Assessment of bioactive compounds from five wild edible fruits, *Ficus racemosa*, *Elaegnus conferta*, *Grewia tillifolia, Scleichera oleosa* and *Antidesma ghasembilla*

S.R. Valvi[1], V.D. Jadhav[2], S.S. Gadekar[1], D.P. Yesane[3]

[1]Department of Botany, Nowrosjee Wadia College, Pune, 411001, Maharashtra, India, Email: valvisujata@gmail.com; [2]Department of Botany, Shivaji University, Kolhapur, Maharashtra, India; [3] Department of Mechanical Engineering, MMIT, Pune, Maharashtra, India

ABSTRACT

Bioactive compounds analysis was carried out from five wild edible fruits (*Ficus racemosa*, *Elaegnus conferta, Grewia tillifolia*, *Scleichera oleosa* and *Antidesma ghasembilla*) in their ripen stage. The crude methanolic extracts were subjected for GCMS analysis. Many compounds were detected, which were rich in bioactive volatile compounds. Among these volatile compounds some are represents class of acid, ketone, amines and hydrocarbons. The major compounds noticed were hexadecanoic acid, n-hexadecanoic acid, Pentadecanoic acid, 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl and 2-Furancarboxaldehyde, 5-(hydroxymethyl).

Keywords: Bioactive compounds, wild edible fruits, *Ficus racemosa*, *Elaegnus conferta*, *Grewia tillifolia, Scleichera oleosa*, *Antidesma ghasembilla*

INTRODUCTION

Fruit is one of the major dietary sources of various antioxidant phytocompounds for humans. Our daily diet plays a key role in healthy aging and preventing chronic disease including obesity, diabetes, cardiovascular diseases, cancer, and osteoporosis. Only a small percentage of the population consumes the recommended intake of a variety of fruits and vegetables, providing vitamins, minerals, antioxidants, enzymes, phytonutrients and other nutrients. In humans they can have a beneficial effect because of the positive biological responses they elicit, often reducing the risk of chronic disease. Foods with high phytonutrient content are sometimes called “super foods” since they are known to have health benefits beyond those of most foods [8].

All volatile organic compounds emitted from plants can originate from biogenic and/or anthropogenic sources. Many plants emit substantial amounts of phytogenic volatile organic compounds, which include alkanes, alkenes, alcohols, aldehydes, ethers, esters and carboxylic acids [3,1,4]. Production and emission of volatile compounds is also a developmentally regulated process. Volatile emission in flowers and accumulation in leaves and fruits follow similar developmental patterns, increasing during the early stages of organ development and then either remaining relatively constant or decreasing over the organs’ lifespan [2,5]. In present study we analyzed some of the volatile compound from five wild edible fruits through GCMS. The information of these five fruits is listed below.

Research Article, Acta Biologica Indica 2014, 3(1):549-555

pISSN 2319-1244, eISSN 2279-0160

Elaeagnus conferta Roxb.

Elaeagnus conferta Roxb. is belongs to family Elaeagnaceae. It is commonly called as 'Nerli'. *Elaeagnus conferta* Roxb is a large, much branched, usually scandent shrub, with stellate tomentum; stems and Branches more or less spinous. Leaves very variable. Flowers many in clusters, straw coloured. Fruits ellipsoid, with 8 strong, blunt ribs, crowned by the top of perianth, pinkish with whitish spots; mesocarp fleshy. Its flowering and fruiting starts from November to May.

Ficus racemosa Roxb.

Ficus racemosa L. belongs to family Moraceae. It is commonly called as 'Umbar'. This is native to Australasia, South-East Asia and the Indian Subcontinent. *Ficus racemosa* L. is large evergreen trees without aerial roots. Leaves alternate coriaceous, bluntly pointed at apex. Flowers are small, Pedicels very short bracts beneath the calyx triangular. Male flowers are sessile. Sepals 3-4, membranous, inflated, enveloping the 2 elongate ovate anthers; filamentous connate. Gall flowers are pedicellate, Perianth gamophyllous, irregularly toothed. Style lateral elongate; stigma clavate. Fertile flowers are subsessile. Fruit are of berries type, globose, 0.75 inch in diameter. Apiculate, smooth, pinkish white or creame colored. Ripe at different time of the year. The flowering and fruiting period is throughout year.

