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Metabolite profiling in the flowers of white pitchi and its mutant genotypes of *Jasminum grandiflorum* (L.)

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Abstract
Jasminum grandiflorum Cv. White Pitchi, is a region-specific cultivar of jasmine popularly cultivated in the southern districts of Tamil Nadu. Mutant genotypes with variation for plant type and flower bud were developed by inducing mutation through physical and chemical mutagens. The flowers of mutant genotypes WPM 2 and WPM 25 and non mutated White Pitchi genotypes were subjected to GCMS analysis for identifying the metabolites and its respective biosynthetic pathways. The metabolite profiling resulted in the identification of various compounds as depicted in the heat map of the metabolites. Six metabolites *viz.*, alpha-Pinene, Benzene, Hexanal, O-Cymene, Tetrapropylammonium, and gamma-Terpinene, in all the three genotypes. Three compounds alpha-Ocimene, Ethyl Acetate and Caryophyllene were found to be present only in the white pitchi mutant genotypes WPM 2 and WPM 25 whereas seven metabolites *viz.*, 1-(p-Tolyl)butan-1-one, 1-Butanol, 2-methyl-, (S)-, alpha-Phellandrene, Dimethyl trisulfide, D-Limonene, Phenylethyl Alcohol, Acetic acid and butyl ester were found to be present in white pitchi and its mutant genotype WPM 2 and one metabolite Bicalutamide, that is grouped under Benzonitriles of Glucuronidation pathway is present in the white pitchi and WPM 25 mutant genotype.

Keywords: *Jasminum grandiflorum*, white pitchi mutants, bioactive compounds profiling

1. Introduction
Jasmine (*Jasminum* sp.) belongs to the family *Oleaceae* is an important fragrant traditional flower used since time immemorial throughout the world. The genus *Jasminum* is reported to comprise of around 200-300 species and about 40 species are reported to occur in India. The name jasmine was derived from the Arabic word *Yasmin* or *yasmyn*. This species is native to Asia, Afghanistan, and Persia, France, Italy, China, Japan, India, Morocco and Egypt. In India, the species *J. grandiflorum*, *J. sambac*, *J. auriculatum* and *J. multiflorum* are commercially cultivated in Tamil Nadu, Karnataka, Andhra Pradesh, Uttar Pradesh and some parts of Bihar and West Bengal for its fresh buds for making flower strings, garlands, bouquets, *veni* and for religious offerings to god.

Jasminum grandiflorum L. called as Spanish jasmine or Royal jasmine, though grown for its flower, it is highly considered as a valuable medicinal plant because of the various biochemical compouds present in the species. India is the largest exporter of jasmine oil in the world accounting for over 40 per cent of total world export. In the middle east and European countries, jasmine flowers are us ed in large scale for extraction of essential oils. In addition, the medicinal formulations claim to cure several organ-related disorders like stomach ailments, the stagnancy of the liver, gastric ulcer, neurasthenia, edema, sciatica, cardiac asthma, heat boils, nausea, constipation and removal of toxicity from the body. The cosmetic preparations comprise creams, emulsions and shampoo for hair and skincare, for the cure of dermatitis, for skin whitening and as antipruritic lotion, perfumes, hair dye and health care cigarettes.

In view of the significant number of patents on products prepared from *Jasminum grandiflorum*, the authentic cultivation of this species as a medicinal plant, would fetch a high market value for the farmers and medicinal plant cultivators. But there exists only limited variability in this flower crop as they are propagated only by asexual means, hence mutation breeding is used as a successful tool for generating genetic variability for the economic traits and breeding new varieties in *J. grandiflorum*.

Two types of cultivars exist in *J. grandiflorum viz.*, Pink Pitchi characterised by bold pink buds and White Pitchi with white colour flower buds. Pink pitchi is the commonly cultivate type wherein two varieties (CO 1 Pitchi and CO 2 Pitchi) have been released for commercial cultivation in Tamil Nadu whereas White Pitchi, is a region-specific genotype of *J. grandiflorum*

