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A Review on Peach (*Prunus persica*): An Asset of Medicinal Phytochemicals

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Abstract: Peach has many anti-disease properties such as anticancer, anti-allergic, antitumor, antibacterial, antimicrobial, anti-inflammatory. Beside this, it has high nutritive value so important for Human nutrition. It is a fast growing evergreen tree which is found in India, Spain and China. This review gives a sharp view on its origin, morphology, biological activity, medicinal uses and its different application for the wellness of mankind.

Keywords: Peach, *Prunus persica*, Medicinal plant, Antioxidant property, Phytochemical

I. INTRODUCTION

The Rosaceae is the 19th largest family of plant [1]-[3]. A group of closely related genera is known as family. The genus *Rosa* is made up of closely related species of Rose. The scientific name of a family ends in case. So Rose family is known as Rosaceae [4]. Michael Adanson was first who published this name "Rosaceae" (Table I) but Antoine Laurent de Jussieu has been accepted by The International Code of Botanical Nomenclature (ICBN) (2006) as the author for this name. For defining multiple characteristics groups, Jussieu incorporated the Linnaean concept of binominal nomenclature with Adanson's methodology so the ICBN preserved Jussieu's names for 76 plant families. Currently, phylogenetic approaches based on analysis by the angiosperm phylogeny group (APG I, 1998; APG II, 2003) are resolving controversies and deficiencies in angiosperm classifications [2]. The Rose family includes some large genera like *Prunus* (peach), *Pyrus* (apple) etc. [4]. It is a large family [5] of about 90-125 genera (Table II) and 3370-3500 species [1], [6]-[8] of trees, shrubs and herbs [10]. That are rhizomatous, thorny, or climbing [1], [3] of worldwide distribution [9]. Its utmost growth is shown in north temperate regions [8]-[11], or northern hemisphere [1]. Rose family distribution is cosmopolitan [1] to sub-cosmopolitan, however it has varied distribution [2]. Extraordinary phenotypic diversity, plant habit, chromosome number, and fruit type has been shown by members of the family after the fast growth of Rosaceae [7], [8], [11]. The plants of this family are mainly grown for their beauty and fragrance [3], [12]. The Rosaceae are very well represented with immense economic and scientific value [8]. The herbaceous species cultivate in temperate forests as understory plants, in salt or freshwater marshes, in arctic tundra, in old fields, and along roadsides [2]. Woody members are prime species, and are well-known in the early stages of forest succession. In mature mixed deciduous forests, rosaceous trees are found in lesser part of it [2].

Table I
Classification of family rosaceae

Kingdom	Plantae
Sub-kingdom	<u>Tracheobionta</u>
Super division	Spermatophyte
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidea
Order	Rosales
Family	Rosaceae

Table II

International code of botanical nomenclature (icbn) accepted genus names within rosaceae[2], [4]

Acaena Mutis ex L.	Ivesia Torr. & A. Gray
Adenostoma Hook. & Arn.	Kageneckia Ruiz & Pav.
Agrimonia L.	Kelseya (S. Watson) Rydb.
Alchemilla L.	Kerria DC.
Amelanchier Medik.	Leucosidea Eckl. & Zeyh.
Aphanes L.,	Lindleya Kunth, nom. cons.
Aremonia Neck. Ex Nestl., nom. cons.	Luetkea Bong.
Aria (Pers.) Host, Aronia Medik., nom. cons.	Neviusia A. Gray
Aruncus L.	Oemleria Rchb.
Bencomia Webb & Berthel.	Orthurus Juz.
Brachycaulos R. D. Dixit & Panigrahi	Osteomeles Lindl.
Cercocarpus Kunth	Pentactina Nakai
Chaenomeles Lindl., nom. cons.	Peraphyllum Nutt. 60
Chamaebatia Benth.	Petrophytum (Nutt. ex Torr. & A. Gray) Rydb.
Chamaebatiaria (Porter ex W. H. Brewer & S. Watson) Maxim.	Photinia Lindl.
Chamaemeles Lindl.	Physocarpus (Cambess.) Raf., nom. cons.
Chamaemespilus Medik.	Polylepis Ruiz & Pav.
Chamaerhodos Bunge	Potaninia Maxim.
Cliffortia L.	Potentilla L.
Coleogyne Torr.	Prinsepia Royle
Coluria R. Br.	Prunus L.
Cormus Spach	Pseudocydonia (C. K. Schneid.) C.K.Schneid.
Cotoneaster Medik.	Purshia DC. Ex Poir. 70
Cowania D. Don	Pyracantha M. Roem.
Crataegus L.	Pyrus L.
Cydonia Mill.	Quillaja Molina
Dalibarda L.	Rhaphiolepis Lindl., nom. cons.
Dichotomanthes Kurz	Rhodotypos Siebold & Zucc.
Docynia Decne.	Rosa L., nom. cons. prop.
Docyniopsis (C. K. Schneid.) Koidz.	Rubus L., nom. cons. prop.
Dryas L. Prunus L.	Sanguisorba L.
Duchesnea Sm.	Sarcopoterium Spach
Eriobotrya Lindl.	Sibbaldia L.
Eriolobus (DC.) M. Roem.	Sibiraea Maxim.
Exochorda Lindl.	Sieversia Willd.
Fallugia Endl.	Sorbaria (Ser. ex DC.) A. Braun, nom. cons.
Filipendula Mill.	Sorbus L.
Fragaria L.	Spenceria Trimen
Geum L.	Spiraea L.
Gillenia Moench	Spiraeanthus (Fisch. & C. A. Mey.) Maxim.

Guamatela Donn. Sm.	Stephanandra Siebold & Zucc.
Hagenia J. F. Gmel.	Taihangia T. T. Yu & C. L. Li
Hesperomeles Lindl.	Tetraglochin Poepp.
Heteromeles M. Roem.	Torminalis Medik.,
Holodiscus (K. Koch) Maxim., nom. cons.	Vauquelinia Corrêa ex Bonpl.
Horkelia Cham. & Schltdl.	Waldsteinia Willd.
Horkeliella (Rydb.) Rydb.	Xerospiraea Henr.

Rosaceae is further classified into four subfamilies such as Amygyloideae (Table III), Maloideae, Rosoideae and Spiraeoideae[2], [8]. Subfamily Amygdylodeae includes genus Prunus (Table II) [2]. Species of Prunus, fruits stone is the most important nut worldwide[2]. The stone fruits are soft at maturity. In general, they are less hardy in comparison to pome fruits. They can be eaten fresh because they have very short storage life comparatively. They are tasty and their flavors are outstanding so they are much preferred. They can also be consumed dried like plum and apricot[2], [59]. Prunus, genus that have their origin in the Asian continent[15].The word ‘Prunus’ might have been taken from Greek ‘Prounos or Proumnos’[19].

A. Prunus Persica (Peach and Nectarine)(Table IV): Morphology and Geographical distribution

It belongs to the family Rosaceae and the subfamily Amygdylodeae [16]. It is commonly known as “Aaru” and in English popularly called “Peach” has been extensively consumed worldwide.Peach has an important place in human nutrition, and can be used as fresh, dried or processed fruit.Peaches (*Prunus persica* (L.) Batsch) are nutritionally and economically essential and they are one of the most popular fruits consumed worldwide [21], [47]. Different phenolic compounds have been recognized in peach fruits [29], [55]

Table III
Some economically important species of subfamily amygyloideae⁽²⁾.

Subfamily	Genus	Species	Common name	Uses
Amygyloideae	Prunus	armeniaca	Apricot	Fresh and processed fruit
		avium	Sweet cherry	Fresh and processed fruit
		cerasus	Tart (sour) cherry	Fresh and processed fruit
		domestica	European plum	Fresh and processed fruit
		dulcis	Almond	Fresh and processed fruit
		mume	Mume	Ornamental
		persica	Peach, nectarine	Fresh and processed fruit
		Serotina	Black cherry	Timber species

It is deciduous tree up to 10m in height[16] or evergreen trees and shrubs naturally distributed throughout temperate regions, originally from Asia or Southern Europe[16], [22].Generally, its bark is grayish or ashy acuminate glabrous[16], [18]. Useful action of its bark is expectorant (used in cough, whooping cough, and chronic bronchitis), sedative, stomachic, demulcent, anti-scorbutic, diuretic[16]. Wide variety of fruit and flesh color yellow to red and shape is its uniqueness[2]. Melting and rubbery are two types of flesh texture of its [57]. They are also consumed as well as processed into juices and sliced or dried product[2]. Its flowers are pinkish- white sessile, short and pedicelled. Green colour leaves are very useful as astringent, demulcent, diuretic, expectorant, febrifuge, laxative, and parasiticide and are seductive[13], [18].Fresh leaves are anthelmintic and powder of its leaves styptic (externally) [60].The fruit of these species is botanically known as a drupe [23] and have stomachic, antiscorbutic action biologically [60]. The fruits usually have a clear ventral suture, do not retain floral residues next to the pedicel, and are characterized by a membranous exocarp, [8] with an outer fleshy mesocarp[58] consisting mainly of parenchyma cells [24]. The mesocarp surrounds a shell (the pit or stone) of hardened endocarp with a seed inside and due to this,Prunusspecies are also referred to as “stone fruit”. In almonds, the consumed portion is the seed within the pit, while the edible part in most stone fruits includes the mesocarp, and eventually the exocarp[14].Like other stonefruit, peaches and nectarines, both closely related [23] have a characteristic, lignified endocarp (pit or stone) that encloses the seed, a fleshymesocarp and a thin exocarp[14]. In initial stage after

fertilization characterized by active cell division, a double sigmoid pattern can be seen while growing of this fruit, followed by a phase in which all the parts of the ovary besides the embryo and endosperm grow[22]. Later on, whole fruit growth is decelerated, while seed development and endocarp lignification occur and lastly mesocarp development resumes [8], [22], [24] Their distinctive aesthetic and organoleptic characteristics make these fruits highly valued. Fresh Prunus species are major contributors of bioactive compounds to the diet during spring and summer, although the increase in year round supply in the developed world has lessened these seasonal eating habits[22].

