditional Mexican medicine to manage diabetes and high blood pressure. *I. carnea*'s medicinal qualities have drawn more attention in recent years, and numerous scientific studies have been carried out to look into its possible health advantages. It possesses antibacterial, anti-inflammatory and antioxidant properties (Filho *et al*., 2022). Its extracts can stop the development of common pathogens like *Escherichia coli* and *Staphylococcus aureus* (Akshaya *et al*., 2023). Alkaloids, flavonoids and terpenoids, among other phytochemicals, are responsible for its antibacterial activity (Chandrakar *et al*., 2022). Its latex contains compounds such as L-rhamnose, jalapinolate, D-chinovose, convolvulinolate and ipurolic acid (Legler, 1965). Its leaves possess swainsonine, calystegines B1, B2, B3 and C1, 2-epi-lentiginosine and N-methyl-trans-4-hydroxy-L-proline (Adsul *et al*., 2009). Studies regarding phytochemical profile of its flowers especially from Pakistan are scarce (Kunal *et al*., 2021). Therefore, the present research work was undertaken to identify medicinally important compounds in methanolic flower extract of *I. carnea* through GC-MS analysis.

Materials and Methods

Collection of I. cornea flowers

Twenty *Ipomea carnea* flowers were collected from the plants growing along the bank of BRB canal 4 km towards east of Daska, district Sialkot during September 2022. The flowers were washed thoroughly under tap water. The moisture on the surface of the flowers was evaporated under a fan. These flowers were dried in an oven at 40 °C and crushed into a course powder.

Preparation of methanolic extract

Five grams of dried powdered flowers of *I. cornea* were dipped in 10 mL of pure methanol in a conical flask. The mouth of the flask was tightly closed with a plastic sheet and left for one week at room temperature. After that, the soaked material was filtered and the filtrate (methanolic extract) was stored in a glass test tube.

Figure 1: *Ipomea carnea plants growing along the bank of BRB canal near Daska, Sialkot.*

GC-MS analysis

For identification of possible compounds in the flower extract of *I. cornea,* the extract was analyzed by GC-MS. For this purpose, the procedure described by Ferdosi *et al.* (2021b). The GC machine model 7890B and MS machine model 5977A (Agilent, USA) were used for analysis of the flower extract. The column was of 30 m × 0.25 µm × 0.25 µm. Injection volume was taken as 1 µL and it was used as a carrier gas in a split less mode. Oven ramping temperature was 80 °C at the start that was increased by 10 °C per min up to 300 °C. Inlet temperature was 280 °C. Total run time was 37 min. MS conditions included a scan range of 50–500 m/z with 5 min solvent delay time; and 230 °C source temperature. The spectra were compared with NIST 2020 library version for the identification of compounds.

Literature survey

To gather information regarding biological activities of the compounds identified in the present study,

Table 1: *List of compounds in methanolic flower extract of Ipomea carnea identified by GC-MS analysis.*

S. No.	Names of compounds	Molecular formula	Molecular weight	Retention time (min)	Peak area (%)
1	Cyclopentanone, dimethylhydrazone	$C_7H_{14}N_2$	126.20	10.290	5.93
2	4H-Pyran-4-one, 2,3-dihydro-3, 5-dihydroxy-6-methyl	$C_6H_8O_4$	144.12	11.696	6.92
3	Caryophyllene	$C_{15}H_{24}$	204.35	17.302	11.28
4	Humulene	$C_{15}H_{24}$	204.35	17.963	5.82
5	Germacrene D	$C_{15}H_{24}$	204.35	18.416	12.44
6	Pentadecane	$C_{15}H_{32}$	212.41	18.622	6.20
7	α-Farnesene	$C_{15}H_{24}$	204.35	18.712	2.83
8	Pentadecanoic acid, 14-methyl-, methyl ester	$C_{17}H_{34}O_2$	270. 45	25.382	1.46
9	*n*-Hexadecanoic acid	$C_{16}H_{32}O_2$	256.42	25.878	12.15
10	Heptadecane	$C_{17}H_{36}$	240.47	27.294	3.38
11	9,12-Octadecadienoic acid, methyl ester, (E,E)-	$C_{19}H_{34}O_2$	294.47	27.701	0.91
12	Heptadecane, 2,6,10,15-tetramethyl-	$C_{21}H_{44}$	296.57	27.788	3.10
13	9,12-Octadecadienoic acid (Z, Z)-	$C_{18}H_{32}O_2$	280.44	28.197	1.69
14	*cis*-Vaccenic acid	$C_{18}H_{34}O_2$	282.46	28.276	3.72
15	*cis*-7-Hexadecenoic acid	$C_{16}H_{30}O_2$	254.41	28.341	2.45
16	Octadecanoic acid	$C_{18}H_{36}O_2$	284.47	28.583	4.05
17	Dotriacontane	$C_{32}H_{66}$	450.86	29.869	5.91
18	Nonadecane	$C_{19}H_{40}$	268.52	30.324	2.02
19	Docosane	$C_{22}H_{46}$	310.60	32.243	7.68