popularly cultivated in the southern districts of Tamil Nadu that has to be exploited further for commercial cultivation. Therefore with an idea to create variability in White pitchi, the terminal cuttings of white Pitchi were irradiated with gamma rays and EMS for inducing variability and the mutants population was evaluated for flower yield and yield contributing traits. In addition to this, GCMS analysis was also performed in the local cultivar and its mutant genotypes to identify and compare the various biochemical metabolites present in the white flowers of *Jasminum grandiflorum*. Gas Chromatography-Mass Spectrometry (GCMS) process is integrated with the features of gas chromatography and mass spectrometry that improves the efficacy of qualitative and quantitative analysis within a test sample. GC-MS is an instrument that combines the features of gas-chromatography and mass spectrometry to identify different organic compounds presents in the organic matter, which includes Alkanes, Fatty acids, Alkenones, Sterols etc. GC-MS is becoming the tool of choice for tracking organic compounds derived from variety of plants. The mass spectrometer breaks each molecule into ionized fragments and the fragments can be detected using their mass to charge ratio. Drug detection, plasma detection, environmental analysis, explosives investigation, and identification of unknown samples are some of the applications of GC-MS (Bramer, 1998) [1]. Therefore the purpose of this study was to identify the volatile biochemical compounds and the biochemical pathways involved in the production of those metabolites in white pitchi and its mutant genotypes of *Jasminum grandiflorum.*

2. Materials and Methods

2.1 Collection of samples and flower extraction

Freshly opened blossoms were collected before 9.30 a.m., from the research plots raised at University Botanical garden, Department of Floriculture and Landscape Architecture, HC&RI, Tamil Nadu Agricultural University, Coimbatore during the year 2021. The fully blossomed flowers are weighed and subjected to extraction of oil and concrete. A non-polar solvent such as hexane is used to extract the aromatic compounds from the flowers. In nature all the volatile compounds are fixed in the flowers along with fibrous materials. At the end of the process, the hexane is evaporated leaving behind a waxy, semisolid substance known as concrete. Presence of all volatile compounds in the flowers will give a good quality concrete.

2.2 Chromatographic analysis by GC-MS

The Gas Chromatography/Mass Spectrometry (GC/MS) instrument separates chemical mixtures (the GC component) and identifies the components at a molecular level (the MS component). It is one of the most accurate tools for analyzing environmental samples.

The concrete extracted from the flowers of white pitchi and mutants of *Jasminum grandiflorum* genotypes (local variety and two mutants) was dissolved in hexane and directly injected into the injection port of gas chromatograph (Agilent Technologies 7890A GC system) coupled with a mass spectrometer The Clarus SQ 8C Gas Chromatography - Mass Spectrometer from Perkin Elmer, available at Department of Agricultural Microbiology, Tamil Nadu Agricultural University and Coimbatore was engaged for the analysis.

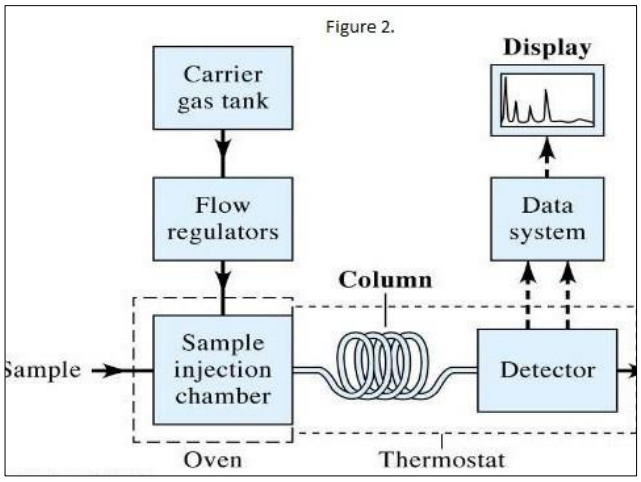
The instrument was set as follows, Injector port temperature set to 220^0 C, Interface temperature set as 250^0C, source kept at 220^o C. The oven temperature programmed as available, 75^0 C for 2 mins, 150^0 C @ 10^0 C/min, up to 250^0 C @ 10^0 C/min. Split ratio set as 1:12 and the injector used was splitless mode. The DB-5 MS capillary standard non - polar column was used whose dimensions were 0.25mm OD x 0.25µm ID x 30 meters length procured from Agilent Co., USA. Helium was used as the carrier gas at a constant flow of 1 ml/ minute. The MS was set to scan from 50 to 550 Da. The source was maintained at 220^0 C and 4.5e -6 motor vacuum pressure. The ionization energy was -70eV. The MS was also having inbuilt pre-filter which reduced the neutral particles. The GC instrument vaporizes the sample and then separates the various components for analysis. Each component was ideally produced a specific spectral peak that was recorded on a paper chart electronically. The Retention time is the amount of time that passes between elution and injection. The Retention time was used to distinguish between various substances. The peak value was measured from the base to the tip of the peak.