Table IV
Taxonomic classification of prunus persica

Kingdom	Plantae
Sub kingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Rosales
Family	Rosaceae
Subfamily	Amygdoideae (Prunoideae.)
Genus	<i>Prunus</i>
Species	<i>Prunus Persica</i>

English -Peach tree.

Ayurvedic-Aaruka.

Unani -Aaaduu, Khokh [60]

Most Prunus fruits and seeds are commonly used for processing [59]. Including jam production, canning, drying or roasting and are regularly consumed year round. Among stone fruits peach contribution of phenolics to the diet is highest [26]. These fruits with low, medium or high acid concentrations are also available [14], [23]. In spite of these general features, both the qualitative and quantitative profiles of these compounds vary markedly depending on the variety [22], [25], [27]-[31]. Peach fruit is rich in ascorbic acid (vitamin C), carotenoids (provitamin A), and phenolic compounds that are good sources of antioxidants [14], [28], [29], [32].

B. Cultivation of Prunus persica

Prunus persica is commonly cultivated in West Asia, Europe, Himalayas and India up to an altitude of 1000 ft. [1], [20]. Prunus has nearly 200 species cultivated for their edible fruits and seeds [20], [37]. In Mediterranean countries with Murcia region it is extensively cultivated [63]. The first introduction of peaches in India can be traced during the reign of King Kanishka by Chinese hostages in 1st century AD. During late 19th century many varieties of peaches and plums along with other temperate fruits have been introduced in Himachal Pradesh by Mr. A. N. Lee, son of Captain R. C. Lee [22], [46], [60]. It is very well represented in North-West China [8], [17] which is native place of it [2]. It was first domesticated and cultivated in the region between the Tarrin basin and the north slopes of the Kunlun Mountain [17]. China is the centre of origin for peach and was domesticated there 4-5000 years ago [21], [38], [42], [43]. China is also place of origin for Chinese wild peach (*P. consociiflora* Schneid.). Flat peaches (*P. persica* var. *platycarpa*) also originated in China [22], [41], [57]. It is cultivated in subtropics. Its production is increased day by day [2]. Commonly cultivated for edible fruits from sub-Himalayan region up to 2400 m. [18], [34], [35]. Chinese literature dates cultivation of the peach in China to 1000 b.c. and it was probably carried from China [36] to westward sea through India and mid-east as well as silk route to Persia [36], [41]. Peach, at one time called "Persian apple", [36] further, it is believed that early Greek and Roman writers gave the 'Peach' nomenclature [22] quickly spread from there to Europe. It is believed that nectarines might have originated in Europe, which was introduced to China. However, it is also considered that nectarines are also native to China

[22], [41] In the 16th century, it was established in Mexico and in the 18th century Spanish missionaries introduced the peach to California, which turned out to be the most important production area after China and Italy [14], [36]. The main world producing countries of stone fruit include China, USA, Italy, Spain and Turkey [22]. The most popular fruits within this group are by far peaches/nectarines and plums with an annual production around 17.5 and 9.7 million tons in 2007 [22]. As the largest producer of peach fruits in the world, China (11.9 million metric tons, 2013 FAO data) currently has approximately more than 1000 peach cultivars [56]. However, no extensive investigation of the phenolic profile and nutritional value of Chinese peach cultivars has yet been carried out [21]. In China, Cultivars Harflame, Nectared 1, Fantasia, Arctic Snow, Summer Fire, Arctic Star, Sunglo, Mayfire, and Flavortop are some popular nectarine cultivars. Cultivars Olimpia, Orex Mex, Flordagem, Flordaglo, Newbelle, Tropic Prince etc. are some popular low chill peach cultivars. Peento peach cultivars are China Flat, Sweet Bagel, Galaxy, Sauzee Queen, Saturn, UFO and Ruipan No. 1 etc [22]. Spain is the leading peach producer. its annual production is of 162000 tonnes from the cultivation area of 11151 hec. In 2010 [63]. 21% and 25% of the peach production and cultivation area is represented by these figures. It is the second large producer in European Union (29% total production) and fourth producer in the world [64] Catalonia and Aragon is the most important area for producing peaches in Spain [65]. While Ebro valley are frequently showed to severe spring frost during the blooming and fruit set periods (March and April to the end of October). 33% of total fruit production in the Spain is provided by the main deciduous fruit crop species [66]. In China, there are more than 3000 peach cultivars in the world today, which can be variously classified as melting and non-melting flesh, or hairy and smooth skin, or clingstone and freestone, etc. [21], [47]. In North China provinces the Mitao cultivars are generally cultivated, whereas, Shumitao peaches (Honey peach), are commonly grown in Southern parts of China [22]. Three groups of peaches are recognized in China, southern group is found in provinces along the Yangtze River, northern group is grown in the provinces along the Yellow river and third group is grown in arid North West China [44]. In India, Peach cultivars J. H. Hale, Early Hale, Halbarta, Candoka, June Elberta and Hale Haven with Hale in their parentage show self-sterility (male sterile) and require pollinizers for fruit set. Peach varieties are grouped on the basis of flesh colour (yellow and white), melting nature of flesh (melting and non-melting), stone adhesion to flesh (free stone, semi cling stone and cling stone) and chilling requirement [43]. In India, Gene bank of NBPGR, Regional Station, Shimla (India), has about 22 indigenous and 27 exotic accessions [45]. Namely: Summer Glo, NemaGuard, Candor, Stark Early Glo, Flordaball, Flordasun, Sunred, Dixi Red, C. O. Smith, Snow Queen, Peach S-37, July Elberta, Fire Prince, Duke, Alton Peach, Ambri, Okubo, Kanto 5, Nishiki, Luna etc. Recommended cultivars in India [39], [40] are Shan-i-Punjab, July Elberta, J. H. Hale, Crawford's Early (locally selected as Paradelux), Red June (Elberta selection), Shaharanpur Prabhat and Flordasun [22]. Such a huge range of cultivars provides important genetic resources for the evaluation of the phenolic profile. So far, phenolic compounds have been characterized in peach germplasms grown in different regions, such as USA [48]-[50], Italy [51], Spain [52], [53], Brazil [54] and Pakistan [55]. As a result, in southern China, melting peaches are famous for their soft texture, juicy flesh, good flavour and sweet taste, which make them quite competitive in the fresh fruit market [21].

C. Volatile in Nature

Peaches are members of the genus *Prunus* that includes apricots, plums, cherries, almonds, and nectarines. Peaches and nectarines differ primarily in that nectarines have a smooth skin whereas peaches possess a downy skin, but both may be freestone – the pit is relatively free of the flesh – or clingstone – the pit follows to the flesh. In this final case, peaches and nectarines are drupes or “stone fruits” – like apricots, plums, cherries, and mangoes – in which an outer fleshy part (exocarp and mesocarp) surrounds a hard stone (endocarp) with a seed inside. Peach and nectarine volatiles have been intensively investigated, and more than 100 compounds have been identified [67]-[88].

A wide range of pre- and postharvest conditions can alter the synthesis and emanation of volatiles from harvested plant products [89] that may be associated with flavor, ripening and other factors impacting quality or storage potential. The volatile composition of peach has been thoroughly studied leading to identification of more than one hundred volatile compound. The most abundant compound is C_6 compound, linalool, benzaldehyde, ester terpinoids, C_{13} norisoprenoids, ketones and lactones [90], [91]. The flowering properties derive from lactones and particularly γ & δ -decalactones, with smaller contributions from C_6 aldehydes, alcohols, terpinoids [92], [93], [94]. The chemical composition of the volatile compound varies in the different part of the fruit. In the pulp volatile compound such as C_6 compound, C_{13} norisoprenoids and benzaldehydes are more concentrated than in the inner mesocarp [95]. Beside the composition evolves during the ripening process: C_6 compound levels decrease drastically, whilst the content of lactones, benzaldehyde, linalool, norisoprenoids and phenylalanine derivatives increase [96]-[99]. The volatile composition is also affected by the storage condition of the fruit [100], [101].