Schleichera oleosa. (Lour.)

Schleichera oleosa belong to family Sapindaceae. It is commonly called as 'Kusum'. It is a large tree. Leaves alternate, pinnate; Leaflets 2-4 paires, oblong or elliptic-oblong. Flowers are white or yellowish regular polygamo-dioecious, fascicled on slender panicles; calyx is four to six lobed. Disks with wavy margin. Drupes pointed, echinate with small, blunt prickles. Seeds one or two enclosed in aril. It's flowering and fruiting starts from March to July.

Grewia tiliifolia Vahl.

Grewia tiliifolia Vahl, Symb. is belongs to family Tiliaceae and commonly called as 'Dhaman'. It is medium size tree. Leaves cordate at base, 5 nerved. Flowers 3-6, in axillary cymes. Petals yellow, notched at apex, gland about 1/3 the length at petal, densely white, villous on margins. Torus rather long, ribbed glabrous. Drupes black, distinctly two lobed. It's flowering and fruiting starts from December to February.

Antidesma ghasembilla Gaertn.

Antidesma ghasembilla Gaertn belong to family Euphorbiaceae. It is commonly called as 'Ambuti'. It is a small deciduous tree. Branchlets are pubescent or fulvous tomentose. Leaves glabrous or nearly so above, pubescent or tomentose beneath. Inflorescence are axillary or terminal type, simple or branched spikes or racemes. Flowers are sessile, in slender paniculate spikes. Male flowers: Calyx is 5-7 partite, densely felvous- hairy. Stamens 4-7; anthers somewhat horse shoe shaped. In female flowers, calyxes are 5-7 partite, densely felvous-hairy, across vain spread out flat. Fruits are subglobose when fresh, 1/5 in diameter, reddish purple, edible. Seeds are small albumen fleshy, cotyledon broad. It's flowering and fruiting starts from March to July.

MATERIALS AND METHODS

Collection of Plant Material

The collection of wild edible fruits were carried out during the flowering and fruiting period of each plant. *Ficus racemosa*, as its fruiting period is throughout the year, collection carried out within the year. *Elaeagnus conferta* were collected during November to May, *Grewia tiliifolia* in March to August , *Antidesma ghasembilla* and *Schleichera oleosa* during March to July. These fruits were collected in various places of Kolhapur district like, Chaloba hill station, Ramtirth, Devulwadi, Ajara, Panhala, Gaibi ghat, Radhanagari, Latgaon, Nesari, Chandgad, Tillari, Shelap, Gadhinglaj etc. The local floristic keys were used for determining the species. Approximately, 3 kg material of selected species was collected. The collected material was placed in a polythene bag to prevent loss of moisture during transportation to the laboratory.

Sample Preparation

The healthy and fresh wild edible fruits were washed thoroughly until no extraneous material remained. They were blotted till the excess moisture absorbed, air dried and weighted to obtain fresh weight. The fruits were cut into small pieces, the seeds were removed and placed in paper envelop and dried in the oven at 40°C until constant weight was obtained. After complete drying the sample was grinded to a fine powder by using an electric grinder. The sample was packed into airtight sample bottles and used for the analysis. All analyses were conducted in duplicate by using analytical grade reagents.

The methanolic extract obtained from ripened fruits of all five wild edible fruits was subjected to Gas Chromatography and Mass Spectroscopy for the determination of bioactive volatile compounds. Some of the important features are summarized below and GC-MS analyses of the samples were carried out using Shimadzu Make QP-2010 with non polar 60 M RTX 5MS Column. Helium was used as the carrier gas and the temperature programming was set with initial oven temperature at 40°C and held for 3 min and the final temperature of the oven was 480°C with rate at 10°C. A 2 µL sample was injected with splitless mode. Mass spectra was recorded over 35-650 amu range with electron impact ionization energy 70 eV. The total running time for a sample is 45 min. The chemical components from the methanolic extarcts of fruits were identified by comparing the retention times of chromatographic peaks using Quadra pole detector with NIST Library to relative retention indices. Quantitative determinations were made by relating respective peak areas to TIC areas from the GC-MS.