2.3 Identification of biochemical compounds

The data system has inbuilt libraries for searching and matching the spectrum. NIST MS Search 2.2v contain more than five lakh references. Interpretation of mass spectrum of GC – MS was done using the database of National Institute Standard and Technology (NIST14) [2]. The resulting data of the three flower samples in spectrum was compared with known spectrum available in NIST, PubChem and Human Metabolome Databases. The important credentials *viz*.,

molecular weight, molecular formula and molecular structures of the constituents in the flowers were ascertained. The spectrum of the known component was compared with the spectrum of the known components stored in the inbuilt library.

Figure 2.



The GC works on the principle that a mixture will separate into individual substances when heated. The sample is injected into the GC inlet where it is vaporized and swept into a chromatographic column by the carrier gas (helium). The sample flows through the column and the compounds comprising the mixture of interest are separated by virtue of their relative interaction with the coating of the column (stationary phase) and the carrier gas (mobile phase). The latter part of the column passes through a heated transfer line and ends at the entrance to ion source where compounds eluting from the column are converted to ions. A beam of electrons ionize the sample molecules resulting in the formation of molecular ion and smaller ions with characteristic relative abundances that provide a 'fingerprint' for that molecular structure. The mass analyzer separates the ions and is then detected.

3. Results and Discussion

The concrete extracted from the flowers of *Jasminum grandiflorum* cultivar - white pitchi, and its mutants WPM 2 and WPM 25 were subjected to GC-MS analysis to identify and compare the metabolites present in the local variety white pitchi and its mutants. The chromatogram generated by gas chromatography showed the composition of the various biochemical compounds present in *white pitchi* (white flower bud) and the two mutants WPM 2 and WPM 25 are given in Tables and Figures (Tables 1,2,3 and Fig. 1, 2, 3). The presence of various biochemical compounds in *Jasminum grandiflorum* was reported by Anac Olcay (1986) [3], Younis (2008) [4], Feng Huan Wei *et al.*, (2015) [5], Ranchana *et al.*, (2017) [6], Hesham Hussein Rassem (2018) [7] Bharathi *et al.*, (2020) [8] and Sanchita Ghosh (2020) [9] in the earlier studies carried out through Gas Chromatographic analysis.

Table 1: GC-MS identification of the chemical constituents in White Pitchi

No	Chemical compound	MW	Retention Time	Area (%)	Classification
1	Bicalutamide	430	1.759	37.699	Benzonitriles
2	Ethyl Acetate	88	2.004	22.694	Carboxylic acid
3	Benzene	78	2.264	0.553	Benzoids
4	Propanoic acid	74	2.459	0.182	Carboxylic acids
5	Butanenitrile, 2-methyl	83	2.679	0.171	Organic metalloid salts
6	1-Butanol,2-methyl-,(S)-	88	2.819	1.056	Hydrocarbon derivatives
7	sec-Butyl acetate	116	2.979	0.180	Carboxylic acid esters
8	Formic acid hydrazide	60	3.194	1.167	Carboxylic acid hydrazides
9	Astilbin	450	3.229	1.931	Flavanonols
10	Hexanal	100	3.449	0.446	Unsaturated fatty acids
11	Acetic acid, butyl ester	116	3.599	2.349	Carboxylic acids
12	Tetrapropylammonium	130	3.890	2.192	Amines
13	3-Hexen-1-ol, (Z)-	100	4.170	0.165	Fatty alcohols
14	1-Butanol,3-methyl-, acetate	130	4.450	0.837	Organic oxides
15	Carbamic acid, methyl-, ethyl ester	190	4.975	0.181	Organic oxides
16	1,3,6-Trioxocane	118	5.025	0.269	Oxacyclic compounds
17	α-Pinene	136	5.475	0.513	Terpene
18	Arsenous acid, tris(trimethylsilyl) ester	342	6.025	0.182	Organic metalloid salts
19	l-Alanine, N-methoxycarbonyl-, isobutyl ester	203	6.125	0.687	Carboxylic acid esters
20	Dimethyl trisulfide	126	6.185	0.472	Sulfenyl compounds
21	1-Octen-3-ol	128	6.320	0.244	Fatty alcohols
22	Bicyclo[4.1.0]heptane, 3,7,7-trimethyl-, [1S-1α,3α,6α)]-	138	6.511	0.368	Polycyclic hydrocarbons
23	Cyclohexene, 1-methyl-4-(1-methylethylidene)-	138	7.076	0.270	Monocyclic monoterpenoids
24	O-Cymene	134	7.221	3.287	Aromatic organic compound
25	D-Limonene	136	7.316	0.349	Monocyclic monoterpenoids