II. APPLICATION OF PRUNUS PERSICA

A. Chemical compound in prunus persica

- 1) Khalil Zaghdoudi et al., examined Accelerated solvent extraction of carotenoids from: Tunisian Kaki (*Diospyros kaki* L.), peach (*Prunus persica* L.) and apricot (*Prunus armeniaca* L.). these carotenoids present in prunus persica moisture content of fruits (skin + flesh), expressed as g of water per 100 g of fresh weight, were found to be $77.66 \pm 1.63\%$, $85.85 \pm 2.79\%$ and $87.00 \pm 5.08\%$ for kaki (*D. kaki*), peach (*P. persica*) and apricot (*P. armeniaca*), respectively. The significantly lower water content of kaki as compared to peach and apricot is in accordance with data from the [102], which indicates that this lower water content is balanced by a higher carbohydrate content of about 23 g/g of fresh product in kaki against only about 10 g/g of fresh product in peach and apricot [103]
- 2) Aslihan Kazanet al., examined Supercritical fluid extraction of *Prunus persica* leaves and utilization possibilities as a source of phenolic compounds. The extraction process was optimized using the total phenol content as a response. The results of radical scavenging activity (RSA) analyses were not included in the optimization step. Second-order polynomial equations were used to express the total phenol content [104].
- 3) Mustafa Serhat Ekinici et al., examined Extraction of oil and β -sitosterol from peach (*Prunus persica*) seeds using supercritical carbon dioxide. The seeds were separated from their shells by a crusher. Unshelled peach seeds were ground into small pieces using a plant grinder. Then the ground unshelled seeds were classified into different sizes: 0.3 mm, 0.7 mm, 1.2 mm and 1.7 mm [105].
- 4) Rongling Yanget al., Convenient synthesis of alkyl and phenyl alkyl β -D glucopyranosides using facile and novel biocatalysts of plant origin. To find new and efficient catalysts for the synthesis of various alkyl glycosides, many fruit and vegetable seeds were tested as the potential sources of α -glucosidase [106].
- 5) R. Raturi et al., examined Chemical Constituents of *Prunus persica* Stem Bark. It was isolated as yellow crystals from methanol [107].

The APCIMS spectrum of compound 1 showed molecular weight of 446 amu, which corresponds to the molecular formula $C_{22}H_{22}O_{10}$. It gave positive test with $FeCl_3$, Mg/HCl and Molish test thereby showed it to be a flavonoid glycoside. The UV spectrum of the compound showed absorption band at 270, 276, 428 nm and IR absorption band appeared at 3410, 1650, 1525, 1430 cm^{-1} which were characteristic for flavonoid glycoside.

The 1H NMR spectrum of compound 1 displayed a typical signal of flavonoid, the presence of two doublets at δ 6.89 and δ 6.66 with coupling constant 7.0 and 5.5 Hz were assigned for H-3 and H-5'. The three singlet at δ 7.3, δ 7.7 and δ 6.95 were characteristic for unsubstituted H-2', H-8, H-5. A sharp singlet at δ 3.09 was assigned for aromatic methoxyl position at C-6, other singlet at δ 1.27 was assigned for rhamnose methyl group. The position of anomeric proton at δ 5.95 (s, 1H) indicated the α configuration of the rhamnose sugar. The ^{13}C NMR spectrum of the compound 1 displayed twenty-two carbons, peak at 168.0 was assigned for carbonyl carbon atom whereas the peaks at 149.0, 129.5, 134.1 and 110.1 were assigned for oxygenated substitution at C-6, C-4', C-3' and C-7 positions. The down field value of 110.1 of C-7 showed glycosidation at this point. The up field signal at 17.5 assigned for rhamnose methyl, whereas signal at 54.3 was depicted for methoxy function. On the basis 772 Chemical Constituents Short Communication, it was crystallized from methanol as crystalline solid. Molecular ion peak was observed at m/z 445[M]⁺ and the other fragment peaks were obtained at m/z 469[M+H+Na]⁺, 490[M-H+2Na]⁺, 272. The peak at m/z 282[M-H-162]⁺ arose by loss of one hexose unit from molecular ion peak.

The UV spectrum of the compound 2 showed a prominent maximum at 259 indicating isoflavonoid nucleus which was supported by a ^{13}C chemical shift of 148.3 for a methylene carbon which corresponds to C-2 of an isoflavone and excluded the isomeric flavone structure [16]. Moreover, the H-2 chemical shift value of δ 8.15 indicated its isoflavone nature. The glycosidic nature of the compound 2 and its sugar moiety was proved by hydrolysis followed by paper chromatography. The aglycon was identified as prunetin and sugar as glucose. The presence of a distinct bathochromic shift R. Raturi et al. of above spectral data the compound was identified as flavon 3', 4', dihydroxy 6 methoxy 7-O- α -L-rhamnopyranoside. The 1H -NMR and ^{13}C -NMR, data of compound 1 are given in Table I.

Fig. 1. Structure of compound 1: flavon 3', 4', dihydroxy 6 methoxy 7-O- α -L-rhamnopyranoside.

Compound 2 (12nm) on addition of $\text{AlCl}_3\text{-HCl}$ to its aglycone and its absence in the UV spectrum of the respective glycoside indicated that the sugar was attached to C-5 OH. The ^1H and ^{13}C chemical shift as well as ^1H - ^1H coupling constant confirmed that the sugar was glucose and it has β configuration ($J \approx 6.0\text{Hz}$). The sides of the linkage of the two substituents Me and β -D-glucosyl were ascertained by two NOE difference experiments on irradiation of the anomeric proton ($\text{H-1}''$). δ 5.05 signal enhancement were observed for one aromatic proton only (H-6) proving that the sugar is attached to that C-5 OH. The appearance of C-3''/5'' responses provided a further argument of glucosyl grouping. The downfield signal at 168.1 (C-4) in its ^{13}C NMR spectrum of compound 2 suggested the presence of carbonyl functional group whereas the anomeric carbon 106.3 (C-1'') and methoxyl 54.5 (OMe) were resonated in its ^{13}C NMR spectrum which confirmed the presence of β linked sugar and methoxyl group at C-5 and C-7 positions of the compound. Irradiation of methoxy proton however induced NOE of both the H-6 and H-8 signals. Thus this substituent is positioned between them i.e. at C-7 OH, the NOE on H-6 is clearly smaller than that on H-8 therefore the methyl group is directed preferably towards the H-8 atom due to its steric interfere with the bulky sugar moiety. Thus on the basis of above studies compound 2 was identified as prunetin-5-O- β -D-glucopyranoside

Enaam Y. Backheet et al., examined flavonoids and cyanogenic glycosides from the leaves and stem bark of *Prunus persica* (meet ghamr) peach local cultivar in assist region [108].

The concentrated extract (350 g) was diluted with distilled water and subjected to solvent fractionation using *n*hexane (6'500 ml), chloroform (5'500 ml), ethyl acetate (6'500 ml) and *n*butanol (5'500 57 ml). The obtained fractions were separately concentrated under reduced pressure till solvent-free residue (200, 40, 50 and 30 g, respectively) and examined for different constituents by silica gel TLC using systems I and III.

B. Leaves

The air-dried powdered leaves (3.8 kg) of *Prunus persica*(L.) Batsch "Meet Ghamr" peach were exhaustively extracted with methanol at room temperature and concentrated under vacuum.

C. Ethyl Acetate Fraction

About 15 g of the ethyl acetate soluble fraction was chromatographed on silica gel column (450 g, 5'150 cm), and eluted with chloroform followed by chloroform-methanol gradient. Fractions of 250 ml were collected, concentrated and monitored by silica gel TLC using systems I & III. Five fractions were obtained; fraction I (1 g, eluted with chloroform), fraction II (5 g, eluted with chloroform-methanol 95:5), fraction III (4 g, eluted with chloroform-methanol 90:10), fraction IV (3.5 g, eluted with chloroform methanol 85:15) and fraction V (1.3 g, eluted with chloroform methanol 80:20). About 3 g of fraction II was rechromatographed on ODS column (300 g, 5'120 cm) and eluted with water-methanol (30:10) to obtain compound 1 (500 mg). Fraction III was rechromatographed on ODS column (300 g, 5'120 cm), eluted with water-methanol (30:10) and (20:10) to yield compound 2 (300 mg) and compound 3 (200 mg). Fraction IV was rechromatographed on silica gel column (100 g, 2'75 cm) and eluted with chloroform-methanol (90:10) to afford compound 4 (200 mg).