RESULTS AND DISCUSSION

Mass spectral analysis of bioactive volatile compounds of wild edible fruits is shown in table 1, while the mass fragments are presented in figure 1 to figure 5. The common compounds from five edible fruits were n-hexadecanoic acid and pentadecanoic acid. Volatile compounds which were listed in table 1, represents the class of monoterpens, alkenes and alcohols.

While discussing with other references, the volatile compounds were analyzed from the *Endopleura uchi* fruits by Marx, 2002 [10] through GCMS. The compounds observed were Hexanal, Isopropyl 2-methyl-propanoate, trans 2-Hexenal, cis-3-Hexen-1-ol, 1-Hexanol, 2-Pentanol, 3, 3-Dimethyl-2-butanol, 2, 3-Dimethyl-3-hexanol, 4-Methyl-2-pentanol, 2-Methyl-tetrahydrofuran, Phellandral, Phenylacetaldehyde, cis-Ocimene, Nonanal, Naphthalene, Geraniol, trans-2-Decenal, Hexadecane, Heptadecane, (E,E)-Farnesol, Ethyltetradecanoate, Octadecane, Methylpalmitate, Palmitic acid, Ethylhexadecanoate, Methyl-6-octadecenoate, Methylstearate, Ethyl

-9, octadecadienoate Ethyl -9 - octadecenoate, Ethyloctadecanoate. Bal et al. [1] determined the volatile compounds from the *Hippopae rhamnoides* fruits. They determined the compound like ethyl 3 methylbutanoateand, butyl pentanoate, 2- methylpropyl 3 methylbutanoate and pentyl 3 methylbutanoate, ethyl 3 methyl butanoate, and ethyl hexanoate. They also identified the terpene, alcohols and phenols aldehyde and ketones, Chen et al. [5] studied the genetic diversity of volatile compounds of Xinjiang Wild Apple. He suggested that it is feasible to discuss the origin evolution and affinity between Xinjiang Wild Apple [*M. sieversii* (Lebed.) Roem] and *M. pumila* cultivars based on the volatile compound component. This offers a new approach in the future to assess the complicated affinity between wild and half-wild Chinese flowering crab apple trees by utilizing their content of volatile substances in the fruit. Stewart et al. [13] identified the bioactive compounds in berries. They determined the quercetin glucosides, pelargonidin, cynidin.

Table 1. Bioactive compounds from five wild edible fruits.

Name of the plant	RT	PA (%)	Compound Analyzed
Ficus racemosa	8.654	8.09	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl
	9.921	12.61	2-Furancarboxaldehyde, 5-(hydroxymethyl)-
	20.625	2.22	Hexadecanoic acid, methyl ester
	21.111	17.22	n-Hexadecanoic acid
	22.641	1.44	1,4,8-Dodecatriene
	23.167	53.12	9-Hexadecenoic acid
	23.418	5.29	Octadecanoic acid
Meyna laxiflora	10.898	6.88	1,3,5-Triazine-2,4,6-triamine
	12.158	11.18	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl
	13.822	56.15	2-Furancarboxaldehyde, 5-(hydroxymethyl)
	19.078	3.05	Malonic acid, bis(2-trimethylsilylethyl ester
	24.585	1.18	Pentadecanoic acid, 14-methyl-, methyl ester
	25.076	21.57	Pentadecanoic acid
Elaeagnus conferta	1.577	4.53	1-Chlorofluoroethane
	3.147	10.39	Cyclopentanone, 2-methyl-
	17.614	18.05	n-Hexadecanoic acid
	20.189	53.82	9-Octadecenoic acid, (E)
	20.434	1.16	Octadecanoic acid
	23.272	1.11	E-11-Hexadecenal
	23.500	1.74	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester
	23.759	0.74	1,2-Benzenedicarboxylic acid, diisooctyl ester
	24.419	2.08	9,10-Anthracenedione, 1,8-dihydroxy-3-methoxy-6-methyl
	24.750	6.40	9-Octadecenoic acid
Schleichera oleosa	1.991	55.18	Formyl trichloride
	2.623	8.81	1-Butanol, 3-methyl
	8.718	10.02	4H-Pyran-4-one,
	9.941	4.71	2-Furancarboxaldehyde
	21.012	4.10	n-Hexadecanoic acid
	21.118	2.99	Palmitic acid
	23.149	12.04	9,12-Octadecadienoic acid (Z,Z)
	23.431	2.15	Octadecanoic acid
Antidesma ghasembilla	6.220	5.47	2,5-Furandione, 3-methyl-
	23.175	5.27	Hexadecane
	25.092	89.27	Pentadecanoic acid
Grewia tiliifolia	12.117	13.72	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl
	13.633	16.26	2-Furancarboxaldehyde, 5-(hydroxymethyl)
	15.033	7.01	5-(Hydroxymethyl)-2-(dimethoxymethyl)furan
	15.625	15.91	2-Undecenal
	21.467	6.82	1-Pentadecene
	24.158	5.92	cis-9-Octadecenal
	25.092	34.36	Pentadecanoic acid