26	α-Phellandrene	136	7.356	3.474	Monocyclic monoterpenoids
27	1,3,5-Trioxepane	90	7.546	1.608	Acetals
28	Dodecane, 4,6-dimethyl-	198	7.746	0.264	Branched alkanes
29	γ-Terpinene	136	7.856	2.467	Terpenoid
30	γ-Chlorobutyrophenone	182	8.031	0.185	Butyrophenones
31	2-Nonanone	142	8.421	0.456	Ketones
32	Nonane, 4,5-dimethyl-	156	8.586	0.368	Branched alkanes
33	Nonanal	142	8.691	0.280	Organic oxides
34	Phenylethyl Alcohol	122	8.907	1.981	Benzene
35	1-(p-Tolyl) butan-1-one	162	9.292	3.940	Toluenes
36	Methyl 10,12-octadecadiynoate	294	9.572	0.174	Fatty acid methyl esters
37	1H-Indene, 1-methylene-	128	10.237	0.363	Aromatic hydrocarbons
38	Tetrasulfide, dimethyl	158	10.767	0.356	Sulfenyl compounds
39	Cyclopentanone, 2-(2-octenyl)-	194	10.952	0.297	Cyclic ketones

Table 2: GC-MS identification of the chemical constituents - WPM2

No	Chemical compound	MW	Retention Time	Area (%)	Classification
1	2-Thioacetyl MAGE	374	1.764	23.021	Thiocarboxylic acids
2	(7,7-Dimethyl-2-oxonorbornan-1-yl)methanesulfonic acid	96	1.819	3.769	Carboxylic acid
3	Ethyl Acetate	88	1.999	8.983	Peptidomimetics
4	Bestatin	308	2.214	2.594	Benzoids
5	Benzene	78	2.269	0.279	Organooxygen
6	Butane, 1-methoxy-3-methyl-	102	2.424	3.995	Hydrocarbon derivatives
7	1-Butanol, 2-methyl-, (S)-	88	2.824	0.308	Fatty Acyls
8	Butanoic acid, 2-methyl-, methyl ester	116	3.184	0.301	Carboxylic acids
9	Acetic acid, methoxy-	89	3.289	0.911	Unsaturated fatty acids
10	Hexanal	100	3.454	0.316	Carboxylic acids
11	Acetic acid, butyl ester	116	3.599	0.918	Amines
12	Tetrapropylammonium cation	130	3.890	1.814	Carboxylic acids
13	Acetic acid, pentyl ester	130	4.445	0.394	Aromatic hydrocarbons
14	2-Propenoic acid, butyl ester		4.735	0.344	Terpene
15	1,4-Dioxane	232	5.050	0.208	Sulfenyl compounds
16	(1R)-2,6,6-Trimethylbicyclo[3.1.1]hept-2-ene	136	5.470	2.342	Prenol lipids
17	Dimethyl trisulfide	126	6.195	0.762	Unsaturated hydrocarbons
18	Bicyclo[3.1.1]heptane, 6,6-dimethyl-2-methylene-, (1S)-	136	6.340	0.470	Fatty Acyls
19	α-Myrcene	136	6.491	1.138	Fatty Acyls
20	Butanoic acid, butyl ester	144	6.586	1.283	Monocyclic monoterpenoids
21	Hexanoic acid, ethyl ester	144	6.631	0.252	Aromatic organic compound
22	α-Phellandrene	136	6.861	1.524	Monocyclic monoterpenoids
23	O-Cymene	134	7.216	2.792	Monoterpenoids
24	D-Limonene	136	7.306	3.270	Saturated hydrocarbons
25	α-Phellandrene	136	7.351	18.959	Terpenoid
26	α-Ocimene	136	7.581	7.002	Organooxygen
27	Dodecane	170	7.731	0.285	Fatty Acyls
28	γ-Terpinene	136	7.836	0.551	Branched alkanes
29	Acetophenone	120	8.006	0.398	Benzene
30	2-Methyl-1-undecanol	186	8.411	0.310	Benzene
31	Octane, 3,5-dimethyl-	142	8.561	0.423	Toluenes
32	Dodecane	170	8.666	0.210	Sulfenyl compounds
33	Phenylethyl Alcohol	122	8.887	0.763	Sulfenyl compounds
34	1-(p-Tolyl)butan-1-one	162	9.272	1.517	Benzothiazoles
35	Boldione	284	10.192	0.447	Organooxygen
36	Dimethyl tetrasulfide	158	10.727	0.322	Sesquiterpenoid
37	Benzothiazole	135	10.877	0.311	Thiocarboxylic acids
38	[1,1'-Bicyclopentyl]-2-one	152	10.917	0.374	Carboxylic acid
39	Caryophyllene	204	14.054	0.786	Peptidomimetics