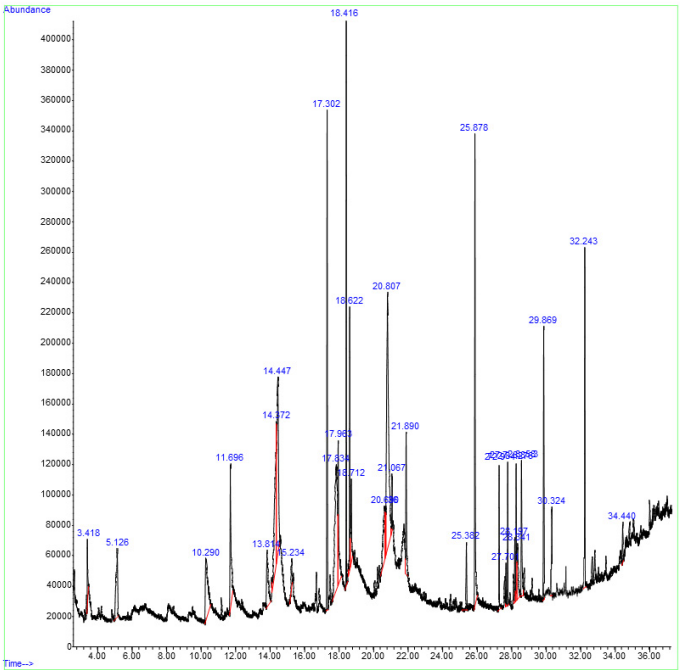

Figure 2: *GC-MS chromatogram of methanolic flower extract of Ipomea carnea.*

an online broad survey of the related published article was carried out. For this purpose, well-reputed databases such as Google Scholar, Science Direct, PubMed, Directory of Open Access Journals, Crossref and SciELO were surveyed.

Results and Discussion

GC-MS chromatogram is shown in Figure 2 that shows 19 compounds in the extract. Their details are shown in Table 1. Among these, three compounds namely germacrene D (12.44%), *n*-hexadecanoic acid (12.15%), and caryophyllene (11.28%) were recognized as the major constituents in the flower extract with 18.416, 25.878 and 17.302 min retention times, respectively. The most abundant compound germacrene D is a sesquiterpene that has also been reported as a major compound in many plant species including *Guatteria australis* and *Siparuna aspera* (Siqueira *et al.*, 2015; Noriega *et al.*, 2019). It is a very active biological molecule. It has the ability to activate an antennal receptor neuron of a moth *Heliothis virescens* (Rostelien *et al.*, 2000). In addition, this compound also possesses antioxidant properties with DPPH IC_{50} of 2.1 mg mL^{-1} (Noriega *et al.*, 2019). Moreover, it also showed insecticidal effects against mosquitoes, and repellent activity against ticks and aphids (Noge and Becerra, 2009). Caryophyllene is also a sesquiterpene that like germacrene D generally occurs in essential oils. It has also been found in methanolic extract of *Ageratum conyzoides* flowers as reported by Ferdosi *et al.* (2021b). It is an