RT: Retention Time; PA: Peak Area

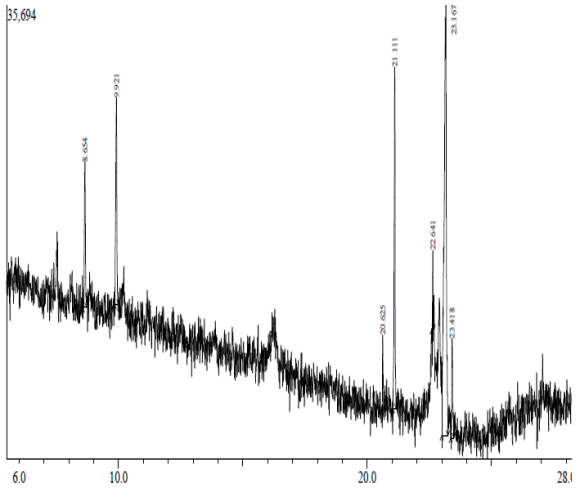

Figure 1.GCMS analysis of *Ficus racemosa* fruits.

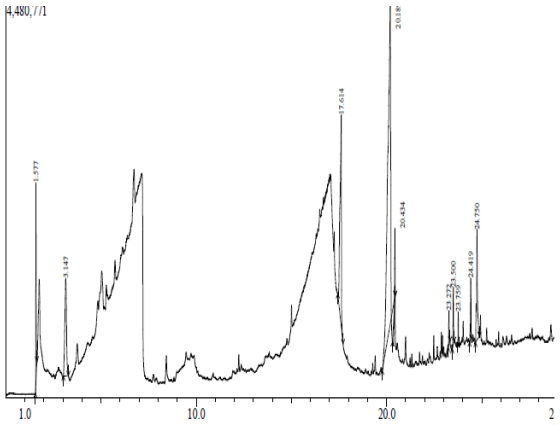

Figure 2. GCMS analysis of *Elaeagnus conferta* fruits.

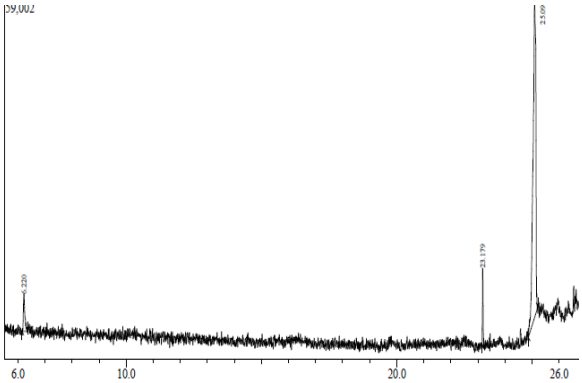

Figure 3. GCMS analysis of *Antidesma ghasembilla* fruits.