Table 3: GC-MS identification of the chemical constituents - WPM25

No	Chemical compound	MW	Retention Time	Area (%)	Classification
1	Bicalutamide	430	1.824	21.825	Benzonitriles
2	Ethyl Acetate	88	2.034	30.463	Carboxylic acid
3	Benzene	78	2.269	11.074	Benzoids
4	Allomatrine	248	2.839	0.738	Lupin alkaloids
5	Toluene	92	3.054	0.550	Benzene
6	Hexanal	100	3.364	0.239	Aldehydes
7	Cyclotrisiloxane, hexamethyl-	222	3.439	0.914	Saturated hydrocarbons

8	Heptane, 2,4-dimethyl-	128	3.569	0.601	Benzenoids
9	Benzene, 1,3-dimethyl-	312	4.225	0.632	Benzenoids
10	Benzenepropanoyl bromide	170	4.535	0.338	Heteroaromatic compounds
11	Silane, methyldiethoxyisopropoxy-	192	4.875	1.172	Carboxylic acids
12	Cyclotetrasiloxane, octamethyl-	356	5.955	1.632	Monoterpenoids
13	Furan, 2-pentyl-	138	6.215	0.794	Monoterpenoids
14	1,3,6-Trioxa-2-silacyclooctane, 2,2,-dimethylsilyl-	162	6.330	0.666	Aromatic organic compound
15	4-Hexen-1-ol, acetate	142	6.481	0.828	Prenol lipids
16	Bicyclo[3.1.0]hex-2-ene, 2-methyl-5-(1-methylethyl)-	136	6.561	0.331	Monoterpenoids
17	1,3-Cyclohexadiene, 1-methyl-4-(1-methylethyl)-	136	6.761	0.215	Saturated hydrocarbons
18	O-Cymene	134	6.916	1.343	Terpenoid
19	Bicyclo[3.1.0]hex-2-ene, 4-methyl-1-(1-methylethyl)-	136	7.046	3.357	Saturated hydrocarbons
20	α-Ocimene	136	7.286	4.667	Saturated hydrocarbons
21	Dodecane	170	7.426	0.404	Sesquiterpenoids
22	γ-Terpinene	136	7.536	0.777	Sesquiterpenoid
23	Undecane	156	8.261	0.263	Thioureas
24	Decane, 2,5,6-trimethyl-	184	8.376	0.204	Organochlorides
25	Cyclopentasiloxane, decamethyl-	370	8.851	0.285	Fatty Acyls
26	Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-methylene-,[1R-(1R*, 4Z,9S*)]-	204	13.493	0.369	Saturated hydrocarbons
27	Caryophyllene	204	13.738	0.972	Organochlorides
28	1,4-Dioxa-7,9,12,14-tetraazacyclohexadecane-8,13-dithione	292	17.375	0.364	Fatty Acyls
29	7-Heptadecyne, 1-chloro-	270	17.595	0.488	Organooxygen
30	7-Methyl-Z-tetradecen-1-ol acetate	268	17.790	0.320	Epoxides
31	Heneicosane	296	17.865	0.610	Fatty Acyls
32	6-Heptadecyne, 1-chloro-	270	17.990	0.676	Saturated hydrocarbons
33	6-Heptadecyne, 1-chloro-	270	18.175	0.932	Benzonitriles
34	11,14-Eicosadienoic acid, methyl ester	322	18.450	1.136	Carboxylic acid
35	7-Heptadecyne, 1-chloro-	270	18.600	0.970	Benzoids
36	Ethanol 2-(9-octadecenyloxy) (Z)-	312	18.825	1.049	Lupin alkaloids
37	2-Methyl-cis-7,8-epoxynonadecane	296	19.025	0.822	Benzene
38	9-Hexadecenoic acid	254	19.216	0.746	Aldehydes
39	Octacosane	394	19.456	1.040	Saturated hydrocarbons