D. N-Butanol Fraction

About 10 g of the *n*-butanol soluble fraction was fractionated on silica gel column (300 g, 5'120 cm). Elution was started with ethyl acetate followed by ethyl acetate methanol gradient. Fractions of 200 ml were collected, concentrated and monitored by silica gel TLC using systems I & III. Four fractions were obtained; fraction I (1 g, eluted with ethyl acetate), fraction II (3 g, eluted with ethyl

acetate-methanol 95:5), fraction III (2 g, eluted with ethyl acetate-methanol 90:10) and fraction IV (3.8 g, eluted with ethyl acetate-methanol 80:20). Fraction II was rechromatographed on sephadex LH-20 using methanol. Further purification by preparative TLC using chloroform-methanol (80:20) afforded compound **5** (500 mg). Fraction III was rechromatographed on ODS column (300 g, 5'120 cm) using water-methanol (10:20) to yield compound **6** (50 mg). Fraction IV was purified on ODS column (300 g, 5'120 cm) using water-methanol (30:10) to obtain compound **7** (40 mg).

Fig. 2. Structure of compound 2: prunetin-5-O- β -D-glucopyranoside[107].

E. Stem Bark

The air-dried ground stems bark (1.1 kg) of *Prunus persica*(L.) Batsch "Meet Ghamr" peach was extracted with methanol at room temperature. The methanolic extract was concentrated under vacuum until solvent-free residue (100 g). The residue was diluted with distilled water and fractionated by using *n*-hexane (3'500 ml), chloroform (3'500 ml), ethyl acetate (5'500 ml) and *n*-butanol (4'500 ml). Each fraction was concentrated under reduced pressure to give the corresponding solubles (15, 10, 50 and 15 g, respectively) and screened by silica gel TLC using system I.

F. Chloroform Fraction

The chloroform soluble fraction (10g) was chromatographed on silica gel column (300 g, 5'120 cm) and elution was performed with *n*-hexane-acetone gradient. Fractions of 150 ml were collected, concentrated and screened by silica gel TLC using system I. Three fractions were obtained; fraction I (2 g, eluted with *n*-hexane-acetone 90:10), fraction II (4.8 g, eluted with *n*-hexane-acetone 80:20) and fraction III (3 g, eluted with *n*-hexane-acetone 70:30). Fraction II was purified by repeated crystallization from methanol to obtain compound **8** (500 mg). Fraction III was rechromatographed on silica gel column (90g, 2'75 cm) and eluted with *n*-hexane-acetone (80:20) to yield compound **9** (500 mg).

G. Ethyl Acetate Fraction

About 15 g of the ethyl acetate soluble fraction was fractionated on silica gel column (450 g, 5'150 cm). Elution was started with chloroform followed by chloroform-methanol gradient. Fractions of 300 ml were collected, concentrated under reduced pressure and monitored by silica gel TLC using system I. Similar fractions were combined to give five fractions; fraction I (800 mg, eluted with chloroform), fraction II (3 g, eluted with chloroform-methanol 95:5), fraction III (3.2 g, eluted with chloroform-methanol 90:10), fraction IV (4 g, eluted with chloroform-methanol 85:15) and fraction V (3.8 g, eluted with chloroform-methanol 80:20). About 2 g of each of fraction II and III was rechromatographed on ODS column (300 g, 5'120 cm) using water-methanol (1:1) to afford pure compounds 10 (70 mg) and 11 (100 mg), respectively. Each of fraction IV and V was purified by repeated crystallization from methanol to yield compound 12 (300 mg) and compound 13 (200 mg), respectively. The molecular formula for Compound 1- Was deduced as $C_{14}H_{17}O_6N$ from FAB-MS, m/z 296 $[M+1]^+$. Its 1H -NMR spectrum showed signals at δ 7.48 and 7.57, representing atypical pattern for monosubstituted benzene ring and a sharp singlet signal at δ 6.03 assigned for an oxygen bearing methine proton. Compound 5 The FAB-MS of compound 5 showed $[M+1]^+$ at m/z 314 was consistent with the molecular formula $C_{14}H_{19}O_7N$. compound 5 was identified as mandelic acid amide- β -D-glucopyranoside which was isolated for the first time from the genus *Prunus*. This compound can be considered as the product of hydration of nitrile group of prunasin.¹⁹ The UV spectral data in methanol for compounds 2-4 indicated their nature as C-3 OH substituted flavonols.²² They were identified as kaempferol-3-O- β -D-galactopyranoside (trifolin), kaempferol-3-O- β -D-glucopyranoside (astragalin), and quercetin- 3-O- β -D-glucopyranoside by direct comparison of their spectral data with literature data^{3,22-24}. Acid hydrolysis followed by co- TLC for each of the aglycone and sugar part with authentic samples confirmed their structures. Enaam Y. Backheet, et al.

For compound: 1, 5, 7

For compound 2, 3, 4, 6

For compound 8, 9, 10, 11, 12, 13

Table V Showing Compounds

Compound	R ₁	R ₂	R ₃	R ₄	R ₅
1	CN	Glucose			
2	Galactose	H			
3	Glucose	H			
4	Glucose	OH			
5	CONH ₂	Glucose			
6	Galactose-glucose	H			
7	CN	Glucose-glucose			
8	H	H	CH ₃	OH	CH ₃
9	H	H	H	H	H
10	OH	H	H	H	H
11	H	H	H	OH	H
12	H	H	CH ₃	O-glucose	CH ₃
13	H	Glucose	H	OH	CH ₃

Compound 6 showed [M+1]⁺ peak at m/z 611 consistent with the molecular formula C₂₇H₃₀O₁₆. The UV spectral data in methanol indicating its C-3 OH substituted flavonol nature.²² Study of the effects of ionizing and complexing agents indicated the presence of free hydroxyl groups at C-5, C-7 and C-4'. Compound 7 were very similar to those of compound 1 with an additional b-glucopyranosyl moiety. This was confirmed by the existence of two anomeric signals at δ 4.42 (d, J = 7.80 Hz, H-1'), δ 103.68 (d, C-1'), δ 4.26 (d, J = 7.80 Hz, H-1'') and δ 101.58 (d, C-1''), indicating its bioside nature.¹⁷ The downfield shift of C-6' at δ 68.47 indicated the interglycosidic linkage to be (1'→6').¹⁷ The identity of the two sugars and their sequence were assigned by the 1H-1H COSY, HSQC and HMBC spectra. Compound 7 was concluded to be mandelonitrile-b-D-glucopyranosyl-(1'→6)-b-D-glucopyranoside (amygdalin) by comparison of its 1H- and 13C-NMR spectral data with those reported.^{18,20} Prunasin and amygdalin were reported from the leaves of *Prunus serotina* and *Prunus virginiana*²¹ and this is the first report for their occurrence in the leaves of the title plant. Compound 8 was found to have the molecular formula C₁₇H₁₆O₆ as deduced from FAB-MS, m/z at 317 [M+1]⁺. The UV data and the study of the effect of ionizing and compound 8 was identified as 5,3'-dihydroxy-7,4'-dimethoxy flavanone (persicogenin).

Compounds 9-11 were identified as naringenin, dihydrokaempferol (aromadendrin) and eriodictyol, respectively by comparison of their spectral properties with literature data [22-25]. The molecular formula of compound 12 was deduced as $C_{23}H_{26}O_{11}$ from its FAB-MS, m/z at 479 $[M+1]^+$. Its 1H - and ^{13}C -NMR spectral data of compound 12 could be identified as persicogenin 3-O- β -D-glucopyranoside. FAB-MS of compound 13 showed $[M+1]^+$ peak at m/z 465 consistent with the molecular formula $C_{22}H_{24}O_{11}$. Compound 13 was identified as hesperitin 5-O- β -D-glucopyranoside. In the course of the present work, it was observed that the flavonoids isolated from the leaves belong entirely to flavonols, while those isolated from the stem bark belong to flavanones and dihydroflavonols [109].

H. Biological Activity

Peach (*Prunus persica*) shows many biological activities. Some biological activities are mentioned below: -

I. Antidiabetic Activity

- 1) P. Hephzibah christabel et al., observed enzyme inhibitors from *Prunus persica* Batsch: An alternate approach to treat diabetes [109].
- 2) Usharani chatragadda et al., studied pharmacological evaluation on glucose lowering efficacy of leave of *Prunus persica* [110].