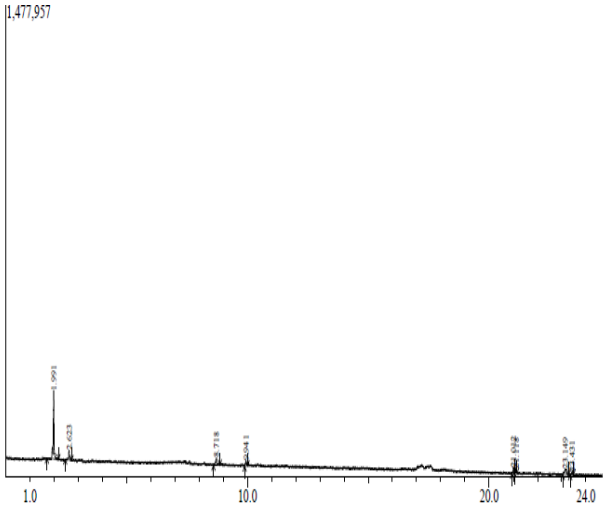

Figure 4. GCMS analysis of *Schleichera oleosa* fruits.

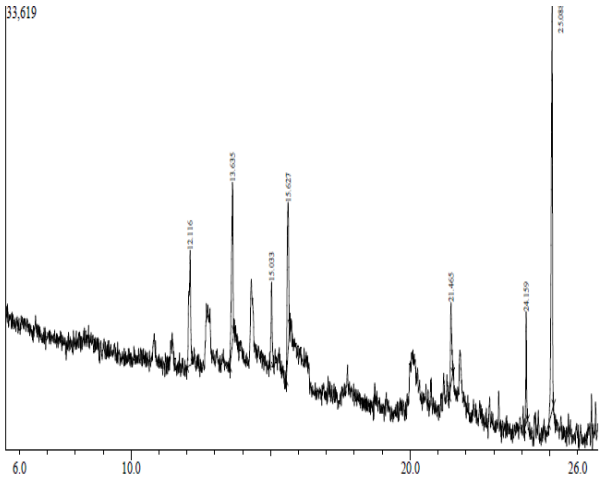

Figure 5. GCMS analysis of *Grewia tiliifolia* fruits.

Xiao-lei et al. [14] analysed the aroma volatile compounds from ripened crabapple fruit of six varieties (Red Splendor, Strawberry Parfait, Pink Spire, Radiant, Sparkler, and Flame through SPME/GC/MS method. They analyzed total of 37 compounds from the sample. The main aroma volatiles of the six varieties of fruit were comprised of 2 hexenal, 3-hexenal, 2, 4 hexadienal, benzaldehyde, diethyl phthalate. The main volatile compound of the crabapple fruit was 2 hexenal, but the relative content percentages were different (45.37, 21.98, 33.56, 32.21, 38.60, and 45.88%). The aroma components accumulated differently as the fruits ripened. The relative content of aldehydes and esters decreased as alcohols increased as the red splendor and strawberry parfait fruit ripened. Few compounds like octadecanoic, Palmitic acid and 2-Hexenal were common to present study.

Duarte et al. [6] evaluated volatile compound from Raspberry through GC-FID. They analyzed the acetyldehyde, ethyl acetate and methanol. Through HPLC they were determined the glycerol,