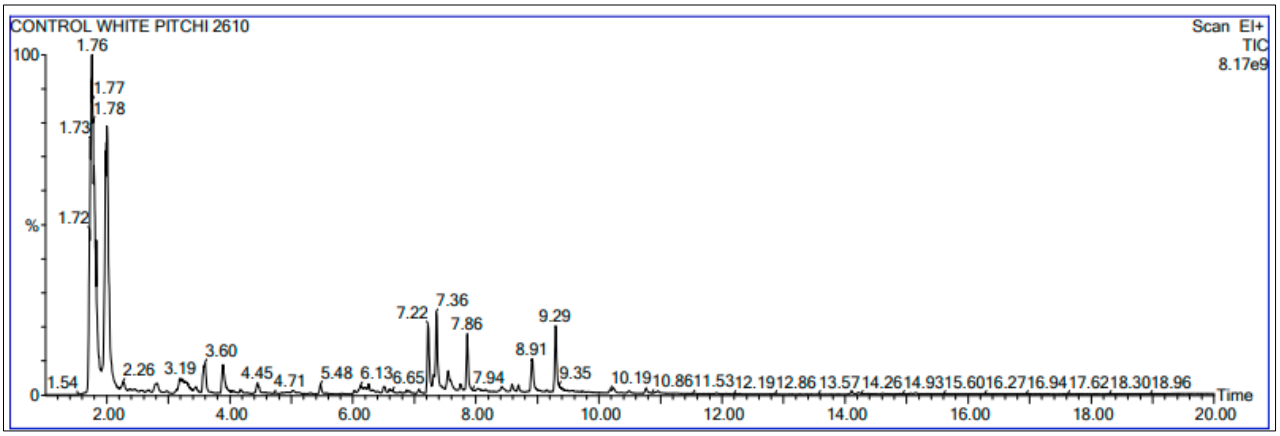


Fig 1: Gas Chromatography Mass Spectrometry (GC-MS) for White Pitchi

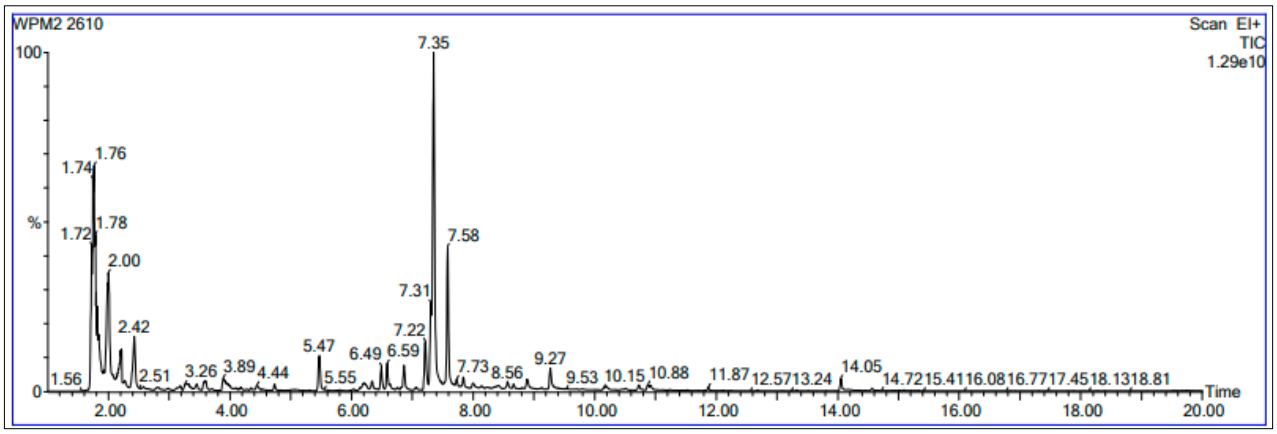


Fig 2: Gas Chromatography Mass Spectrometry (GC-MS) for mutant WPM 2

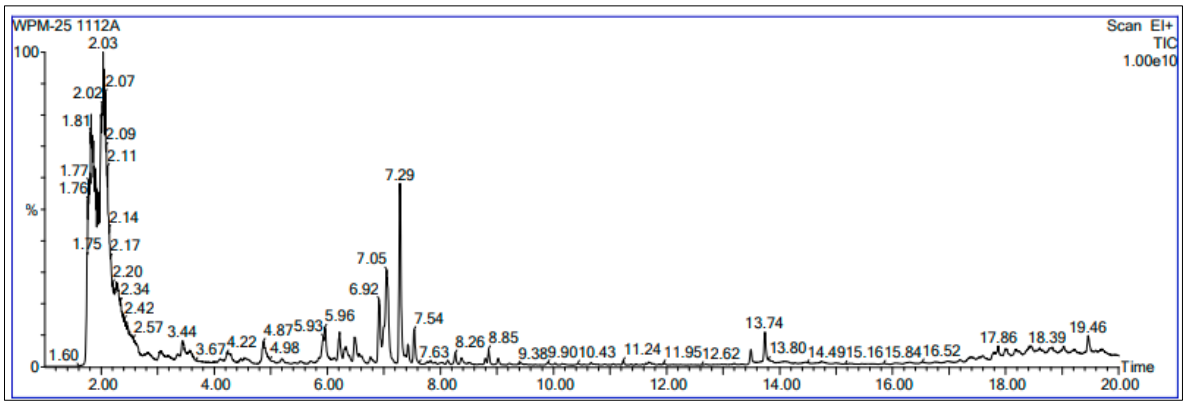


Fig 3: Gas Chromatography Mass Spectrometry (GC-MS) for mutant WPM 25

Table 4: Chemical composition of *J. grandiflorum* white pitch and its mutants

Sl. No.	Phytoconstituents	Retention Area (%)			Classification	Pathways
		White Pitchi	WPM 2	WPM 25		
1.	Alpha-Pinene	0.513	2.342	0.273	Terpene	Limonene and pinene degradation, Biosynthesis of terpenoids and steroids
2.	Benzene	0.553	0.279	11.074	Benzoids	Degradation of aromatic compounds
3.	Hexanal	0.446	0.316	0.239	Unsaturated fatty acids	Biosynthesis of unsaturated fatty acids
4.	O-Cymene	3.287	2.792	1.343	aromatic organic compound	Xylene degradation, Degradation of aromatic compounds
5.	Tetrapropylammonium	2.192	1.814	5.543	Amines	Polyamine metabolic pathway