J. Antioxidant Activity

- 1) Feten Belhadj et al., examined bioactive compounds contents, antioxidant activities during ripening of *Prunus persica* L. varieties from the North West of Tunisia [111].
- 2) Abderrahmane Mokrani, et al., inspected Effect of solvent, time and temperature on the extraction of phenolic compounds and antioxidant capacity of peach (*Prunus persica* L.) fruit [112].
- 3) Naveen Dhingra, Rajesh Sharma, Anand Kar., observed Towards further understanding on the antioxidative activities of *Prunus persica* fruit: A comparative study with four different fractions [113].
- 4) Marina Carbonaro, et al., observed Modulation of Antioxidant Compounds in Organic Vs Conventional Fruit (Peach, *Prunus persica* L., and Pear, *Pyrus communis* L.) [114].
- 5) Weibo Jianget al., inspected Changes in phenolics and antioxidant property of peach fruit during ripening and responses to 1-methylcyclopropene [115].
- 6) Ana García-Ibarra et al., Changes in the antioxidative metabolism induced by Apple chlorotic leaf spot virus infection in peach [*Prunus persica* (L.) Batsch] [116].
- 7) Rakesh Raturi et al., observed antioxidant activity of methanolic extract of bark of *Prunus persica* [18].
- 8) C. Font i Forcada et al., observed Fruit sugar profile and antioxidants of peach and nectarine cultivar on almond $\times$ peach hybrid rootstocks [117].
- 9) Peerzada R. Hussain et al., Gamma irradiation induced enhancement of phenylalanine ammonia-lyase (PAL) and antioxidant activity in peach (*Prunus persica* Batsch, Cv. Elberta) [118].
- 10) Kyoung-Hee Kim et al., observed inactivation of contaminated fungi and antioxidant effects of peach (*Prunus persica* L. Batsch CVDangeumdo) by 0.5–2 kGy gamma irradiation [119].
- 11) Alex F. Puerta-Gomez et al., examined Postharvest studies beyond fresh market eating quality: Phytochemical antioxidant changes in peach and plum fruit during ripening and advanced senescence [120].
- 12) Salem Edrah et al., examined Preliminary Phytochemical Screening and Antibacterial Activity of *Pistacia atlantica* and *Prunus persica* Plants of Libyan Origin [121].

K. Antimicrobial Activity

Feten Belhadj, et al., detected antimicrobial activities during ripening of *Prunus persica* L. varieties from the North West of Tunisia [111].

L. Antibacterial Activity

Rakesh Raturi et al., observed Antibacterial activity of methanolic extract of bark of *Prunus persica* [18].

M. Antitumor Activity

Giuliana Noratto et al., Polyphenolics from peach (*Prunus persica* var. Rich Lady) inhibit tumor growth and metastasis of MDA-MB-435 breast cancer cells in vivo [122].

N. Anti-Allergic Inflammatory activity

Tae-Yong Shin et al., detected Anti-allergic inflammatory activity of the fruit of *Prunus persica*: Role of calcium and NF- κ B [123].

O. Anticancer Activity

Chang Ki Lee et al., inspected The Extract of *Prunus persica* Flesh (PPFE) attenuates Chemotherapy-induced Hepatotoxicity in Mice [124].

P. Cholinesterase Inhibitory Activity

Seok-Jong Suh et al., detected Pharmacological Characterization of Orally Active Cholinesterase Inhibitory Activity of *Prunus persica* Batsch in Rats [125].

Q. Free Radical Scavenging Activity

Lokesh deb et al., inspected Free radical scavenging activity of aqueous n- butanol fraction of *Prunus Persica* l aqueous extract [126].

R. Prokinetic Activity

Wei Han et al., inspected Prokinetic Activity of *Prunus persica* (L.) Batsch Flowers Extract and Its Possible Mechanism of Action in Rats [127].

S. Polyphenoloxidase Activity

Marina Carbonaro et al., Polyphenoloxidase activity and polyphenol levels in organically and conventionally grown peach (*Prunus persica*) [128].

IV. CONCLUSIONS

This review article throws light on the different useful activity of peaches. These are members of the genus *prunus* that includes apricots, plums, cherries, almonds, and nectarines. Peach has prime importance in the wellness of mankind having medicinal properties in its phytochemicals, biological activity, and high nutritive value makes it significant for Human being.

REFERENCES

- [1] W. Judd, C. Cambell, E. Kellogg, P. Stevens and M. Donoghue. (1999), Plant Systematics: A Phylogenetic Approach Sinauer Associates, Sunderland USA
- [2] Kim E. Hummer and Jules Janick. (2009). Genetics and Genomics of Rosaceae, Plants Genetics and Genomics: Crop and Models-Book. Springer Science Business Media, LLC
- [3] Hafiz Majid Rasheed, Taous Khan, Fazli Wahid, Rasool Khan and Abdul Jabbar Shah. (2015), Chemical Composition and Vasorelaxant and Antispasmodic Effects of Essential Oil from *Rosa indica* L. Petals. Evidence-Based Complementary and Alternative Medicine, 2015, 9.
- [4] Esmaili A (Ph.D.), Masoudi Sh (Ph.D.), Masnabadi N (M.Sc.) and Rustaiyan AH (Ph.D.). 2010, Chemical Constituents of the Essential oil of *Sanguisorba minor* Scop. Journal of Medicinal Plants, 9, 67-70.
- [5] T. A. Dickinson, E. Lo and N. Talent. (2007). Polyploidy, reproductive biology, and Rosaceae: understanding evolution and making classification. Plant Systematics and Evolution, 266, 59-78.
- [6] D. Potter, T. Eriksson, R. C. Evans et al. (2007), Phylogeny and classification of Rosaceae. Plant Systematics and Evolution, 266, 5-43.
- [7] D. Potter, F. Gao, P. E. Bortiri, S. H. Oh, and Baggett. (2002). Phylogenetic relationships in rosaceae inferred from chloroplast matK and trnL-trnF nucleotide sequence data. Plant systematics and Evolution, 231, 77-89.
- [8] Lu Lingdi, Gu Cuizhi, Li Chaoluan et al. (2003), Flora of China, 9, 46-434.
- [9] Pigg, M. L. DeVore and K. B. Robertson. (2007), A brief review of the fossil history of the family Rosaceae. Plant Systematics and Evolution, 266, 45-57.
- [10] Heywood, V. H. Flowering Plants of the World. s.l. : Oxford University Press, 1993.
- [11] Xiao-Long Wang, Yan Zhong, Zong-Ming Cheng and Jin-Song Xiong. (2015). Divergence of the bZIP Gene Family in Strawberry, Peach and Apple Suggests Multiple Modes of Gene Evolution after Duplication. International Journal of Genomics, 2015, 11.
- [12] A. Farooq, M. A. Khan, A. Ali, and A. Riaz. (2011). Diversity of morphology and oil content of *Rosa damascena* landraces and related *Rosa* species from Pakistan, Pakistan Journal of Agricultural Sciences, 48, (3), 177-183.
- [13] Kritkar KR and Basu BD. (1984). Indian Medicinal Plants, Bishen Singh Mahendra Pal Singh, Dehradun 1:954.
- [14] Susan Lurie and Carlos H. Crisosto, 2005, Chilling injury in peach and nectarine, Postharvest Biology and Technology, 37, 195-208.
- [15] Claudete Bastos, Lillian Barros, Montserrat Dueñas, et al, Chemical characterization and bioactive properties of *Prunus avium* L.: The widely studied fruits and the unexplored stems 1-33.