antimicrobial agent and is used in food industry (Pieri *et al*., 2016). Moreover, many other activities such as anti-inflammatory, anticancer and antioxidant have also been associated with this compound (Dahham *et al*., 2015). The third major comound *n*-hexadecanoic acid is an important bioactive compound found in many plant species such as *Chenopodium murale, Vinca major* and *Tagetes erecta* (Javaid *et al*., 2021a; Ferdosi *et al*., 2022; Naqvi *et al*., 2022). It is an antifungal agent and can control the growth of various *Candida* species namely *C. krusei, C. glabrata, C. parapsilosis* and *C. albicans* (Souza *et al*., 2015). In addition, it also possesses anti-inflammatory potential (Aparna *et al*., 2012), and cytotoxic effect against human colorectal carcinoma cells (Ravi and Krishman, 2017).

Ten compounds *viz.* docosane (7.68%), 4H-pyran-4-one, 2, 3-dihydro-3, 5-dihydroxy-6-methyl (6.92%), pentadecane (6.20%), cyclopentanone, dimethylhydrazone (5.93%), dotriacontane (5.91%), humulene (5.82%), octadecanoic acid (4.05%), *cis*-vaccenic acid (3.72%), heptadecane (3.38%), and heptadecane, 2,6,10,15-tetramethyl- (3.10%) were identified as moderately occurring ones (Table 1). Among these, humulene appeared at 17.963 min retention time, has therapeutic potential against the growth of *Bacteroides fragilis* that causes inflammatory bowel disease (Jang *et al*., 2020). In addition, humulene isolated from leaves of *Hibiscus manihot* showed antioxidant activity as reported by Gunawan *et al*. (2016). Likewise, dotriacontane that appeared at 29.869 min in the GC-MS chromatogram, was previously isolated from *Drimia sanguinea*, *Senecio longiflorus* and *Helichrysum paronychioides* showed a number of biological activities such as antioxidant and antimicrobial (Asong *et al*., 2019).

Six compounds including *cis*-7-hexadecenoic acid (2.45%), nonadecane (2.02%), 9, 12-octadecadienoic acid (Z, Z)- (1.69%), pentadecanoic acid, 14-methyl-, methyl ester (1.46%), and 9, 12-octadecadienoic acid, methyl ester, (E, E)- (0.91%) were designated as less abundant ones (Table 1). The last two compounds which were appeared at 25.382 and 27.701 min in the chromatogram, respectively, have also been reported in roots of *Senna occidentalis* (Javaid *et al*., 2022b). 9, 12-octadecadienoic acid (Z, Z)- was previously reported from *Cannabis sativa* (Javaid *et al*., 2021b). Being a fatty acid methyl ester, it may act as an antimicrobial agent (Chandrasekaran *et al*., 2011).

Conclusions and Recommendations

I. carnea flowers are very rich in bioactive compounds. The major compounds in the flowers were germacrene D (12.44%), *n*-hexadecanoic acid (12.15%), and caryophyllene, all possess various biological properties such as antimicrobial, cytotoxicity, antioxidant, insecticidal, insect repellant, anticancer and anti-inflammatory. Although 19 compounds were identified in the present study where compounds are known for their biological activities, but there is need of further studies to identify more compounds using other spectroscopic techniques. GC-MS has its limitations. Only volatile compounds can be identified through this technique. Therefore, further studies are suggested to use LC-MS, NMR and mass spectrometry etc. for identification of other compounds.

Acknowledgement

Authors are grateful to the administration of Faculty of Agricultural Sciences for proving facilities to carry out this research work.

Novelty Statement

In this paper, GC-MS analysis of flowers of Ipomoea carnea was carried out to identify possible medically important compounds. Such reports from I. carnea plants growing in district Sialkot, Pakistan are lacking.

Author's Contribution

Arshad Javaid: Perceived the idea, supervised the whole research work and finalized the paper. Iqra Haider Khan: Contributed in paper writing. Malik F. H. Ferdosi: Collected and processed the plant materials for GC-MS analysis.
Aneela Anwar: Supervised and discussed the work related to GC-MS analysis.
Mujahid Manzoor: Contributed in paper writing.

Conflict of interest
The authors have declared no conflict of interest.

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