6.	gamma-Terpinene	2.467	0.551	0.474	Terpenoids	Terpenoid biosynthetic pathway
7.	alpha-Ocimene	0	7.002	4.667	Monoterpenoids	Monoterpene biosynthesis
8.	Caryophyllene	0	0.786	0.972	Sesquiterpenoid	Triterpenoid biosynthesis
9.	Ethyl Acetate	0	8.983	30.463	Carboxylic acid	Citrate cycle
10.	1-(p-Tolyl)butan-1-one	3.94	1.517	0	Toluenes	Toluene degradation pathway
11.	1-Butanol, 2-methyl-, (S)-	1.056	0.308	0	Hydrocarbon derivatives	Butanoate metabolism, Degradation of aromatic compounds
12.	alpha-Phellandrene	3.474	1.524	0	Monocyclic monoterpenoids	Terpenoid biosynthetic pathway
13.	Dimethyl trisulfide	0.472	0.762	0	Sulfenyl compounds	Sulfenylation
14.	D-Limonene	0.349	3.27	0	Monocyclic monoterpenoids	Monoterpenoid biosynthesis, Limonene and pinene degradation
15.	Phenylethyl Alcohol	1.981	0.763	0	Benzene	Phenylalanine metabolism
16.	Acetic acid, butyl ester	2.349	0.918	0	Carboxylic acids	Citrate cycle
17.	Bicalutamide	37.699	0	21.825	Benzonitriles	Glucuronidation pathway