- [16] Gaur, R. D. (1999) Flora of the district Garhwal North West Himalayas, Transmedia, Srinagar Garhwal. pp.227.
- [17] Janik 2003(Li, 1984 sharma 1993).
- [18] Rakesh Raturi, S.C. Sati, Harpreet Singh, M. D. Sati, P. Bahuguna and P. P. Badoni. (2011), chemical examination and anti-inflammatory activity of prunus persica steam bark International Journal of Pharmacy and Pharmaceutical Sciences, 3, 315-317.
- [19] Biswajit Das, N. Ahmed and Pushkar Singh. (2011). Prunus diversity- early and present development: A review international Journal of Biodiversity and Conservation. 3(14), 721-734.
- [20] Sumaira Aziz and Habib-ur-Rahman. (2012). Biological activities of Prunus persica L. batch,7(15), 947-951.
- [21] Xiaoyong Zhao, Wenna Zhang, Xueren Yin, Mingshen Su, Chongde Sun, Xian Li and Kunsong Chen. (2015). Phenolic Composition and Antioxidant Properties of Different Peach [Prunus persica (L.) Batsch] Cultivars in China, Int. J. Mol. Sci. 16, 5762-5778.
- [22] Ariel R. Vicente, George A. Manganaris, Luis Cisneros-Zevallos and Carlos H. Crisosto CAB International.(2011). Health-promoting Properties of Fruit and Vegetables (ed. L.A. Terry)
- [23] Brady, C.J. (1993). Stone fruit. In: Biochemistry of fruit ripening. Seymour, G.B., Taylor, J.E., Tucker, G.A. Eds. Chapman & Hall. ISBN 0412408309. 379–404.
- [24] Romani, R.J. and Jennings, W.G. 1971, Stone fruits. The biochemistry of fruits and their products, 2411–436. Hulme A.C. (Ed), Academic Press, NY.
- [25] Ruiz, D., Reich, M., Bureau, S., Renard, C.M.G. and Audergon, J.M. (2008). Application of reflectance colorimeter measurements and infrared spectroscopy methods to rapid and nondestructive evaluation of carotenoids content in apricot (Prunus armeniaca L.). Journal of Agricultural and Food Chemistry, 56, 4916–4922.
- [26] Vicente, A.R., Manganaris G.A., Sozzi, G.O. and Crisosto, C.H. (2009). Nutritional quality of fruits and vegetables in: Postharvest Handling: A Systems Approach, Second Edition Edited by Wojciech J. Florkowski, Robert L. Shewfelt, Bernhard Brueckner and Stanley E. Prussia. ISBN: 978-0-12-374112-7. Academic Press. pp. 58–106.
- [27] Vizzotto, M., Cisneros-Zevallos, L., Byrne, D., Ramming, D. and Okie, W. (2007). Large variation found in the phytochemical and antioxidant activity of peach and plum germplasm. Journal of the American Society for Horticultural Science, 132 (3), 334–340.
- [28] Tomás-Barberán, F. and Espín, J.C. (2001). Phenolic compounds and related enzymes as determinants of quality in fruits and vegetables. Journal of the Science of Food and Agriculture, 81, 853–876.
- [29] Tomás-Barberán, F.A., Gil, M.I., Cremin, P., Waterhouse, A.L., Hess-Pierce, B. and Kader, A.A. (2001) HPLC-DAD-ESIMS analysis of phenolic compounds in nectarines, peaches, and plums. Journal of Agricultural and Food Chemistry, 49, 4748–4760.
- [30] Dalla Valle, A.Z., Mignani, I., Spinardi, A., Galvano, F. and Ciappellano, S. (2007). The antioxidant profile of three different peaches cultivars (Prunus persica) and their short-term effect on antioxidant status in human. European Food Research and Technology, 225, 167–172.
- [31] Díaz-Mula, H.M., Zapata, P.J., Guillén, F., Castillo, S., Martínez-Romero, D., Valero, D. and Serrano, M., (2008). Changes in physicochemical and nutritive parameters and bioactive compounds during development and on-tree ripening of eight plum cultivars: a comparative study. Journal of the Science of Food and Agriculture. 88, 2499–2507.
- [32] Byrne, D.H.(2002). Peach breeding trends. Acta Hort. 592, 49–59.
- [33] Genard, M., Reich, M., Lobit, P., Besset, J.,(1999). Correlation between sugar and acid content and peach growth. J. Hort. Sci. Biotech. 74, 772–776.
- [34] Gaur RD. (1999).Flora of Garhwal North West Himalaya. (Trans Media Srinagar Garhwal, 327.
- [35] Anonymous, the wealth of India, A Dictionary of Indian Raw Materials and Industrial Products (CSIR/PID, New Delhi, 2003) 17.
- [36] LaRue, J. (1989). Introduction. In: LaRue, J.H., Johnson, R.S. (Eds.), Peaches, Plums, and Nectarines: Growing and Handling for Fresh Market. University of California Division of Agriculture and Natural Resources Publicatio, 3331, 1–2.
- [37] Rheder A. (1940). Manual of cultivated trees and shrubs hardy in North America, Macmillan Company, New York. 425-481
- [38] Aranzana MJ, Abbassi EL-K, Howad W, Arus P ,(2010). Genetic variation, population structure and linkage disequilibrium peach commercial varieties. Bio. Med. Cen. Genet., 11(69), 1-12.
- [39] Anonymous. (2000). Package of practices for fruit crops. Directorate of Extension Education. Dr. YSP University of Hort. & Forestry, Solan. H.P., India.
- [40] Das B, Ranjan JK, Hare Krishna, Pragya. (2007). Production of quality planting materials of temperate fruit crops. In Das et al. (eds.) Model Training Course on Advanced Technologies in Production of Temperate Fruit Crops, Central Institute of Temperate Horticulture. Regional Station, Mukteshwar, Nainital, Uttarkhand, India, 26-31.
- [41] Janick J. (2003) English title: History of Asian horticultural technology. Acta Hort, 620, 19-32.
- [42] Hedrick UP. (1917). The peaches of New York. Rep New York Agric. Exp. Sta.
- [43] EJ (Wang ZH, Zhuang).(2001). China fruit monograph- peach flora. China Forestry Press, Beijing, pp. 42-51.
- [44] Li ZL,(1984), Peach germplasm and breeding in China. HortScience, 19, 348-351.
- [45] Sharma BD, Rana JC, Yadav SK, (2001), A glance at temperate fruits gene bank. NBPGR, Regional Station, Shimla, 4, 1-20.
- [46] Sharma RL. (1993). Genetic resources of temperate fruits. In Chadha KL, Pareek OP (ed.) Advances in Horticulture Vol. 1-Fruit crops Part 1, Malhotra Publishing House, New Delhi, India, 244-263.
- [47] Faust, M.; Timon, B.(1995), Origin and dissemination of peach. Hortic. Rev. 17, 331–379.
- [48] Cevallos-Casals, B.A.; Byrne, D.; Okie, W.R.; Cisneros-Zevallos, L., (2006), Selecting new peach and plum genotypes rich in phenolic compounds and enhanced functional properties. Food Chem., 96, 273–280.
- [49] Gil, M.I.; Tomás-Barberán, F.A.; Hess-Pierce, B.; Kader, A.A., (2002), Antioxidant capacities, phenolic compounds, carotenoids, and vitamin C contents of nectarine, peach, and plum cultivars from California. J. Agric. Food Chem., 50, 4976–4982.
- [50] Di Vaio, C.; Graziani, G.; Marra, L.; Cascone, A.; Ritieni, A.,(2008), Antioxidant capacities, carotenoids and polyphenols evaluation of fresh and refrigerated peach and nectarine cultivars from Italy. Eur. Food Res. Technol., 227, 1225–1231.
- [51] Cantín, C.M.; Moreno, M.A.; Gogorcena, Y., (2009), Evaluation of the antioxidant capacity, phenolic compounds, and vitamin C content of different peach and nectarine [Prunus persica (L.) Batsch] breeding progenies. J. Agric. Food Chem. Vol.57, pp. 4586–4592.
- [52] Reig, G.; Iglesias, I.; Gatiús, F.; Alegre, S, (2013), Antioxidant capacity, quality, and anthocyanin and nutrient contents of several peach cultivars [Prunus persica (L.) Batsch] grown in Spain. J. Agric. Food Chem., 61, 6344–6357.