ethanol, succinic acid, acetic acid, malic acid, chlorogenic acid, ferulic acid and β -cumaric acid. The minor volatile compound like 4methyl 2 pentanol, 2butanol, 4 methy l1 pentanol, 2heptanol, 3methyl, 1pentanol, 1heptanol. Guo-bin et al. [7] studied the volatile components from the fruit of *Ziziphus mauritiana* Lam. They identified 40 volatile components. Some of the volatile compounds were bis (2-ethylhexyl) phthalate (18.00%), dibutyl phthalate (12.33%), 5-hexyldihydro-2(3H)-furanone, (4.60%). Ibliiez et al. (1998) were analyzed the volatile components from various fruits. From raspberry they were analysed the linalool, citral, linalyl acetate, terpenolene, beta-lonone. From strawberry they analysed ethyl acetate, methyl butanoate, methyl 2 methyl butanoate, transe 2 hexene-1-ol, methyl hexanoate, ethyl hexanoate, butyl butanoate, ethyl octanoate, octyl acetate. From Blackberry they were analyzed the 3 methyl butanal, hexanal,transe 2 hexanal, transe 2 hexen-1-ol, 2 heptanol, p-cymen-8-ol. The hexanal and butane compounds are common from the present study. Li et al. [9] were determined the aroma volatile Compound Analysis of SPME Headspace and Extract Samples from Crabapple (*Malus* sp.) fruit Using GC-MS. The main volatiles compound obtained by them were 2 hexenal, 3hexenal, 2,4-hexadienal, benzaldehyde, diethyl phthalate, hexen-1-ol, 2 hexen-1-ol, 3 hexen-1-ol, benzenpropanoic acid, dibutyl phthalate, formic acid, bezoic acid, acetic acid etc. Osorio et al. [12] were determined the new monoterpenoids (2E)-2,6-dimethyl-2, 5-heptadienoic acid, (2E)-2, 6-dimethyl-2, 5-heptadienoic acid b-D-glucopyranosyl ester, (5E)-2, 6-dimethyl-5, 7-octadiene-2, 3-diol, and (3E)-3, 7-dimethyl-3-octene-1,2,6,7-tetrol were isolated from the fruit pulp of *Passiflora quadrangularis* along with the known 2,5-dimethyl-4-hydroxy-3(2H)-furanone-b-D-glucopyranoside. Oliveira et al. [11] evaluated the volatile profile of *Arbutus unedo* L. fruits through ripening stage. They obtained the main compounds like alcohols, aldehyde, esters, norisopropenoid derivates, sesquiterpenes, monoterpenes. In present study, the ripened fruits showed some of the common volatile compounds with previous study.

All the studied wild edible fruits, many compounds were detected, which were rich in bioactive volatile compounds. Among these volatile compounds some are represents class of acid, ketone, amines and hydrocarbons. The major compounds noticed were exadecanoic acid, n-hexadecanoic acid, Pentadecanoic acid, 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl and 2-Furancarboxaldehyde, 5-(hydroxymethyl). Hence, the presence of some of the important bioactive volatile compounds will certainly prove the use of fruit extract for the preparation of various antimicrobial products. From the GCMS, compounds, which were found, are responsible for flavour and odour. Because of the presence of such volatile compounds in fruits, these may be highly demanded in the pharmaceutical and food industries.

REFERENCES

[1] Bal LM, Meda V, Naik SN, Satya S. Food Res. Int. 2011, 44(7):1718-1727.
[2] Battino M, Greabu M, Totan A, et al. Pharma. Rep. 2007, 59:613-618.
[3] Bouwmeester, HJ, Gershenzon J, Konings MCJM, Croteau R. Plant Phys. 1998, 117:901-912.
[4] Ciganek M, Pisarikova B, Zraly, Z. Veterinarni Medicina 2007, 52(3):111-120.
[5] Chen XS, Feng T, Zhang YM, et al. J. Genet. Genomics 2007, 34:171-179.
[6] Duarte WF, DiasDR, Oliveira JM, et al. Food Res. Int. 2010, 43:2303-2314.
[7] Guo-Bin D, Xue-Mei L, Yu L, et al. Food Chem. 1987, 26(3):201-212.
[8] Heber G. Natural Factors Nutritional Products Ltd, 2009, 1-2.
[9] Li XL, Kang L, Hu J, et al. Agric. Sci. China 2008, 7(12):1451-1457.
[10] Marx F, Andrade EHA, Zoghbi MDGB, Maia JGS. Eur Food Res. Technol. 2002, 214:331–334.
[11] Oliveira I, Baptista P, Malheiro R, et al. Food Res. Int. 2011, 44:1401-1407.
[12] Osorio C, Duquea C, Fujimoto Y. Phytochem. 2000, 53:97-101.
[13] Stewart D, Mcdougall GJ, Sungurtas J, et al. Food Res. 2007, 51(6):645-651.
[14] Xiao-Lei L, Luan K, Jing-Jing H, et al. Agric. Sci. China 2008, 7(12):1451-1457.