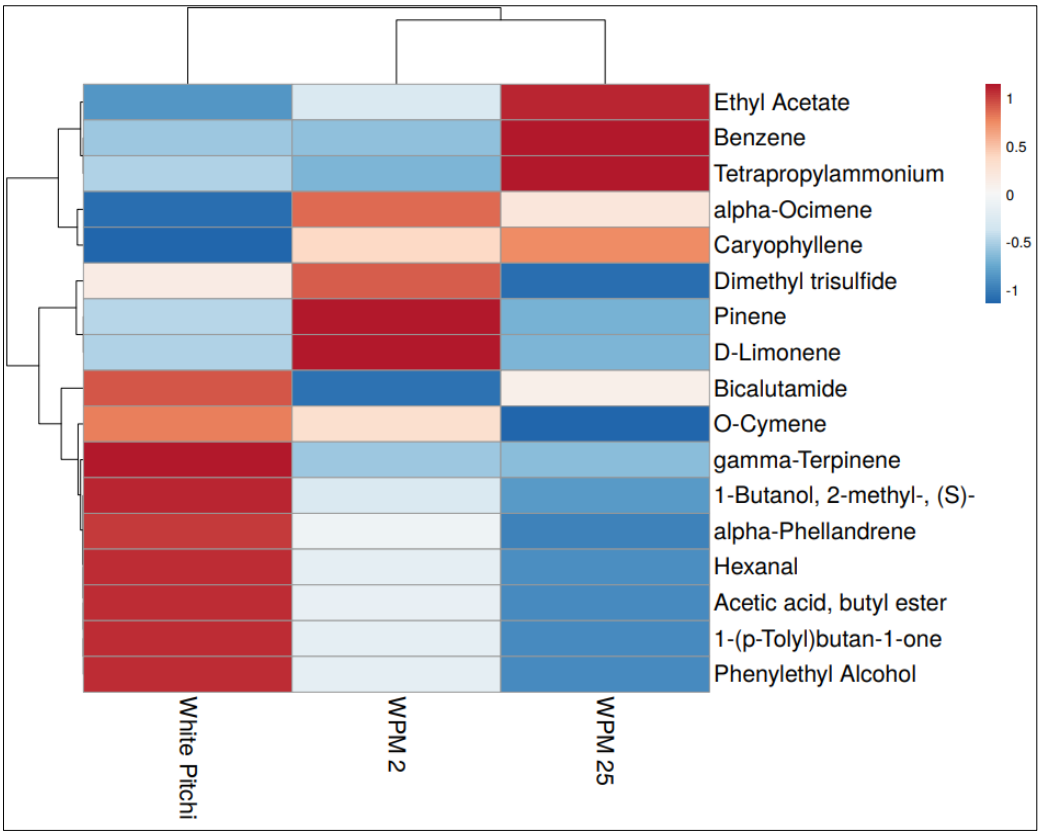


Fig 4: Heat Map for metabolites of *J. grandiflorum cv.* white pitchi and its mutants

The metabolite profiling through GC-MS analysis of *Jasminum grandiflorum* - white pitchi and its mutants WPM 2 and WPM 25 resulted in the identification of various compounds as depicted in the heat map of the metabolites (Table 4 and Fig 4.). Six metabolites *viz.*, alpha-Pinene, Benzene, Hexanal, O-Cymene, Tetrapropylammonium, and gamma-Terpinene, in all the three genotypes. Three compounds alpha-Ocimene, Ethyl Acetate and Caryophyllene were found to be specific in the mutant genotypes WPM 2 and WPM 25 whereas seven metabolites *viz.*, 1-(p-Tolyl) butan-1-one, 1-Butanol, 2-methyl-, (S)-, alpha-Phellandrene, Dimethyl trisulfide, D-Limonene, Phenylethyl Alcohol, Acetic acid and butyl ester were found to be present in white pitchi and its mutant genotype WPM 2 and one metabolite Bicalutamide, that is grouped under Benzonitriles of Glucuronidation pathway is present in the white pitchi and WPM 25 mutant genotype.

4. Conclusion

The metabolite profiling through GC-MS analysis of *Jasminum grandiflorum* - white pitchi and its mutants WPM 2 and WPM 25 resulted in the identification of various compounds as depicted in the heat map of the metabolites. It was found that three different compounds of three different biosynthesis pathways are involved in the production of the metabolites in the mutant genotypes. Three compounds *viz.*, alpha-Ocimene, a Monoterpenoid of Monoterpene biosynthesis pathway; Ethyl Acetate, a carboxylic acid of Citrate pathway and Caryophyllene, a Sesquiterpenoid of Triterpenoid biosynthesis pathway were found to be present only in the white pitchi mutant genotypes WPM 2 and WPM 25 whereas it is absent in the non-mutated genotype of white pitchi of Jasminum grandiflorum. The presence of these biochemical compounds in the mutant genotypes may be due to the alteration in the respective biochemical pathways that happened due to the cause of mutation.

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