- [53] Rossato, S.B.; Haas, C.; Raseira, M.D.C.B.; Moreira, J.C.F.; Zuanazzi, J.Â.S. , (2009), Antioxidant potential of peels and fleshs of peaches from different cultivars. *J. Med. Food* 12, 1119–1126.
- [54] Manzoor, M.; Anwar, F.; Mahmood, Z.; Rashid, U.; Ashraf, M., (2012), Variation in minerals, phenolics and antioxidant activity of peel and pulp of different cultivar of peach (*Prunus persica* L.) fruit from Pakistan. *Molecules* 17, 6491–6506.
- [55] Scordino, M.; Sabatino, L.; Muratore, A.; Belligno, A.; Gagliano, G., (2012), Phenolic characterization of Sicilian yellow flesh peach (*Prunus persica* L.) cultivars at different ripening stages. *J. Food Qual.* 35, 255–262.
- [56] FAOSTAT (Food and Agriculture Organization of the United Nations Statistics Division). Available online: <http://faostat3.fao.org/download/Q/QC/E>. page (accessed on 2 March 2015).
- [57] Yunfei Zheng, Gary W. Crawford, Xugao Chen.(2014). Archaeological Evidence for Peach (*Prunus persica*) Cultivation and Domestication in China, *PLOS one*, 9(9), 1-9.
- [58] Hye-Ryun Kim, I-Doo Kim, Sanjeev Kumar Dhungana,(2014), Mi-Ok Kim, Dong-Hyun Shin, Comparative assessment of physicochemical properties of unripe peach (*Prunus persica*) and Japanese apricot (*Prunus mume*), *Asian Pac J Trop Biomed*, 4(2), 97-103.
- [59] V. Poonam, Raunak, G. Kumar, C.S. Reddy L., R. Jain, S.K. Sharma, A.K. Prasad and V.S. Parmar. (2011), Chemical Constituents of the Genus *Prunus* and their Medicinal Properties, *Current Medicinal Chemistry*, 18, 3758-3824.
- [60] C p khare(2007). indian medicinal plants, Springer Science BusinessMedia, LLC
- [61] D.Potter, F. Gao, P. E. Bortiri, S. H. Oh, and Baggett.(2002), Phylogenetic relationships in rosaceae inferred from chloroplast matK and trnL-trnF nucleotide sequence data. *Plant systematics and Evolution*, 231, 77-89.
- [62] R. Morgan, D. E. Soltis and K. R. Robertson.(1994), Syatematic and evolutionary implications of RBCL sequence variation in Rosaceae. *American Journal of Botany*, 81, 890-903.
- [63] Magrama. (2011). Anuario de Estadística Agraria. Ministerio de Agricul-tura, Alimentación y Medio Ambiente, Madrid, Available in: <http://www.magrama.gob.es> (last accessed 27.12.12).
- [64] Faostat, 2012. Website: www.faostat.org (accessed 13.05.12).
- [65] Iglesias, I. (2010) la coltizione Del pesco in spogna: situazione produttiva, innovazioni vartietali e tecniche colturali. *Italus Hort.* 17(3), 7-10.
- [66] Kalberer, S.R., Wisniewki, M., Arora, R., 2006. Deacclimation and reacclimation of cold hardy plants: current understanding and emerging concepts. *Plant. Sci.* 171, 3–16.
- [67] Aubert, C., Gu`nata, Z., Ambid, C., & Baumes, R. (2003). Changes in physicochemical characteristics and volatile constituents of yellow and white-fleshed nectarines during maturation and artificial ripening. *Journal of Agricultural and Food Chemistry*, 51, 3083–3091.
- [68] Bayonove, C. (1973). Recherches sur l'aro`me de la pe`che. I. Evolution des constituants volatils au cours de la maturation de la varie`te´ Cardinal. *Annales de Technologies Agricoles*, 22, 35–44.
- [69] Bayonove, C. (1974). Evolution des compose´s volatils de la pe`che pendant la maturation apre`s re`colte. *Colloques Internationaux C.N.R.S.*, 238, 237–333.
- [70] Berger, R. G. (1991). Fruits I. In H. Maarse (Ed.), *Volatile compounds in foods and beverages* (pp. 291–304). New-York: Dekker.
- [71] Chapman, G. W. Jr., Horvat, R. J., & Forbus, W. R. Jr., (1991). Physical and chemical changes during the maturation of peaches (cv. Majestic). *Journal of Agricultural and Food Chemistry*, 39, 867–870.
- [72] Crouzet, J., Etievant, P., & Bayonove, C. (1990). Stoned fruit: apricot, plum, and peach, cherry. In I. D. Morton & A. J. Macleod (Eds.), *Food flavors part C. The flavours of fruits* (pp. 43–91). Amsterdam, Netherlands: Elsevier.
- [73] Derail, C., Hofmann, T., & Schieberle, P. (1999). Difference in key odorants of handmade juice of yellow-flesh peaches (*Prunus persica* L.) induced by the workup procedure. *Journal of Agricultural and Food Chemistry*, 47, 4742–4745.
- [74] Do, J. Y., Salunkhe, D. K., & Olson, L. E. (1969). Isolation, identification and comparison of the volatiles of peach fruit as related to harvest maturity and artificial ripening. *Journal of Food Science*, 34, 618–621.
- [75] Engel, K. H., Flath, R. A., Buttery, R. G., Mon, T. R., Ramming, D. W., & Teranashi, R. (1988). Investigation of volatile constituents in nectarines. 1. Analytical and sensory characterization of aroma components in some nectarine cultivars. *Journal of Agricultural and Food Chemistry*, 36, 549–553.
- [76] Engel, K. H., Ramming, D. W., Flath, R. A., & Teranashi, R. (1988). Investigation of volatile constituents in nectarines. 2. Changes in aroma composition during nectarine maturation. *Journal of Agricultural and Food Chemistry*, 36, 1003–1006.
- [77] Horvat, R. J., & Chapman, G. W. (1990). Comparison of volatile compounds from peach fruit and leaves (Cv. Monroe) during maturation. *Journal of Agricultural and Food Chemistry*, 38, 1442–1444.
- [78] Horvat, R. J., Chapman, G. W., Robertson, J. A., Meredith, F. I., Scorza, R., Callahan, A. M., et al. (1990). Comparison of the volatile compounds from several commercial peach cultivars. *Journal of Agricultural and Food Chemistry*, 38, 234–237.
- [79] Jennings, W. G., & Sevenants, M. R. (1964). Volatile components of peach. *Journal of Food Science*, 29, 796–801.
- [80] Lavilla, T., Recasens, I., & Lopez, M. L. (2001). Production of volatile aromatic compounds in big top nectarines and royal glory peaches during maturity. In *Proceedings of the fourth international conference on postharvest*. Acta Horticulturae (Vol. 553, pp. 233–234). Jerusalem, Israel: ISHS.
- [81] Lim, L., & Romani, R. (1964). Volatiles and the harvest maturity of peaches and nectarines. *Journal of Food Science*, 29, 246–253.
- [82] Robertson, J. A., Meredith, F. I., Horvat, R. J., & Senter, S. D. (1990). Effect of cold storage and maturity on the physical and chemical characteristics and volatile constituents of peaches (Cv. Cresthaven) *Journal of Agricultural and Food Chemistry*, 38, 620–624.
- [83] Souty, M., & Reich, M. (1978). Effets de traitements technologiques (conge`lation et appertisation) sur certains constituents de l'aro`me des pe`ches. *Annales de Technologies Agricoles*, 27, 837–848.
- [84] Spencer, M. D., Pangborn, R. M., & Jennings, W. G. (1978). Gas chromatography and sensory analysis of volatiles from cling peaches. *Journal of Agricultural and Food Chemistry*, 26, 725–732.
- [85] Sumitani, H., Suekane, S., Nakatani, A., & Tatsuka, K. (1994). Changes in composition of volatile compounds in high pressure treated peach. *Journal of Agricultural and Food Chemistry*, 42, 785–790.
- [86] Takeoka, G. R., Flath, R. A., Buttery, R. G., Winterhalter, P., Guntert, M., Ramming, D. W., et al. (1992). Free and bound flavor constituents of white-fleshed nectarines. In R. Teranishi, G. R. Takeoka, & M. Gu`ntert (Eds.), *ACS symposium series 490, flavor precursors – thermal and enzymatic conversions* (pp. 116–138). Washington, DC: American Chemical Society.

- [87] Takeoka, G. R., Flath, R. A., Guntert, M., & Jennings, W. (1988). Nectarine volatiles: vacuum steam distillation versus headspace sampling. *Journal of Agricultural and Food Chemistry*, 36, 553–560.
- [88] Visai, C., & Vanoli, M. (1997). Compound production during growth and ripening of peaches and nectarines. *Scientia Horticulturae*, 70, 15–24.
- [89] Kays, S.J., Paull, R.E., 2004. *Postharvest Biology*. Exon Press, Athens, GA.
- [90] Horvat, R. J., & Chapman, G. W. (1990). Comparison of volatile compounds from peach fruit and leaves (cv. Monroe) during maturation. *Journal of Agricultural and Food Chemistry*, 38(7), 1442–1444.
- [91] Sevenant, M. R., & Jennings, W. G. (1966). Volatile components in peach. 2. *Journal of Food Science*, 31(1), 81–86.
- [92] Do, J. Y., Salunkhe, D. K., & Olson, L. E. (1969). Isolation, identification and comparison of volatiles of peach fruit as related to harvest maturity and artificial ripening. *Journal of Food Science*, 34(6), 618–621.
- [93] Maga, J. (1976). Lactones in foods. *Critical Reviews in Food Science and Nutrition*, 1–56.
- [94] Spencer, M. D., Pangborn, R. M., & Jennings, W. G. (1978). Gas-chromatographic and sensory analysis of volatiles from cling peaches. *Journal of Agricultural and Food Chemistry*, 26(3), 725–732.
- [95] Aubert, C., & Milhet, C. (2007). Distribution of the volatile compounds in the different parts of a white-fleshed peach (*Prunus persica* L. Batsch). *Food Chemistry*, 102(1), 375–384.
- [96] Aubert, C., Ambid, C., Baumes, R., & Gunata, Z. (2003). Investigation of bound aroma constituents of yellow-fleshed nectarines (*Prunus persica* L. Cv. Springbright). Changes in bound aroma profile during maturation. *Journal of Agricultural and Food Chemistry*, 51(21), 6280–6286.
- [97] Chapman, G. W., Horvat, R. J., & Forbus, W. R. (1991). Physical and chemical changes during the maturation of peaches (cv. Majestic). *Journal of Agricultural and Food Chemistry*, 39(5), 867–870.
- [98] Eduardo, I., Chietera, G., Bassi, D., Rossini, L., & Vecchiotti, A. (2010). Identification of key odor volatile compounds in the essential oil of nine peach accessions. *Journal of the Science of Food and Agriculture*, 90(7), 1146–1154.
- [99] Visai, C., & Vanoli, M. (1997). Volatile compound production during growth and ripening of peaches and nectarines. *Scientia Horticulturae*, 70(1), 15–24.
- [100] Yang, D. S., Balandran-Quintana, R. R., Ruiz, C. F., Toledo, R. T., & Kays, S. J. (2009). Effect of hyperbaric, controlled atmosphere, and UV treatments on peach volatiles. *Postharvest Biology and Technology*, 51(3), 334–341.
- [101] Zhang, B., Xi, W. P., Wei, W. W., Shen, J. Y., Ferguson, I., & Chen, K. S. (2011). Changes in aroma-related volatiles and gene expression during low temperature storage and subsequent shelf-life of peach fruit. *Postharvest Biology and Technology*, 60(1), 7–16.
- [102] Danish Food Composition Databank, National Food Institute, Technical University of Denmark (DTU). 2009. URL: <<http://www.foodcomp.dk>>. [Accessed 25.06.14].
- [103] K. Zaghdoudi, S. Pontvianne, X. Framboisier, M. Achard, R. Kudaibergenova, M. A. Trabelsi, J. K. Cherif, R. Vanderesse, C. Frochot and Y. Guivarc'h. (2015). Accelerated solvent extraction of carotenoids from: Tunisian Kaki (*Diospyros kaki* L.), peach (*Prunus persica* L.) and apricot (*Prunus armeniaca* L.). *Food Chemistry*, 184, 131–139.
- [104] A. Kazana, H. Koyub, I. C. Turuc and O. Y. Celiktasa. (2014). Supercritical fluid extraction of *Prunus persica* leaves and utilization possibilities as a source of phenolic compounds. *J. of Supercritical Fluids*, 92, 55–59.
- [105] M.S. Ekinci and M. Gürtü. (2014). Extraction of oil and β -sitosterol from peach (*Prunus persica*) seeds using supercritical carbon dioxide. *J. of Supercritical Fluids*, 92, 319–323.
- [106] R. Yang, Z. Wang, Y. Bi, J. Jia, X. Zhao, X. Liu and W. Du. (2015). Convenient synthesis of alkyl and phenylalkyl α -D-glucopyranosides using facile and novel biocatalysts of plant origin. *Industrial Crops and Products*, 74, 918–924.
- [107] R. Raturi, S. C. Sati, P. P. Badoni, H. Singh, and M. D. Sati. (2012). Chemical Constituents of *Prunus persica* Stem Bark. *J. Sci. Res.* 4 (3), 769–774.
- [108] E.Y. Backheet, S.F. Farag, A.S. Ahmed and H.M. Sayed. (2003). Flavonoids and cyanogenic glycosides from the leaves and stem bark of *Prunus persica* (meethamr) peach local cultivar in Assiut region. *Bull. Pharm. Sci., Assiut University*, 26, 55–66.
- [109] P. Hephzibah Christabeli and V.K. Gopalakrishnan. (2013).
- [110] Usharani Chatragadda, Nori Kodandaram and Vimochana Bowjanku. (2014). Pharmacological evaluation on glucose lowering efficacy of leave of *Prunus persica*. *ijipsr* 2(7), 1321–1336.
- [111] Feten Belhadj, Imen Somrani, Neyssene Aissaoui, Chokri Messaoud, Mohamed Boussaid and M. Nejib Marzouki. (2016). Bioactive compounds contents, antioxidant and antimicrobial activities during ripening of *Prunus persica* L. varieties from the North West of Tunisia. *Food Chemistry*, 204, 29–36.
- [112] Abderrahmane Mokrani and Khodir Madani. (2016). Effect of solvent, time and temperature on the extraction of phenolic compounds and antioxidant capacity of peach (*Prunus persica* L.) fruit. *Separation and Purification Technology*, 162, 68–76.
- [113] Naveen Dhingra, Rajesh Sharma and Anand Kar. (2014). Towards further understanding on the antioxidative activities of *Prunus persica* fruit: A comparative study with four different fractions. *Molecular and Biomolecular Spectroscopy*, 132, 582–587.
- [114] Marina Carbonaro, Maria Mattered, Stefano Nicoli, Paolo Bergamo and Marsilio Cappelloni. (2002). Modulation of Antioxidant Compounds in Organic vs Conventional Fruit (Peach, *Prunus persica* L., and Pear, *Pyrus communis* L.). *J. Agric. Food Chem.* 50, 5458–5462.
- [115] Hui Liu, Jiankang Cao and Weibo Jiang. (2015). Changes in phenolics and antioxidant property of peach fruit during ripening and responses to 1-methylcyclopropene. *Postharvest Biology and Technology*, 108, 111–118.
- [116] Ana García-Ibarra, Maria Jose Clemente-Moreno¹, Gregorio Barba-Espin, Pedro Diaz-Vivancos, Manuel Rubio, Federico Dicenta, Pedro Martinez-Gomez and Jose Antonio Hernandez. (2011). Changes in the antioxidative metabolism induced by Apple chlorotic leaf spot virus infection in peach [*Prunus persica* (L.) Batsch]. *Environmental and Experimental Botany*, 70, 277–282.
- [117] C. Font i Forcada, Y. Gogorcena and M.A. Moreno. (2013). Fruit sugar profile and antioxidants of peach and nectarine cultivars on almond $\times$ peach hybrid rootstocks. *Scientia Horticulturae*, 164, 563–572.
- [118] Peerzada R. Hussain, Ali M. Wani, Raghuveer S. Meena and Mohd. A. Dar. (2010). Gamma irradiation induced enhancement of phenylalanine ammonia-lyase (PAL) and antioxidant activity in peach (*Prunus persica* Bausch, Cv. Elberta). *Radiation Physics and Chemistry*, 79, 982–989.
- [119] Kyoung-Hee Kim, Mi-Seon Kim, Hong-Gi Kim and Hong-Sun Yook. (2010). Inactivation of contaminated fungi and antioxidant effects of peach (*Prunus persica* L. Batsch) by 0.5–2 kGy gamma irradiation. *Radiation Physics and Chemistry*, 79, 495–501.

- [120] Alex F. Puerta-Gomez and Luis Cisneros-Zevallos (2011). Postharvest studies beyond fresh market eating quality: Phytochemical antioxidant changes in peach and plum fruit during ripening and advanced senescence. *Postharvest Biology and Technology*, 60, 220–224.
- [121] Salem Edrah, Fouzy Alafid and Ashok Kumar. (2015). Preliminary Phytochemical Screening and Antibacterial Activity of *Pistacia atlantica* and *Prunus persica* Plants of Libyan Origin. *IJSR*, 4(2), 1551-1554.
- [122] Giuliana Noratto, Weston Porter, David Byrne and Luis Cisneros-Zevallos. (2014). Polyphenolics from peach (*Prunus persica* var. Rich Lady) inhibit tumor growth and metastasis of MDA-MB-435 breast cancer cells in vivo. *Journal of Nutritional Biochemistry*, 25, 796–800.
- [123] Tae-Yong Shin, Seung-Bin Park, Jin-Su Yoo, In Kyeom Kim, Hyun-Shik Lee, Taeg Kyu Kwon, Moon Kyu Kim, Jung Chul Kim and Sang-Hyun Kim. (). Anti-allergic inflammatory activity of the fruit of *Prunus persica*: Role of calcium and NF- κ B. *Food and Chemical Toxicology*, 48, 2797–2802.
- [124] Chang Ki Lee, Kwang Kyun Park, Jae Kwan Hwang, Sang Kook Lee and Won Yoon Chung (2008). The Extract of *Prunus persica* Flesh (PPFE) attenuates Chemotherapy-induced Hepatotoxicity in Mice. *Phytother. Res.* 22, 223–227.
- [125] Seok-Jong Suh, Byung-Soo Koo, Un-Ho Jin, Moon-Je Hwang, In-Seon Lee, and Cheorl-Ho Kim (2006). Pharmacological Characterization of Orally Active Cholinesterase Inhibitory Activity of *Prunus persica* L. Batsch in Rats. *Journal of Molecular Neuroscience*, 29, 101-108.
- [126] Lokesh deb, Binduswari Pandey, D. bhowmik and A.S. Dutta. (2010). Free radical scavenging activity of aqueous n- butanol fraction of *Prunus Persica* l aqueous extract. *Der Pharmacia Lettre*, 2(5), 379-386.
- [127] Wei Han, Jing Dong Xu, Feng Xian Wei, Yong Dong Zheng, Jian Zhong Ma, Xiao Dong Xu, Zhen Gang Wei, Wen Wang, and You Cheng Zhang. (2015). Prokinetic Activity of *Prunus persica* (L.) Batsch Flowers Extract and Its Possible Mechanism of Action in Rats. *Hindawi Publishing Corporation BioMed Research International*, 2015, 1-10.
- [128] Marina Carbonaro and Maria Mattera (2001). Polyphenoloxidase activity and polyphenol levels in organically and conventionally grown peach (*Prunus persica* L., cv. Regina bianca) and pear (*Pyrus communis* L., cv. Williams). *Food Chemistry* 72 (2001) 419-424.

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